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OVERVIEW

Will Brexit shake UK construction?

Opinion is divided on whether Brexit will undermine mega construction projects in the UK, with some experts warning of troubled times ahead

JOHN OSBORNE

A vast army of talented engineers and other construction professionals are working flat out to complete massive projects in the UK, including Crossrail and the Thames Tideway Tunnel. Will Brexit affect investment in these construction projects, as well as the cost and availability of materials and labour?

"The infrastructure projects in which we invest should experience limited fallout from Brexit," according to Giles Frost, chief executive at International Public Partnership, the FTSE 250 infrastructure fund which is a member of the Bazalgette Consortium investing in and delivering the Thames Tideway scheme. "In the 11 months since the referendum, we haven't seen any slowdown in investors wanting to invest in UK infrastructure projects."

Mr Frost, who is also chief executive of Amber Infrastructure, adds: "Infrastructure investment is low risk and uncorrelated to the wider equity markets. The day after the referendum, the share price of International Public Partnerships increased while the broader FTSE went down because of the immediate uncertainty. Brexit has had no negative impact on investment in infrastructure."

However, fear and scepticism surround Brexit. "Uncertainty is never good for business," he says. "Brexit has caused unnecessary confusion and navel gazing. It is an extra complexity that nobody predicted, but thanks to the long-term nature of our horizons, infrastructure investment is well positioned to weather this uncertainty."

But a major concern is the cost of hiring the tunnel boring machines used on major projects. David O'Reilly, vice president of KBR, formerly Kellogg Brown & Root, says plant costs could soar, but expects financing of the machinery to have been managed by buying euros at forward rates, thereby minimising the effect of detrimental fluctuations in the exchange rate.

Mr O'Reilly, who is project director of the Qatar Expressway Programme, urges UK construction professionals to look beyond Europe. "For UK businesses, the world is your oyster. We have considerable skills. These skills have no association with Brexit. There is an appetite for UK professionals. That is why KBR has been trading successfully for the last 30 to 40 years," he says.

Jeff J Mitchell/Getty Images

Construction of the new £1.4-billion, 1.7-mile bridge over the Firth of Forth, South Queensferry

The UK is a world leader in construction and civil engineering, but labour costs are another major concern. "UK construction is becoming increasingly dependent on skilled labour, as well as unskilled labour, from overseas," says Mr Frost. It is possible labour costs will go up if the UK is less able to access labour from overseas, he says, also expressing concern that immigration controls might be introduced which could prevent or deter workers normally resident outside the UK from coming here.

Grahame Carter, managing director of Matchtech, a leading engineering recruitment agency, says: "To deliver projects similar to the scale of High Speed 2 and Thames Tideway, some countries, including Dubai and Qatar, implement a visa system. Companies that win contracts are allocated a set number of visas to guarantee enough talent to complete the project successfully."

Although there is a considerable amount of optimism about willingness to invest in large infrastructure projects and confidence in the UK's construction workforce, many people are still worried.

Andrew Goldman, group marketing and technology director at Rydon Group, a construction, development, maintenance and management group, explains: "The UK construction sector shrank after the UK voted to leave the EU, but has shown some recovery subsequently."

Also, he is concerned about the supply of labour. "There are simply not enough British workers to meet the demands of the construction industry and Brexit threatens to diminish EU resources further," says Mr Goldman. According to London Assembly figures in February 2017, 25 per cent of construction workers in the capital were from the European Union.

The cost of materials is another worry. He says: "Sixty four per cent of the building materials used in the UK are imported from the EU. The EU is also the largest market for the construction materials we export, purchasing 63 per cent. Brexit will potentially lead to heavy duties or limits on quantities of materials."

In mid-May, the Brexit Infrastructure Group of the Institution of Civil Engineers sent an open letter to leaders of the political parties, outlining the risks faced by the infrastructure sector ahead of the general election and Brexit negotiations.

It said the government must clarify the UK's future relationship with the European Investment Bank following departure from the EU. "The Brexit Infrastructure Group has offered a three-part strategy to ensure Brexit does not disrupt the delivery of the planned pipeline of major infrastructure projects, which underpins government's current efforts to drive up UK productivity. This planned pipeline will require £500 billion of private investment over the next ten years," the group said.

But the Royal Institute of Chartered Surveyors (RICS) warns of difficult times ahead.

RICS says the UK construction industry is "already facing skills shortages, jeopardising a predicted £500-billion project pipeline" and adds that "8 per cent of the UK's construction workforce comes from the EU".

"Post-Brexit, should the UK lose access to the single market, 176,500 jobs could be under threat," RICS warns, adding that "30 per cent of construction professionals surveyed revealed that hiring non-UK workers was important to the success of their businesses".

64%
of the building materials used in the UK are imported from the EU

63%
of the construction materials exported from the UK go to the EU

8%
of the UK's construction workforce come from the EU

COMMERCIAL FEATURE

New environmental regulations: from threat to opportunity

A raft of stringent new environmental regulations on energy use in buildings and industry could cause serious difficulties for some organisations. Others though are turning this challenge into an opportunity to improve their bottom line and reputation

MITSUBISHI ELECTRIC

Organisations are under increasing pressure from regulators and from their customers to ensure that their buildings and operations use energy in the most sustainable way. According to a survey by the Carbon Trust, published in November, more than half of consumers (56 per cent) said they would feel more positive about a company that has reduced the carbon footprint of its products.

Next April another significant piece of environmental legislation comes into force. The Minimum Energy Efficiency Standards (MEES) will apply to landlords or tenants of commercial buildings and commercial apartments. Initially it will prevent new lettings and lease renewals of energy-inefficient buildings, in other words those with F & G ratings. Such buildings are still very common and they house organisations in all sectors around the country. From April 2023, regulations will become tougher still as MEES is extended to all existing leases.

"This is a wake-up call to all business leaders and facilities managers," says Deane Flint, joint managing director at Mitsubishi Electric. He points to findings by the Association for the Conservation of Energy (ACE), which show that in London alone more than a third of commercial buildings have the worst Environmental Energy Performance Certificates (EPC) ratings in the UK, with 18,000 of these only qualifying for an EPC rating of F or G. Of the capital's 265,000 commercial buildings only 34 per cent have a performance rating of C or above.

The ACE report reveals that although commercial and industrial buildings constitute around a quarter of London's building space, they consume almost half the energy, while workplaces are currently responsible for around 42 per cent of the city's carbon emissions. The report also discovered a similar state of affairs with London's housing stock where a quarter – 830,000 homes – have the worst energy efficiency ratings of E, F or G.

"These figures show that the impact on the commercial property market is likely to be highly significant and they highlight the sheer scale of the challenge facing many building owners and operators," says Mr Flint. "Failure to comply with the new standards could bring about serious financial repercussions and prevent landlords from letting property until they've taken action to meet all these new requirements."

The MEES regulations come on top of the F-Gas regulations, which came into force in January 2015 and relate to the mixture of gases within an air conditioning system and the possibility of reducing their global warming potential. The aim of these initiatives and a raft of other new regulations is to ensure emissions from homes and commercial properties are completely removed by 2050 so the UK can meet its stringent international targets.

"These new and increasingly onerous requirements will obviously present serious challenges for many organisations," says Mr Flint. "However, we've noticed that a growing number of shrewd business leaders and forward-thinking professionals, who develop and manage buildings, are starting to regard MEES, F-Gas and other requirements not as a problem or threat, but as an opportunity."

DEAN FLINT
JOINT MANAGING DIRECTOR
MITSUBISHI ELECTRIC

> Failure to comply with the new standards could bring about serious financial repercussions and prevent landlords from letting property

