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FIRE SAFETY

Reforms and regulations in Grenfell's wake

The Grenfell Tower tragedy claimed the lives of 72 people, underscoring the limitations of building regulations and a lax attitude towards fire safety. So what's changed since?

Rich McEachran

A few years before the events that took place in the early hours of June 14, 2017, fire-resistant zinc cladding was approved by residents for installation as part of the Grenfell Tower refurbishment. This was later swapped for cheaper, aluminium panels to cut costs by around £300,000.

Six weeks after the Grenfell Tower fire, tests conducted by the Building Research Establishment found that at least 82 residential multi-occupancy buildings used a combination of cladding and insulation that didn't meet the fire safety standards at the time.

Dame Judith Hackitt, who led an independent inquiry into building regulations following the Grenfell fire, released a report in May 2018 in which she concluded that ignorance had led to a "race to the bottom". She called for "a radical rethink" of building safety practices.

"The public may perceive progress and change to have been slow, but the issues are complex and need to be considered carefully or we risk causing further problems," says Jeffrey Tribich, lead health and safety consultant at Malcolm Hollis, one of the UK's largest independent building consultancies.

Mr Tribich believes that it's going to take widespread legislative overhaul to force through all the complex and comprehensive health and safety changes that the construction industry should have in place. Yet there have been some promising signs, he adds.

The Construction Industry Council has been looking into construction professionals' fire safety competence, as well as a fire protocol for use with building contracts. Meanwhile, in response to Dame Hackitt's report, the Royal Institute of British Architects launched its Plan of Work for Fire Safety last September. It will act as a resource for design and construction teams to help them clarify roles, responsibilities and procedures for fire safety in new buildings.

At the United Nations in Geneva, in July 2018, the Royal Institute of Chartered Surveyors joined other organisations from around the world to launch the International Fire Safety Standards Coalition. The aim is to pave the way for a global set of fire safety standards.

Most significant of all, though, is arguably the government ban on using combustible cladding on new high-rise construction projects. It came into force at the end of last December, 18 months after the fire.


Getty Images \ ADRIAN DENNIS

Despite the government taking a crucial step towards reforming construction regulations, it still faced criticism from some quarters; the issue being that the new guidance wasn't specific enough.

It was assumed that it only applies to new residential blocks, as well as student accommodation, hospitals and care homes, that are 18 metres or higher. The other assumption was that it applied just to the insulation on the outside of buildings and not to the exterior of the cladding.

In response to this, the government has since moved to clarify its position. In July, it advised building control officers to check the cladding on buildings under 18 metres. It has also urged building owners to remove any combustible materials from balconies, regardless of height.

"This clarity is welcome, but we have already seen the impact of the previously unclear regulations," says Chris Farrow, director of design-led structural and civil engineering consultancy Farrow Walsh.

"The broad-brush approach taken to the materials used on high-rise developments is compounded by insurance companies increasing premiums for consultants working on buildings over a certain number of storeys. The implications of this on the cost of projects, and to firms seeking to secure insurance on materials, is having a significant impact on small and medium-sized construction and engineering businesses."

Nevertheless, Mr Farrow stresses that there has been increased scrutiny placed on both residential and commercial tower blocks post-Grenfell. This is particularly noticeable in the elements of a building that, although not always seen, are critical to its structure's fire safety, including airtightness and, more prominently, thermal insulation, he says.

In May, the government announced that it would foot the £200-million bill to replace Grenfell-type cladding on more than 150 private high-rise blocks of flats.

While much of conversation over the last couple of years has been about improving regulations to reduce the risk of fire, Grenfell has also put the spotlight on the need for laws to reduce overheating risks in new buildings.

There are 7,000 heat-related deaths in the UK every year and the Committee on Climate Change has been calling for building regulations to be updated for several years. The government has previously rejected the organisation's advice.

Modular housing, in particular, has come under scrutiny. Last July, the Commons Environmental Audit Committee called on the government to stop funding "hothouse" modular homes, deeming them to be poorly constructed and expensive to heat. In response, industry experts argued that there's no correlation between a home being modular and the building's performance.

"The idea that modular homes are prone to overheating is overplayed. Of course, overheating can be a problem in urban areas, where there are denser developments, more people and the urban heat-island effect is in full swing. But this isn't an issue specifically related to modular homes," argues Dave Sheridan, executive chairman of modular housebuilder Ilke Homes.