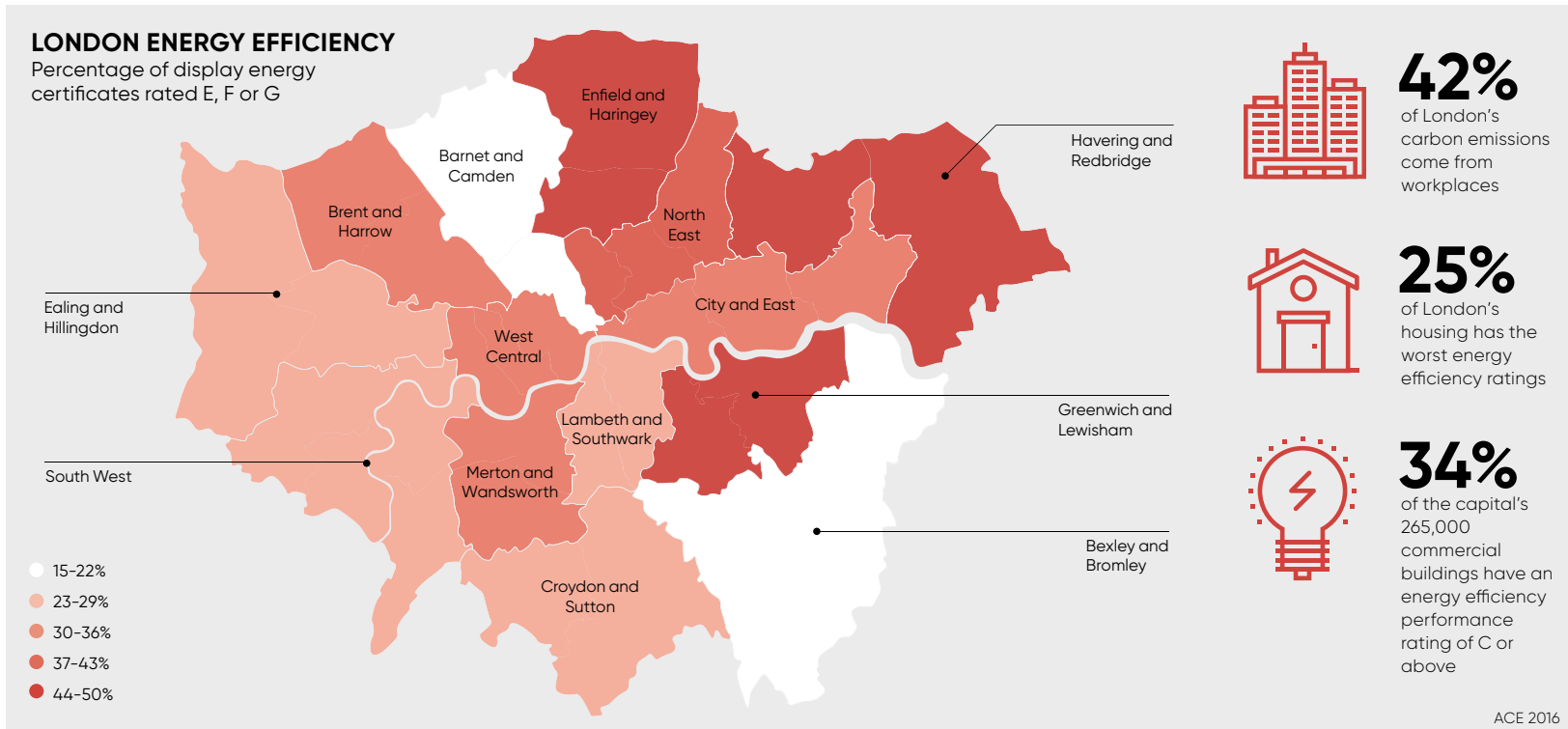
According to the ACE report, shops that reduce their energy costs by 20 per cent can benefit from the equivalent of a 5 per cent increase in sales. Forward-thinking companies are taking a positive, proactive approach. They're making the most of government-backed renewable technology, such as heat pumps through the Renewable Heat Incentive, which pays for every kilowatt of renewable heat that a system produces.

As well as helping companies around the world to find new and effective ways in which to improve the energy rating of their buildings, Mitsubishi Electric has been doing the same with its own headquarters over the last eight years.

It has installed an air conditioning system that allows it to cool and heat different parts of the HQ at the same time as heat rejected from the server room is used to warm other parts of the building. When the gas boiler began to reach the end of its life, rather than replace it, the building managers made a case for removing gas from the site altogether and adding a heat pump boiler to the air conditioning system so rejected heat energy supplies hot water for the kitchens. Photovoltaic cells on the roof supply the building with electricity and sell any excess back to the grid. As a result, the building's energy rating has now improved from E to B.

"What we've done has been relatively simple and straightforward," says Mr Flint. "We've used technology and common sense to build a compelling business case, and we've saved money and engaged staff in these issues as a result. It's something that any sensible business can achieve if its leaders are willing to take action early to meet these new environmental regulations."

For more information please visit www.timeforr32.co.uk/time



ENERGY LOOPS: NEW FACE OF SOLAR PANELS

The use of solar panels or photovoltaic technology is now well established. However, a new chapter is being opened in this form of green energy. Every day the sun heats up water in rivers, canals and lakes. Now, using existing heat pump technology, it's possible to capture low-grade heat from this water and to upgrade this form of solar energy to provide renewable heating for buildings.

This is already being used successfully in developments such as Kingston Heights in Surrey, where 137 apartments get their renewable heating from the River Thames, 200 metres away.

The use of this technology is also becoming more common in community heating schemes, in Barking, east London, and Manchester for example, where air source forms of heat pumps are used to provide communal heating with individual billing.

The government has already recognised this opportunity. In August 2014, the Department of Energy and Climate Change introduced a water source heat map of England to help illustrate the opportunities available for deploying heat pump technology in the country's river and open water sources.

Further information on energy loops can be found at thehub.mitsubishielectric.co.uk

MICRO-HOUSES

Space invaders: arrival of the micro-home

Pressure on space and affordability is driving the design and construction of micro-homes in crowded, heavily populated cities

Y:Cube units made for the YMCA in Mitcham, south London; the development is made up of 36 modular, studio-like apartments 280sq ft in floor area and constructed off-site in a factory

NICK EASEN

Combine unaffordable housing with increased urbanisation and single-person occupancy, as well as population growth globally, then you have a bottleneck. Constrained living spaces or micro-homes could be the answer. Architects and construction companies are now advocating so-called tiny houses under 500 square feet (46m²) as a way of solving the housing crisis, an issue that looks set to get worse.

More than half the world's population live in urban areas; by 2030 it will rise to 60 per cent, then one in every three people will live in cities with at least half a million inhabitants, according to the United Nations. By 2050 another 2.5 billion will be added to the urban masses.

It doesn't help that London has the unenviable reputation of being the world's least affordable city for real estate, second only to Hong Kong, says research by UBS Wealth Management. Other cities at risk of housing bubbles include Vancouver, Stockholm, Munich and Sydney.

> The real issue is putting incentives into the regulations to ensure micro-housing is developed in a sustainable and affordable fashion

"The fact is micro-housing built close to mass-transportation services is an easy win towards liveable, sustainable and affordable cities," says Alex Symes, architect and founder of Big World Homes, whose company is developing one of the world's first flat-pack homes in Australia.

"The challenge is that governments around the world are cautious to change minimum home sizes and zoning, as developers can take advantage of such planning amendments. The real issue is putting incentives into the regulations to ensure micro-housing is developed in a sustainable and affordable fashion."

The UK is no stranger to the tiny house concept. Head to the borough of Mitcham in south-west London and you can see the Y:Cube, 36 modular, studio-like apartments only 280 square feet (26m²) in size. Made for the YMCA, they cost around £30,000 to build, off-site in a factory. Container City in the Docklands is another micro-home development made of customised shipping containers; more are planned.

With top-notch design, the construction of small homes can be an efficient use of space. They can also provide short-term solutions for cities looking to utilise plots that have yet to be zoned properly. "That way the micro-home purchaser is not having to pay full value for the land and therefore can enter the market at a lower cost," explains Mr Symes.

There's also great flexibility when it comes to the use unexpected spaces. "We were approached by British Rail to see if we were interested in using land under the arches of elevated rail tracks. These spaces can be up to ten metres high – great for micro-homes," says Quinten de Gooijer, general manager at Amsterdam-based Tempohousing.

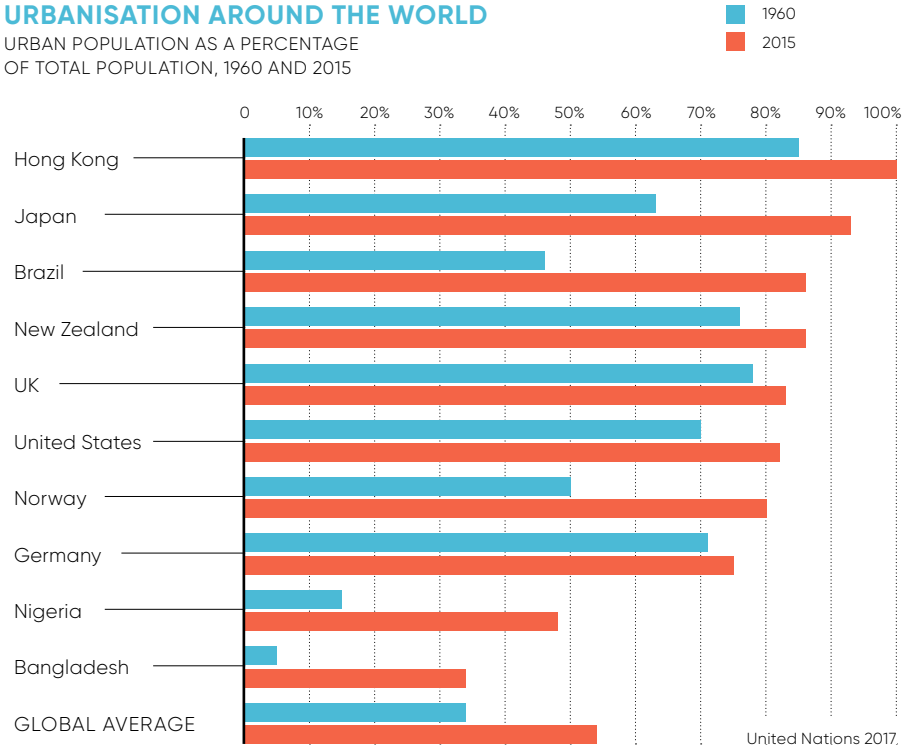
Smaller units are also easier to prefabricate, saving time and money on each build. "We work in a production hall with an efficient lay out of systems and, with no rain or snow, this increases the build quality significantly," says Mr de Gooijer.