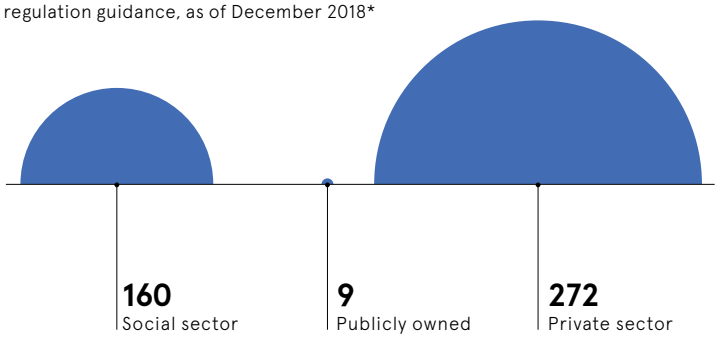
Mr Sheridan adds that by manufacturing each home in a controlled factory environment, the level of insulation and airtightness of these buildings will exceed the necessary requirements.

Another issue that needs to be taken into consideration is the responsibility of the end-user. According to research by fire-resistant technology firm Zeroignition, one in four architects (26 per cent) consider the end-user to be the root cause of fire protection failure.

Ian King, Zeroignition's chief operating officer, says that few occupants consider the risks of the building they're living or working in. This is something that needs addressing so they're aware of any preventative measures they can take to prevent another Grenfell Tower fire.

COMBUSTIBLE CLADDING: A WIDESPREAD PROBLEM

Number of buildings identified post-Grenfell deemed unlikely to meet building regulation guidance, as of December 2018*



*Building over 18 metres in height with aluminium composite material (ACM) cladding systems
Ministry of Housing, Communities and Local Government

Yancy Min/Unsplash

DIVERSITY

Building the case for marginalised workers

Diversity issues in construction are hardly new, but a greater representation of historically marginalised groups is vital and must happen sooner rather than later

Oliver Balch

The construction industry has a diversity problem. Whether it's on a building site or at the drafting table, men predominate. And not just any men. Picture the average construction worker and he almost certainly is likely to be white, middle-aged and able bodied.

The homogeneity of the construction workforce is not a new revelation. Study after study has flagged the issue, especially regarding gender. Take the UK government's latest industry survey which found a measly 13 per cent of the British building sector to be women.

Where the diversity debate is changing, however, is the increased attention now being given to non-gender representation. As research highlights, construction companies are failing dismally to recruit from historically marginalised groups, especially those related to sexuality, ethnicity, age and disability.

"The inclusion of women has been on the agenda for quite some time, but levels of focus vary substantially when you look at other protected characteristics," says Yvonne Smyth, group head of diversity and inclusion at recruitment firm Hays.

She points to a recent landmark survey conducted by Hays which, among other startling findings, revealed 78 per cent of black workers in the construction industry claim to have experienced restrictions in their career progression due to their race or other "protected" factors, such as age or sexuality.

Resolving this lack of diversity in construction represents an obvious imperative for the industry. Before anything else, there's a question of social injustice at stake. Whether due to structural prejudice or, as the industry would argue, unconscious bias, it doesn't much matter as the current reality smacks of discrimination.

But compelling business reasons also exist for construction companies to act and act fast. Among the most immediate is the sector's recruitment problem. With fewer young people wanting to join the industry, contractors are struggling for manpower. In the UK, Brexit is complicating the problem further as many European workers are opting to return home.

Impending tech-led disruption also means the construction worker of tomorrow is as likely to be operating a robotically controlled bricklayer as he or, hopefully, she is to be mixing cement. Firms need to be casting their net as wide as possible to prepare themselves for future skill needs.

The industry is well aware of its need to act, says Nathan Garnett, director of UK Construction Week, an annual trade show. But what exactly should firms be doing?

For Mr Garnett, the answer has to start with fixing the sector's image problem. Historically, construction "has never been seen as particularly welcoming", he concedes. That needs to change. And the best way to do it, he argues, is for new or potential entrants to see positive role models higher up the career ladder.

With this in mind, UK Construction Week is spearheading a role model campaign that provides a platform for people from across the industry, including under-represented groups, to share their career stories and publicly discuss the challenges they face. The scheme has seen a four-fold increase in applications since it launched last year.

"There are some incredible people from diverse backgrounds who have managed to succeed and love their career. By projecting their stories, we can go a long way to breaking down barriers and solving the sector's skills gap," says Mr Garnett.

Another critical factor in advancing the cause of diversity in construction is vocal leadership from the top. At an individual firm level, the sector is awash with well-intentioned policies and specially tailored schemes. What is missing is a joint industry response.

So argues Richard Threlfall, global head of infrastructure at professional services firm KPMG. The construction industry suffers from a "lack of collective ownership" of the issue, he says, with firms looking at "what they need individually, rather than at the industry as a whole".

To an extent, this is understandable. The construction industry is highly fragmented, with even the largest companies controlling just a tiny stake of the market. The habit of major contractors to farm out work to sub-contractors, who may sub-contract to others, also makes it difficult to pinpoint who is ultimately responsible for promoting a diverse workforce.

Such challenges are not insuperable, according to Mr Threlfall. For inspiration, he singles out various large-scale infrastructure projects that have made inclusive recruitment a priority issue. Contractors have, in turn, adapted their practices.