In the United States the drive for tiny houses has turned into a movement born out of the financial crisis a decade ago, which at the time drove Americans to seek more affordable, debt-free housing. Since then it's flourished, with how-to websites, organisations and TV programmes.

In Europe some now see micro-homes and apartments as a move towards the sharing economy, since many normal homes are just unaffordable. "The new generations tend to move from ownership of everything to a right-of-use model," explains Mr de Gooijer. "The housing industry will eventually undergo that same transformation – it is about offering quality living first of all and not about creating an investment for your future pension."

URBANISATION AROUND THE WORLD

URBAN POPULATION AS A PERCENTAGE OF TOTAL POPULATION, 1960 AND 2015



United Nations 2017.

COMMERCIAL FEATURE

Overcoming the digital construction challenge

As projects become more complex, with ever-tighter budgets and shorter timescales, building information modelling (BIM) is at the heart of a complete rethink of the construction process

Clearbox

The pressure on project, commercial and design managers, among others, to deliver evermore complex projects on time and budget continues to grow. Even with the availability of enterprise resource planning (ERP) to access financial control information more quickly, the challenge to all professionals in the construction industry is increasing.

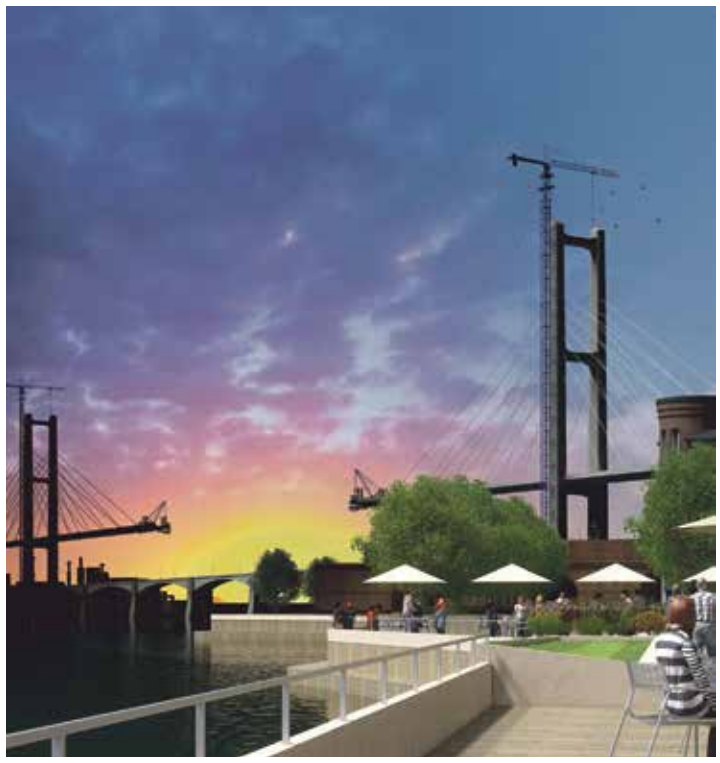
"In many cases it's like trying to run a business using Excel spreadsheets with macros all connected to a server in an office. No one can change a sheet because they're locked in a rigid environment that amalgamates the figures at the end of the month," says Graeme Forbes, chief executive of Clearbox, a technology company that provides solutions with a simple integrated single source of information across an asset's life cycle, from conception to operation.

Sharing information effectively is key to successful project management, he points out. "Our clients come to us because in some respects we're the front-end to the ERP back-end for construction," says Mr Forbes. "We're taking a world dominated by information contained in model files and adapting it so that these files can be read by a common platform. We're helping companies on their big data management journey, and their ability to harness real-time knowledge about their projects and their business."

> The construction industry is undergoing a fundamental step change in how it operates

He describes ERP as "typically the financial plumbing of a business" and explains: "We feed the front-of-house activity to normalise or regularise the information to better enable back-of-house ERP and make it easier to integrate for downstream tasks."

One of the major challenges for the construction industry, according to Clearbox, whose clients include Kier Group as well as overseas companies such as Witteveen+Bos, is that the most commonly used BIM tools are appropriate for authoring one particular element of a construction project.



"With a complex project, you have a variety of these tools all involved in the same job. The tools are often difficult to integrate, generally complex and designed to create information. This makes them difficult to use because the information they contain is compartmentalised in different files and yet different people need access, be they the project manager, the commercial manager or the engineering team, and often for a quite simple need," says Mr Forbes.

To overcome this, Clearbox's technology can slice data in different ways and make it relevant for different audiences in a user-friendly format that goes beyond the capability of the visual tools currently widely used.

"Take the construction of a tunnel, for instance," says Mr Forbes. "I might look at every aspect of it, but then I discover that the drivers, in other words the end-customer, are forced to put their foot on the brakes half way along it because their visibility of an interchange isn't great. That could lead to lifelong tailbacks. However, I can now take the visual technology and integrate it with other technology, such as gaming-based tools, to simulate people driving through my tunnel to check it works in practice in the way that all parties would have expected."

With the refurbishment of London's Chelsea River Bridge, Clearbox's technology based on BIM processes allowed the team to ensure that each piece of steel used had gone through the various stages of survey, approval, refurbishment and inspection correctly, without having to access the various different files to check any cross-references. The client had a detailed record of the work done and alongside that nearly £900,000 was shaved off the £6-million cost, even though its technology was only put into practice by the time the third arch out of five was being repaired.

"The construction industry is undergoing a fundamental step change in how it operates," says Mr Forbes. "We're moving into a world of truly digitally enabled processes and we're playing catch-up with most other sectors. Our industry needs to fully embrace this technology; there's a lot to gain including providing a more engaging environment for young recruits.

"Companies must have the desire and feel the need to deliver to produce this major evolution," he says. "You need a road map for your whole journey to know the sort of place you want to head to, but you can take small steps to get to your destination – most importantly you need to start the journey."

For more information please visit www.clearboxbim.com

TECHNOLOGY

An industry ripe for tech disruption

Despite some reticence, the construction industry is on the cusp of a technology revolution which will reshape its future

NICK EASEN

Innate conservatism are words that are used to describe the construction industry. While the retail and automotive sectors are the proverbial hares when it comes to implementing technology, those who plan our built environment are the tortoises.

"We're a low-margin industry, which has led to a lack of investment in research and development over recent decades, especially when compared to other industries," explains Sam Stacey, director of innovation, industrialisation and business improvement at Skanska UK.

However, there's now a groundswell of professionals who realise technology can disrupt this sector, boosting flat-lined productivity and changing the way the industry works for ever.

"It's the change in mindset that's always proven to be the biggest challenge," says Tim Chapman, director at Arup. "There are still many practitioners who want to protect the established ways of doing things, but the evidence from other industries where technology has taken hold is that soon it will be too big a draw to ignore."

It doesn't help that the industry is highly segregated between disciplines making the adoption of unified workflows difficult. Many projects are also bespoke rather than iterations of previous designs. This means the technological applications are more complicated. There's also been a lack of investment in tools and training.

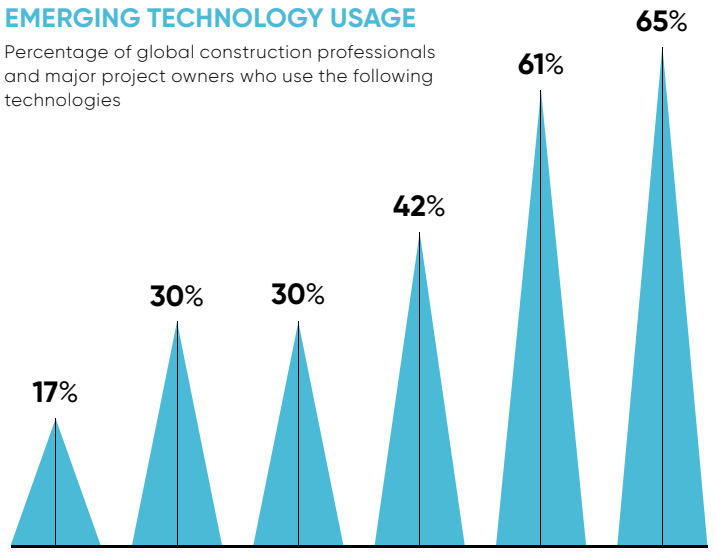
"Design is heavily rooted in past experience and the latest technologies are viewed as risky and priced accordingly," explains Mathew Riley, managing director of Ramboll UK. "Construction earns its money on a series of individual, mostly unrelated, projects with no incentive to invest in new ways of working."

It doesn't help that clients don't want to be guinea pigs, testing out new technology, especially if the project has a multi-million-pound price tag, yet there are companies shaking things up. "The amount of disruptive technologies emerging for smarter construction in 'pursuit of a better way' is astonishing," says Jon Harris, director of digital technology at Mace.

Real-time collaboration, building information modelling in the cloud,

EMERGING TECHNOLOGY USAGE

Percentage of global construction professionals and major project owners who use the following technologies



KPMG 2016

Zhang Jian/Chengdu Economic Daily/VCG/Getty Images

A drone towing a cable over the Dadu River in the construction of a 1.1km bridge in Ya'an, Sichuan Province, China

> The evidence from other industries where technology has taken hold is that soon it will be too big a draw to ignore

3D printing, augmented reality, survey drones, big data and the internet of things, as well as wearable technologies, gaming and digital workflows are now being deployed.

"Adoption is the key to overcoming barriers in the construction industry and will require broad-thinking clients who actively encourage a better way of working for the overall benefit of their project and end-users," says Paul Westbury, group technical director at Laing O'Rourke.

The main benefit is time compression. New tech allows engineers, architects and surveyors to make better decisions quickly, optimising design, automating engineering or reducing the risk involved in off-site and on-site construction. Project life cycles can be shortened, boosting productivity.

"It also offers us the single biggest opportunity to mitigate the risk against a skills shortage across the industry, whether accessing a broader skillset in design or reducing the dependency for on-site labour," says Mr Riley.

Drones are now used to perform surveys, scans and inspections, saving on the cost of employing a well-trained engineer on-site. It also reduces the need for safety equipment and risk assessments since drones can work in dangerous areas.

Health and safety is a big concern for the industry, driving technology adoption and reticence at the same time. "We're finding that clients are still hesitant about processes automated by computers, as many large building projects involve operating heavy machinery," explains Mr Chapman.

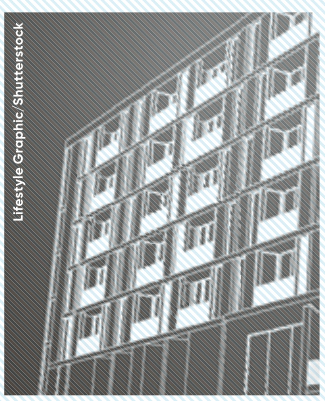
Some believe it's time the industry developed a "technology roadmap" where there's a mutual understanding of the key challenges which need to be overcome and the supporting technologies that will enable this to happen. The Infrastructure Industry Innovation Platform (i3P) is one answer to this.

This aims to utilise smart design and manufacturing, new materials, smart infrastructure underpinned by artificial intelligence, virtual and augmented reality, autonomous vehicles and drones, as well as protecting people through wearable technology.

"Many organisations have experimented with some of these technologies, but to achieve widespread adoption it requires a commitment to collaborative innovation," Nick Sumption, industry innovation lead for i3P at Thames Tideway Tunnel, concludes.

CASE STUDY

ARTIFICIAL INTELLIGENCE



Lifestyle Graphic/Shutterstock

Artificial intelligence (AI) will shake up construction taking on mundane tasks that are labour intensive, especially design. "AI in building information modelling (BIM) will bring a paradigm shift to our industry," says Tim Chapman, director at Arup.

It will transform the way we build; eventually it will be used to design bridges and tunnels, for example, as well as other standard features. Soon we will be able to drag and drop a rail bridge on to a computer model of, say, the High Speed 2 rail link for BIM software to calculate all the parameters.

The software is slowly becoming more sophisticated, so it won't be long before this will happen. "AI still needs to evolve. BIM is still in its early days. When you look at average BIM data, this becomes clear. AI works with a very complex dataset. Construction cannot yet inform AI, but it will in the future," says Malcolm Stagg, director of digital engineering at Skanska UK.

Machine-learning will also allow design tools to provide rapid feedback on how to maximise the value of each building site in terms of the best configurations.

"AI will allow greater knowledge-sharing, making sure there is a central brain that learns from experience," says Mr Chapman. Machine-learning should also free up professionals to spend more time doing creative thinking.

"There is now demand for supply to be cheaper as the global need to construct new infrastructure increases. Applying AI will lead to reduced prices, better safety, and more accurate and rapid assembly," he explains.

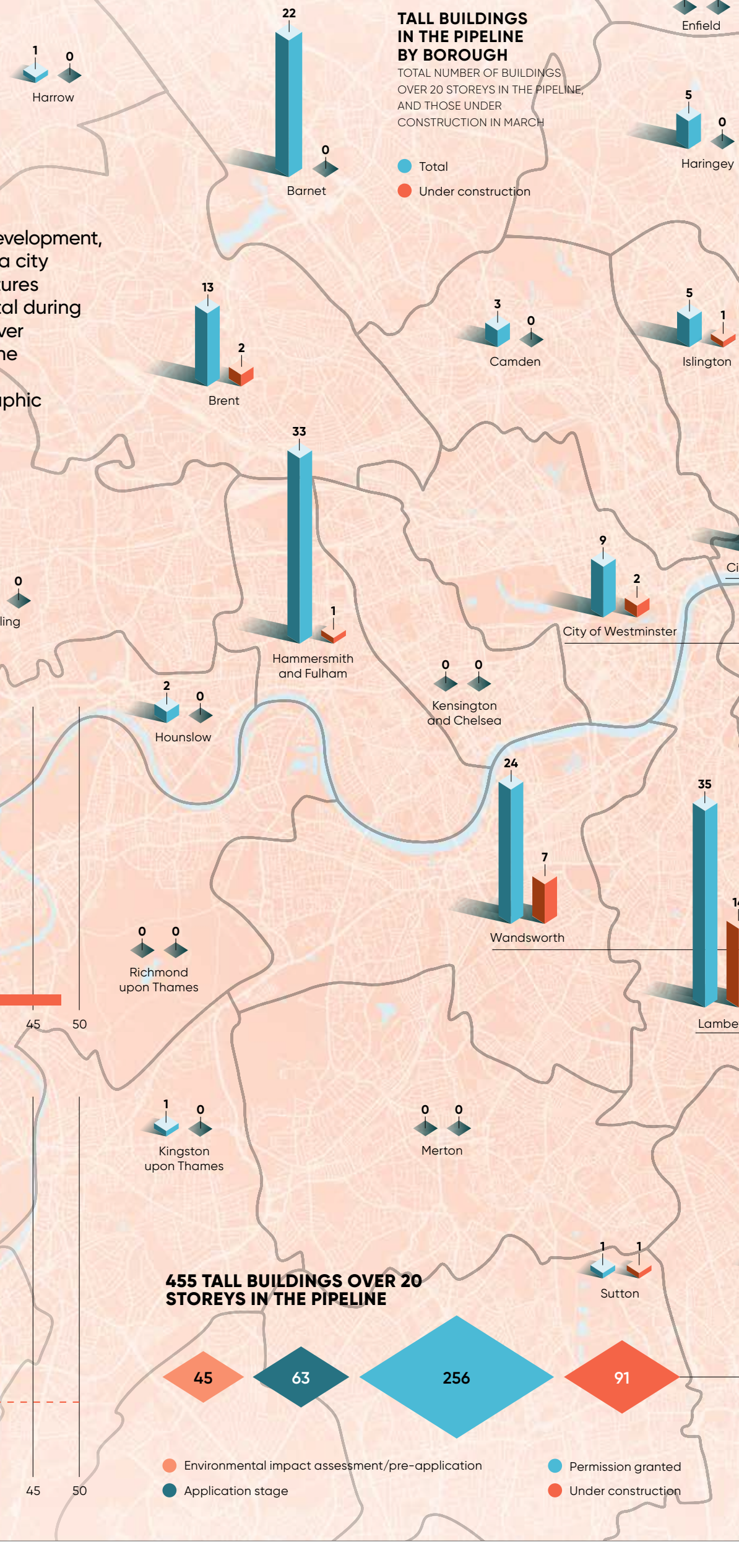
THE ONLY WAY IS UP

Tall buildings remain a critical part of London's development, creating crucial office and residential space in a city where space is in high demand. Some 26 structures 20 storeys or more were completed in the capital during 2016, more than four times the annual average over the past decade. With a further 455 towers in the pipeline, the city skyline will look dramatically different over the coming decades. This infographic looks at completions over the years and where the newest skyscrapers will pop up

TALL BUILDINGS IN THE PIPELINE BY BOROUGH

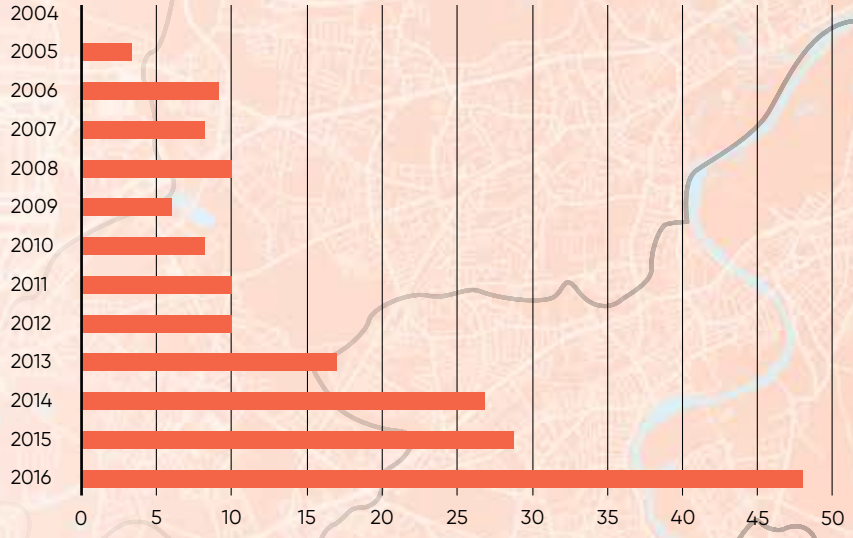
TOTAL NUMBER OF BUILDINGS OVER 20 STOREYS IN THE PIPELINE, AND THOSE UNDER CONSTRUCTION IN MARCH

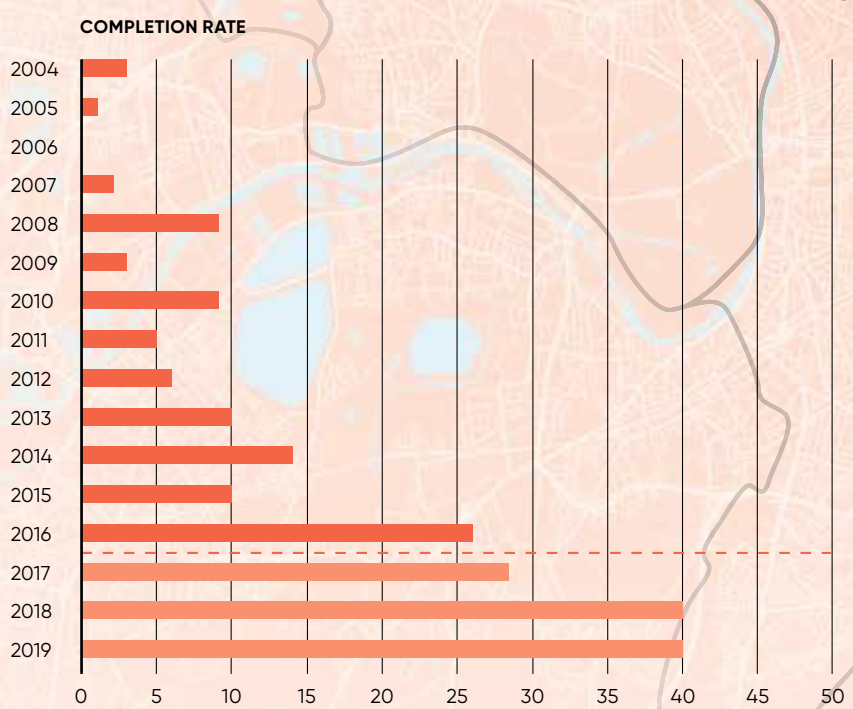
Total
Under construction



TALL BUILDINGS PIPELINE

START AND ESTIMATED COMPLETION RATES





455 TALL BUILDINGS OVER 20 STOREYS IN THE PIPELINE

Environmental impact assessment/pre-application
Application stage
Permission granted
Under construction

26
buildings over 20 storeys were completed in 2016, compared with an average of six a year over the past decade

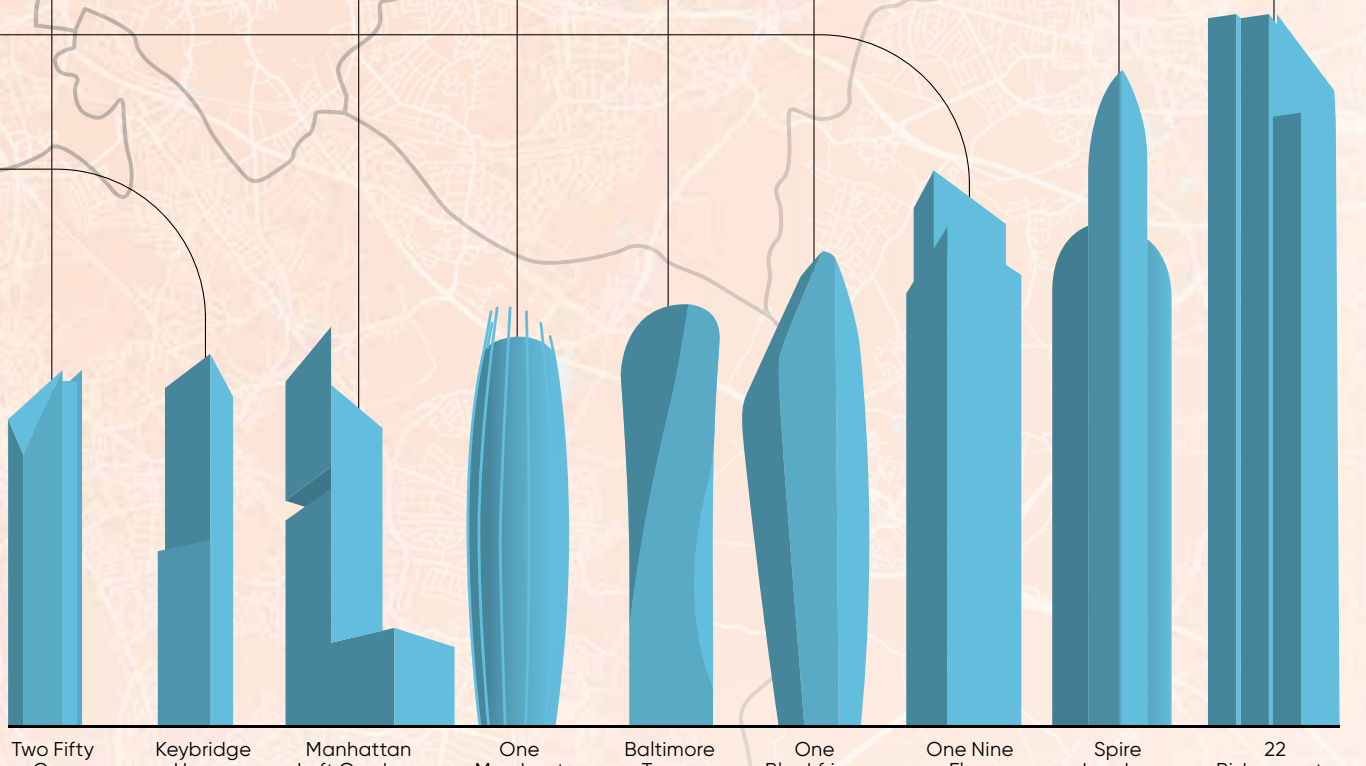
48
buildings over 20 storeys started construction in 2016, equal to almost one a week

30%
of homes currently under construction in London are in tall buildings over 20 storeys

38
hectare footprint of buildings over 20 storeys in the pipeline, equivalent to more than 53 football pitches

Redbridge 3 0
Waltham Forest 0 0
Hackney 17 4
Tower Hamlets 77 25
Newham 31 11
Barking and Dagenham 7 1
Havering 0 0
Southwark 37 7
Greenwich 68 9
Bexley 0 0
Lewisham 14 2
Bromley 0 0
Croydon 21 0

TALLEST BUILDINGS UNDER CONSTRUCTION



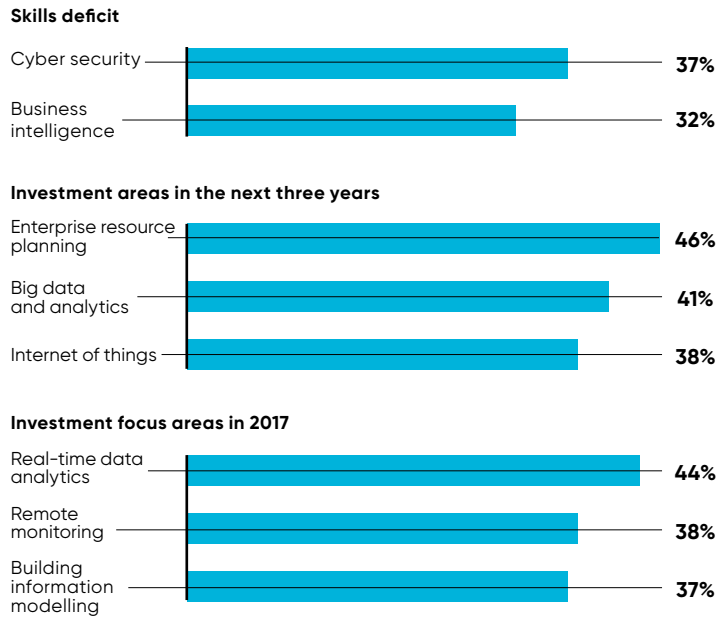
	Two Fifty One	Keybridge House	Manhattan Loft Gardens	One Merchant Square	Baltimore Tower	One Blackfriars	One Nine Elms	Spire London	22 Bishopsgate
HEIGHT (m)	**127**	**133**	**143**	**150**	**151**	**170**	**199**	**235**	**255**
NUMBER OF FLOORS	41	37	42	41	45	52	58	67	59
COMPLETION	2017	2017	2018	2018	2017	2017	2018	2020	2019

New London Architecture 2017

COMMERCIAL FEATURE

GLOBAL DIGITAL CHANGE IN CONSTRUCTION

PERCENTAGE OF RESPONDENTS WHO AGREED WITH THE FOLLOWING



Digital Change Survey 2017. Research conducted globally by Raconteur on behalf of IFS

UK construction must, and can, compete on a world stage

Construction is one of the UK's most important industries, the sector is growing and its standards are recognised the world over. But there is a danger of the industry becoming complacent with its success. **Kenny Ingram**, global industry director for construction at world-leading enterprise software solution provider IFS, explains why

Flagship projects such as London's Crossrail represent the UK construction industry at its best. When we look at what's happening in the industry, everyone is talking about Crossrail. It is a fantastic project, 26 miles of tunnelling beneath London, showcasing the UK construction industry and the BIM (building information modelling) process.

However, we are not the only ones doing this. Turkey, for example, has built an underwater tunnel 47 miles long, China has the Three Gorges Dam and the United Arab Emirates has a 745-mile-long national railway network.

The UK has done a lot of work to build standards for BIM, led by government, to make the construction industry more efficient and competitive globally. The rest of the world is looking at the UK and taking those standards, but will they buy more construction from us? In many ways the UK construction industry is very insular. It needs to think more globally and, fundamentally, look at how it operates.

Culture has a significant impact on where the industry is today. Take technology, for example. Construction is lagging behind other industries in adopting technology, maybe because the industry is still dominated by financial and commercial management, not yet engaged enough with technology-led opportunities to enhance their function. Many companies still run their entire business on Microsoft Excel. They know they are behind the times, but feel comfortable using Excel spreadsheets.

Another cultural influence is the industry's reliance on quantity surveyor methodologies. This is a very UK-centric phenomenon seen in few countries beyond the UK and British colonies. This has to impact our export potential. There is huge resistance to change, but are these methodologies still the best ones? Why don't we have a standard way of working across the globe, as happens in the oil and gas sectors? We should at least be looking at this.

Digital technology can be an enabler of global growth, efficiency and cost reduction, and BIM is the platform for the digital revolution. If you have a BIM-based model, you can visualise your asset and know what it will look like before you start building it. BIM not only allows for improved efficiency of design, construction and operation of an asset, it also enables longer-term performance and cost benefits to be considered, designed in and measured across the asset's whole life cycle.

As a specialist in project and asset life cycle, this is a key area for IFS because more than half of what the construction industry actually does is about asset management and it encompasses every single industry sector. BIM is effectively a data asset through every stage of its life; when the asset is handed over to the owner or operator, it is handed over as a digital set of data.

While the mandated use of BIM for government-funded projects such as Crossrail certainly acts as a catalyst, it is still seen by many as a compliance issue, with contractors more concerned about what they need to do to get their BIM badge than its benefits for the long-term future of their business. This may sound like a Utopian view, but the reality is by embracing BIM and other new technologies, and by changing the way they run their business, their future survival is far more assured through saving money and the additional potential catalyst of efficiency-led growth.

BIM is massively important to the digital journey of the construction industry, but adoption needs to speed up if we are to achieve our competitive potential on a global basis.

We also need to be more global in our thinking. Out of the top 100 global construction companies, twenty six are based in China, sixteen in the United States, seven in Spain and the UK has just one. At one large Spanish construction firm I visited recently, 80 per cent of its business was coming from outside Spain. No UK construction company comes close in terms of overseas business. We are insular, we are risk averse and we should be learning from global thinkers like Spain, and waking up to the reality of what might happen when companies from other countries start moving into the UK market.

Global competition presents many challenges for UK construction, however a bigger threat, or potential opportunity, could lie much closer to home and not necessarily from within the sector. We are seeing a growth in the building of modular homes as one mechanism to address the housing crisis. One new entrant to this market is Legal and General Homes, essentially a finance company. They are setting out to build modular houses in a factory and deliver them to the site, fully fitted out. This convergence of construction and manufacturing industries is speeding up processes, improving quality, and reducing costs and time. Inevitably more industry sectors are likely to get involved in what has the potential to be the UK construction sectors "Uber moment".

Another important trend in construction is the adoption of servitisation. Clients – the asset owners – don't just want construction firms to build the asset, they want them to provide the services required to maintain their assets over their entire life cycle.

34% of respondents say aversion to change is the number one barrier

30% say security threats are the number-one barrier

24% say skills shortages are a major barrier

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If you are a construction company today, you need to think about this because tomorrow you might be a manufacturing company or an asset maintenance service provider. This "contracting for outcomes" initiative, backed by the government, moves the sector towards an entire life-cycle management approach. Building and managing hospitals measured by patient wellbeing, university campus construction based on students' success measures are two potential outcomes of the new way of thinking some are already adopting, having learnt, in part, from the global aviation sector whose measures in construction of an aircraft are now often based on the number of flying hours in service and not at the point the new asset is delivered to the airline.

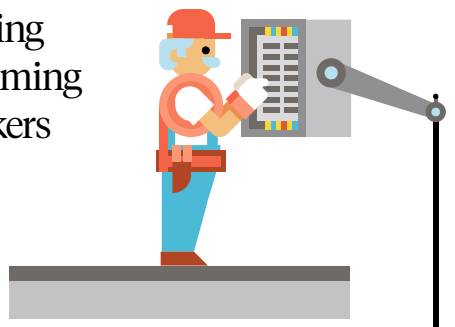
At IFS we have the technology systems, platforms and expertise that are already helping construction companies through the convergence or servitisation journey to becoming a hybrid organisation. This is the future of construction and UK companies have a great opportunity to embrace that future now.

For more information please visit ifsworld.com/times or call 01494 428900

MENTAL HEALTH

Building up wellbeing in construction

Macho culture of mainly men working on building sites has been among barriers to improving alarming rates of mental illness among construction workers



DANNY BUCKLAND

The gleaming steel, glass and masonry, the clean lines, the manipulation of space and showcase design features are the visible characteristics of construction.

But behind many successful builds lies a hidden toll that never makes the glossy prospectus; the plight of the workers who shape the buildings we live and work in.

Bleak statistics put the UK's 2.1 million construction workers in the basement of mental health wellbeing with the trade experiencing staggering levels of depression and suicide.

The industry has been shocked by a series of studies that lay out the scale of the problem. Office of National Statistics figures released in March this year highlight that the risk of suicide among low-skilled male labourers, particularly those in construction, is 3.7 times higher than the male national average. The figures, for workers aged 20 to 64, showed 1,419 suicides in construction and building trades from 2011 to 2015.

Other research details that work-related stress, anxiety and depression cost the industry 400,000 work-days a year and accounted for around 20 per cent of all cases of ill health in construction over the last five years.

"We were getting national statistics that two people a week in construction had taken their lives. It was totally unacceptable and, frankly, shaming on the industry," says Clive Johnson, who helped create the Health in Construction Leadership Group (HCLG), which brings together the main construction companies, unions and safety organisations to tackle health issues.

"The industry had been focusing on safety because of the immediacy of injuries as opposed to the latency of occupational ill health. We had not done enough."

Under the HCLG banner, chief executives of 150 top companies resolved last year to tackle occupational health, including mental health, and five companies – Wilmott Dixon, Balfour Beatty, Careys, Heathrow and Tideway – are now trialling a version of the Australian Mates in Mind programme that tackles stigma on building sites. Each operative coming on to a site has a 45-minute session on mental health wellbeing, while supervisors get 3.5 hours' coaching and line managers attend a two-day mental health first aid course.

Transferring good intentions from a classroom to the intestines of a site is a mammoth task as Mr Johnson explains: "There is a transient workforce with people often travelling long distances to jobs with a lot of pressure being away from home, along with deadlines and worry about their next job, and these ingredients affect mental stability. But they simply don't talk about their problems; it attracts stigma in a macho industry."

Mr Johnson, who is group head of health and safety at Land Securities, the UK's largest listed commercial real estate company with a £14.5-billion portfolio, believes getting the right tone to reach workers is vital. He even arranged for a professional comedian to deliver mental health messages in a stand-up routine as part of an innovative approach.

> The industry had been focusing on safety because of the immediacy of injuries as opposed to the latency of occupational ill health

"We struggle to attract people to our industry because the impression is it's dirty and dangerous, so we need to change the image by making workplaces safer, happier and healthier. There is also a productivity element, so investing in this is a win-win for the industry."

The RISE Group has run a series of seminars for its own staff and sub-contractors, and is training workers as mental health first aiders. "There is mental health stigma across society, and this may be exacerbated in construction because there are more men working in it and men are less likely to talk about these things," says Nathalie Duncan-Sletten, senior consultant at the construction and project management specialists, whose work includes the refurbishment of the Royal Opera House and establishing Amazon's new UK headquarters in Shoreditch, London.

"It won't change overnight. It is about educating employees and line managers to change attitudes so people do not feel guilt at having to take time off work due to mental illness, and for managers to be open and recognise it as a true from of malaise."

Unite, the biggest union representing construction workers, is part of the HCLG and campaigns for greater understanding of building-site pressures where workers move from job to job frequently.

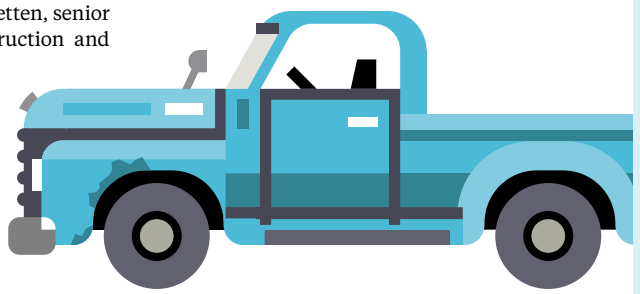
According to Unite: "Some of these initiatives are at an early stage so we are not seeing a change at cabin or canteen level yet. As a union we are developing initiatives to tackle mental health issues, but one of the challenges is to overcome the macho culture which remains prevalent.

"It is also important to recognise that some workers are only on sites for a few days and it is difficult to get messages across to them, and when you are working in a fragmented manner, the camaraderie of the construction site can be a myth."

A 2016 survey of site workers by UCATT (Union of Construction, Allied Trades and Technicians), now merged with Unite, recorded that 64 per cent of respondents suffered or had suffered from stress, yet 72 per cent did not mention it at work. A disturbing 65 per cent had experienced mental health issues.

But Mr Johnson believes the societal swing towards understanding mental health, accelerated by the Duke and Duchess of Cambridge and Prince Harry's Heads Together campaign, is energising change.

"The commitment from big companies is fantastic, and we are going to hold them to it and challenge them regularly," he says. "We can reduce absenteeism and make sure workers have a longer, happier retirement and this is a moral obligation as well as a professional one. Construction has to change – and it is."



OPINION COLUMN

'To attract the right talent, offering flexibility and work-life balance will be essential'

MICHAEL BUEHLER
Head of infrastructure and urban development
World Economic Forum

Recruiting and managing talent in the coming years will be challenging for the construction sector, according to a World Economic Forum report. The prospective scarcity of skilled labour driven by demographic shifts and the increasing sophistication of technology, which demands new and broader skillsets at all levels, coupled with the traditionally high volatility of workforce demand and composition, will be major tests.

Recent survey results confirm these fears. According to the US National Association of Homebuilders, 82 per cent of construction companies consider their main concern to be the shortage of construction workers. Sure enough, figures show that the average age of the workforce is rising faster than ever.

The UK Chartered Institute of Building reports that the set of workers over 60 is increasing faster, and the set under 30 is decreasing faster, than any other. In a construction industry survey conducted for the World Economic Forum, 77 per cent of respondents agreed that the industry is not doing enough to attract and retain talent.

Construction companies are often characterised by a conservative corporate culture and mindset. They are frequently hampered by organisational inertia. To support their overall business goals, the companies themselves need to drive organisational change. This is an iterative process, which requires careful alignment of a company's culture and goals, its organisational design, and incentive schemes.

Traditionally, workforce management in construction was equivalent to living a boom-to-bust cycle as hiring and firing followed the general trend of the economy. Winning the war for talent, however, requires a fundamentally different and longer-term approach. The first step involves strategic workforce planning, thinking strategically about the company's future demand in terms of quantity and quality of skills, and the likely availability of those skills to plan recruitment, retention and training systematically.

The concerns are not just about the quantity but also the quality of the future skilled workforce. The construction industry is undergoing a rapid digital transformation, through disruptive technologies such as building information modelling, wireless sensing, big data and analytics, 3D printing, and autonomous equipment, which requires radically different skillsets, and puts the industry in competition with technology companies for data scientists and IT experts.

By embracing innovation and new technologies, construction companies cannot only make themselves ready for the future, but can also meet the talent challenge. Increased automation, off-site prefabrication, new collaboration tools and suchlike advances will help to enhance productivity and wages as well as reduce the time spent on-site, two key wishes of respondents in the World Economic Forum industry survey.

Some innovations that are now standard in the automotive industry – exoskeletons, human-robot collaboration and ergonomic work processes – could benefit construction work too, making it less physically demanding and better suited to an ageing workforce.

The sector is well positioned to create a more appealing image, one of a dynamic and purpose-driven industry. In our survey, industry professionals proudly cited their beneficial impact on society, their contribution to national development, and their engagement with some of the serious modern challenges such as urbanisation and climate change.

Construction stakeholders should collaborate more in communicating this impact and should relay their fascinating stories more broadly by means of social media. Companies should start early, and go out to schools and universities to shape the image of the industry actively. To be successful in attracting the right talent, offering flexibility and a sufficient work-life balance will be essential.

The various actions will require a firm commitment from industry stakeholders and often a considerable financial investment too. As always, any investment should be based on a clear strategy and should be prepared carefully to pay off in the future. Failing to make a generous investment in talent would definitely be short-sighted. In the words of the renowned management consultant Peter Drucker: "Developing talent is business's most important task – the *sine qua non* [essential condition] of competition in a knowledge economy."

SUSTAINABILITY

Change is in the air with

The construction sector stands accused as a polluter, but has an opportunity to clean up its act

JIM McCLELLAND

From cyclists battling smog in Beijing, to car-free days on the Champs-Élysées in Paris, air pollution has become a high-profile, global problem. The bad news for the construction industry is that it has historically been a big part of that problem.

Adverse health effects of exposure to air pollution range from respiratory impacts and asthma, to heart disease and diabetes, plus foetal and postnatal implications.

In the UK, the issue makes headlines every month. Only five days into 2017, the country had already breached its annual air pollution limits for the entire year. Just a few weeks later, London mayor Sadiq Khan declared the toughest emission standard anywhere in the world will be introduced this October.

Even more recently, legal activist group ClientEarth announced it will be taking the government to court for a third time over air pollution, having sued successfully twice before.

For construction, there has already been a tightening of restrictions around emissions, says Charlie Law, managing director of Sustainable Construction Solutions and editor of the CIRIA (Construction Industry Research and Information Association) *Environmental good practice on-site pocket book*.

He says: "The regulatory framework with regard to air pollution has been relatively minor up until recently, with only the Environmental Protection Act 1990 imposing controls on dust emissions from construction sites. However, introduction of the London Non-Road Mobile Machinery Regulations in 2015 has really started to address the issue of NOx and PM10 [nitrogen oxides and particulate matter] emissions."

NOx are the gases associated with severe pollution effects such as smog and acid rain. PM10 is particulate matter with a diameter of up to 10 micrometres (microns), easily inhaled deep into the lungs. Only ten years ago, US Environmental Protection Agency research into diesel emissions found construction responsible for as much as 32 per cent of all mobile-source NOx and 37 per cent of PM.

Cleaner engine technologies and emissions restrictions on newer vehicles will inevitably bring incremental improvements. However, with replacement costs high and progress slow, education and training in more efficient use of existing assets offers easier, quicker wins, according to Mr Law.

Recent emissions scandals involving major vehicle manufacturers have also served to put construction firms on notice, says Shaun McCarthy, chair of the Supply Chain Sustainability School. "'Dieselgate' captured the world's attention and contractors need to understand that death and ill health due to plant and vehicle emissions are as much their responsibility as accidents on-site. This is not an optional extra," he warns.

> Away from site, the bulk of environmental impact occurs down long and complex industry supply chains

On-site there is no substitute for effective policy implementation, says Daniel Sweeney, environmental manager at John F Hunt Demolition. "A well-planned environmental management policy allows for impacts to be identified and appropriate control measures put in place to minimise risk," he says. "It will aid in achieving environmental objectives, plus sets out a clear chain of control and response, allowing for good communication between all stakeholders."

In the wake of the "modernise or die" 2016 *Farmer Review of the UK Construction Labour Model*, it is perhaps what the industry can do offsite, rather than on-site, that offers greatest hope.

Swapping the potential inefficiencies and unpredictable weather associated with traditional on-site working for the controlled environment of the factory floor promises clear opportunity for impact minimisation. Whether companies are looking to cut resource consumption or reduce risk of pollution there are gains in prospect on energy, water, waste, carbon emissions and air quality.

Additional potential benefits relate to wellbeing, health and safety, quality, cost and time.

Starting with a single room, prefabrication and modern methods of construction can deliver multiple environmental benefits, says James Stephens, managing director of bathroom pod manufacturer Offsite Solutions.

He says: "With use of off-site for bathroom construction, the number of activities and trades on-site is radically reduced – from around 15 different operations to just one pod supplier. This significantly reduces vehicle movements and associated emissions, plus achieves programme savings."

Away from site, the bulk of environmental impact occurs down long and complex industry supply chains. Construction is coming under increasing pressure to avoid charges of effectively exploiting communities and suppliers by exporting pollution.

In this regard, it is significant that the recent "world first" for completing the opening assessment against the new international standard for sustainable procurement, ISO 20400, went to leading international infrastructure group and giant of the British construction industry Balfour Beatty.

city pollution

VCG/Getty Images

01

THOMAS SAMSON/Stringer/Getty Images

02

01 Heavy smog shrouding construction sites in Beijing

02 Pedestrians on the Champs-Élysées in Paris as the world-famous shopping street went car-free for a day last May to tackle pollution in the French capital

A prime focus for environmental footprinting of business activities is, of course, carbon. Built environment numbers are big, but ambition needs to be bigger, says global industry director for construction at IFS, Kenny Ingram.

"Buildings contribute to 40 per cent of world carbon emissions and the UK has targeted a 50 per cent reduction in greenhouse gas emissions by 2025 – a stepping stone to cutting 80 per cent by 2050," he says.

While the imperative might be clear, so too is the urgent need for construction to up its game, says Mr McCarthy. "Industry awareness and understanding has historically proved very poor, with many players simply ignorant of the issues," he says. "We need a step-change in our approach to carbon, in both what we build and how we build it, before disruptive players enter the market and wreak commercial havoc."

In a bid to boost sector education and engagement, the Supply Chain Sustainability School is currently working together with the Carbon Trust and UK Green Building Council on a Carbon Month of activities throughout June, from free events to e-learning.

It is time for construction to start seeing carbon emissions not as some mere measure of cost-saving energy efficiency, but as a direct form of environmental pollution, in their own right.

Ultimately, when it comes to whether construction can cross the bridge from environmental problem to sustainable solution, we already know the answer, says Martin Brown, Living Building Challenge (LBC) UK ambassador and author of *FutuREstorative*.

"Not only is it conceivable that buildings can be restorative, we now have evidence they can indeed do more good, not just less harm, to the environment and human health," he says.

With the LBC flagship Bullitt Centre in Seattle restorative in energy, water and health, the problem now is not the buildings or the process, but the industry, Mr Brown says. He concludes: "We have all the tools, thinking and capability for a restorative future. The biggest barrier to true implementation is ourselves, with our entrenched culture and mindset."

Technology is rebuilding the foundations of construction...

In response to population growth and urbanisation, building and infrastructure projects are becoming more complex and worldwide spending on construction is forecast to almost double by 2030

AUTODESK.

The global construction industry is faced with an intimidating challenge. How can it deliver a built environment that meets the aspirations of a growing, urbanising population, but do it in such a way that is economically viable, socially inclusive and environmentally sustainable?

At the same time, technology is rapidly changing. While there is a rich heritage of technological change in construction, the pace is picking up so fast that it will completely transform the industry in a short period of time. Industry leaders need rapidly to understand and accommodate new technologies, such as infinite computing in the cloud, machine-learning, big data, robotics, drones, 3D printing, virtual reality and the internet of things (IoT).

Faced with such a rapid pace of change on these two fronts, the industry cannot keep pace by simply making modest tweaks to the way it does things.

Dominic Thasarathar, industry thought leader, construction, energy and natural resources at Autodesk, describes the pace of change and the opportunities it brings for the construction industry as "breathtaking".

He says: "What is so exciting is the convergence of all these new technologies that is like nothing we have seen before. When you put them all together, it is going to transform totally the way we design and build, and the way we operate buildings, infrastructure and cities. The timing couldn't be more pertinent given the task the industry faces over the next decade and a half."

6%
of global GDP is represented by construction

180M
construction workers woldwide

10
years until full-scale digitalisation of the construction industry will lead to huge annual global cost-savings

Cloud computing has given even the smallest contractors access to computer processing power that was unthinkable just a few years ago and until recently was out of reach for all but the biggest companies.

Connecting building information modelling (BIM) with the power of the cloud – what Autodesk calls Connected BIM – is allowing project teams to improve collaboration on projects and, via mobile communications and computing, remove the traditional barriers between the site and the office. Information is going to flow far more efficiently throughout project supply chains and across the life cycle of built assets.

Whereas the traditional design process has often been an exercise in compromise, limited by time, money, computing power and expertise, these constraints will be lifted by technology, using algorithms, which enable generative design to allow designers to explore almost limitless options, and machine-learning to guide better decisions. It will bring about a shift from today's best-practical approach to one of "best possible tomorrow".

Productivity in construction has lagged behind developments in other industries, but technology will enable huge improvements in how projects are selected, funded and delivered.

Digital technology will become part of the DNA of buildings and infrastructure, through sensors and systems linked by the IoT, allowing better use of BIM to make buildings more responsive to the needs of their owners and occupants.

"By adapting the new technologies, we will not only make the industry better, but deliver a better built environment

"By adapting the new technologies, we will not only make the industry better, but deliver a better built environment," says Mr Thasarathar.

Some of the technology is verging on science fiction and is in its infancy, such as using 3D printing to build bridges, but some, such as the connection of cloud computing with BIM for cloud-connected project delivery teams, is fast becoming part of everyday commercial life.

Autodesk makes software used to produce things, from smartphones and cars to skyscrapers and animated film characters. Mr Thasarathar says: "There is definitely a change going on and, because we span several industries, we can see a new industrial revolution taking place and cross-pollination as industries learn from each other."

Exactly how quickly the foundations of construction will change is unclear, but the one certainty is that it will change. Industry professionals need to invest time to understand the new era of connection and how they can harness the opportunities it will bring.

For more information please visit www.autodesk.co.uk/campaigns/eoc-video-study or follow @autodesk_UK

ARCHITECTURE

Hadid's lasting legacy lives on...

The Antwerp Port House is perhaps one of Dame Zaha Hadid's most striking creations – an enduring reminder of the late architect's bold creativity and daringly experimental style

Utku Pekli/Shutterstock

Tristan Fewings/Getty Images

Having achieved prominence as one of the world's foremost architects of her generation, Dame Zaha Hadid's sudden death last March came as a shock to the world of architecture and design. As the first woman to be awarded the Pritzker Architecture Prize, and the first and only to win the Royal Gold Medal of the Royal Institute of British Architects, she set the precedent for futuristic, expressive designs, such as the Guangzhou Opera House in China and the London Aquatics Centre in Stratford's Olympic Park. The Antwerp Port House (pictured), which opened last year, was one of the first major projects completed by her firm following her passing. Designed to resemble the bow of a ship, the Port House repurposed, renovated and extended a derelict fire station into a new headquarters for the port.

OPINION COLUMN

'It is vital that in building new homes, they are conceived and constructed with a less stable climate in mind'

ALASTAIR CHISHOLM
Head of policy and communications
Chartered Institution of Water and Environmental Management

Climate change represents one of the greatest challenges of our age, with quite small increases in average atmospheric temperature carrying the potential to influence and change weather patterns significantly at a more local level.

In the UK we are positioned in the firing line of Atlantic weather systems and the Association of British Insurers has recently warned that, alongside increases in rain storm intensity, we should also prepare ourselves for more damage from destructive wind storms. Additional risk exists in relation to the impact of heatwaves. Flooding is perhaps the most frequent and familiar to the UK public, though financial impact of wind storms can be greater and the death toll is typically highest from heatwaves.

Obviously the ultimate aim should be to slow if not stop the emission of anthropogenic greenhouse gases such that these manifestations of climate change are avoided. But equally we need to ensure that our built environment is resilient to these impacts as far as possible.

The UK is in the midst of a housing crisis, which lead to the last government setting a target to build a million new homes by 2020. Incorporating resilience is easier with new build, particularly on greenfield sites where cost and availability of land allows for greater use of landscape features and unrestricted design to optimise resilience. It is vital that in building these new homes, and supporting infrastructure, they are properly conceived and constructed with a less stable and predictable climate in mind.

Aside from new build, a far bigger challenge exists in what to do with the vast majority of our existing built environment, developed decades or centuries ago with little or no consideration of resilience against storms and heatwaves. For many who have been flooded in recent years, sometimes a number of times, this is an all too present challenge. They often cannot move, insurance, if obtainable, can at best repair but little more, so retrofitting resilience measures is a sensible, cost-effective option.

The Chartered Institution of Water and Environmental Management (CIWEM) is currently helping to develop awareness, standards and codes of practice to ensure that when property flood-resilience measures are put into homes and business premises, this is done to a high standard to help keep water out or speed up the rate at which a building can be reoccupied following a flood. With insurers on board, the prospects to deliver real improvements in property flood resilience look positive.

Far too many people do not know they're at risk of flooding. While most are likely to recognise risk of flooding from rivers and the sea, more people are likely to be affected by surface water flooding that occurs as a direct result of heavy, intense rain storms. We should be building and retrofitting our towns and cities to handle this flash flooding more effectively.

While traditionally the approach has been to pipe water away to the nearest river, this can cause problems. Firstly, as with much of the built environment, drainage systems can be decades or even centuries old, and are increasingly overloaded by new development and the increasingly intense rainfall. Secondly, by draining quickly into the nearest river, this can increase the risk of flooding to communities downstream.

The answer is to make our drainage systems better able to store water and let it drain away slowly, effectively removing the "flash" element from the flooding equation. CIWEM has been championing sustainable drainage systems, which do this by using a wide range of approaches from green roofs, permeable surfaces, ponds or underground tanks to store the water.

Designed at an early stage in a development, they are cost effective and can deliver a host of wider benefits, not least making towns and cities greener and more attractive. We are currently working with government to make sure policies and guidance work to mainstream this approach, and we are hopeful of real progress in the near future.

AUTODESK.

The Future of the Construction Manager

The lives of construction managers across the UK are rapidly changing as technology transforms how buildings and infrastructure are designed and built. We call this the Era of Connection. Find out how the trends will affect you in a new video made in conjunction with CIOB, and discover how you can stay ahead of the curve.

Watch the video at
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