He cites the Thames Tideway Tunnel, a major nine-year revamp of London's sewer system initiated in 2015 that is run by a consortium of investors and, via its four main delivery partners, employs some 4,000 workers.

Among other steps, Tideway has sought to recruit as much as possible from local areas, widening the profile of its workforce given the ethnically diverse boroughs through which the project passes. Tideway is also certified as a disability-confident employer and as a Stonewall diversity champion, two pioneering schemes designed to improve the workplace for disabled and LGBT+ employees, respectively.

"We have focused not just on 'diversity' but on conscious inclusion, listening closely to how people work and what they need from the world of work, and turning that into employment practices," says Marcia Williams, the company's head of development and inclusivity.

> **Whether due to structural prejudice or unconscious bias, the current reality smacks of discrimination**

The notion of listening to workers and potential employees echoes a point made by Hays' Ms Smyth about flexible working. Construction firms can take numerous measures to make their workforce more diverse and inclusive, from tailored internships and apprenticeships to so-called returnships for older workers.

But if there is a silver bullet, Ms Smyth argues, then it is asking people what working arrangements suit them and adapting to fit. Like accommodating for religious holidays for instance, or allowing older workers time-off to care for a spouse or grandchild.

That said, no one-size-fits-all solution will fix construction's diversity problem. Success will depend on collective will and shared leadership across the whole industry. Only then will a fully open-to-all culture be built.

78%

of black construction workers feel their career progression opportunities are limited because of discrimination, compared with 41 per cent of white employees

Hays 2019

32%

of construction workers who are black, Asian or from minority ethnic (BAME) backgrounds believe their voice is heard and respected at their company, compared with 43 per cent of all employees

Hays 2019

60%

of all workers believe their leaders have a bias toward people who look, think and act like them

Hays 2019

OPINION

‘The system is in danger of collapse, which threatens to greatly reduce the construction of new homes’

For decades, the UK has been constructing fewer new homes than society needs, annually increasing the cumulative problem of insufficient housing capacity. The new cabinet will have the pressing priorities of Brexit and parliamentary arithmetic, but the nagging issue of housing provision remains a running sore.

Lying in the political undergrowth is a fast-running problem that, if not quickly resolved, will have serious implications for housing supply and potentially undermine the post-Grenfell activity of government and industry working together to improve building safety.

You may never have heard of an approved inspector (AI). There are only 95 of them and they range in size from sole practitioners up to large multinational entities. AIs now provide building control services on around 150,000 projects a year, which is approximately 40 per cent of all controllable building work in England and Wales; the rest is provided by local authorities.

AIs must pass a robust application process, and are regularly reviewed and audited by the Construction Industry Council Approved Inspectors Register, a wholly owned subsidiary of the Construction Industry Council, the only body designated by the secretary of state and Welsh ministers to approve inspectors and maintain a register in accordance with section 49 of the Building Act 1984 and part two of the Building (Approved Inspectors etc) Regulations 2010.

They are a critical component for enabling the efficient delivery of construction and housing projects, and the production of safer buildings, both under the current regime and in the much-needed reforms being developed for the future. But their very existence is under threat.

It is a legislative requirement that all AIs must carry professional indemnity insurance (PII) from a scheme approved by the secretary of state that conforms with conditions prescribed by government, such as mandatory run-off cover for ten years, against an industry norm of six years, and a low excess requirement of £5,000, both set in the 1990s and never subsequently revised.

The impact of the Grenfell Tower disaster, in association with other factors, has led to a hardening of the PII market in relation to construction and it seems AIs are at the thin end of that wedge; an irony since no AI was involved in the refurbishment of Grenfell Tower.

As a result of this changing attitude to risk, the underwriters of one of only two active approved schemes of insurance have ceased to underwrite any new business and no alternate has been found. It is evident that the insurance criteria set by the Ministry of Housing, Communities and Local Government is outdated and unnecessarily stringent, presenting a barrier to entry for new insurers.

The vagaries of time have already dealt a blow to four AIs – the first in the queue to arrive at policy renewal, after this problem emerged – and they are being forced out of business, since they cannot trade without insurance. This leaves approximately 20,000 projects without building control oversight with work reverting to local authorities that are already resource constrained.

As time goes by, the likelihood of more AIs having to cease trading for no fault of their own increases, as does the size of the problem in terms of the number of projects affected. The system is in danger of collapse, which threatens to greatly reduce the construction of new homes.

Robert Jenrick has recently been appointed as the new secretary of state for housing, communities and local government, with Esther McVey as the housing minister, incredibly the 18th person to hold that role in the past 22 years. For the sake of building new homes that have been properly controlled and are safe to occupy, let’s hope these ministers can take a break from Brexit for long enough to take urgent action to address and resolve this problem.

Graham Watts
Chief executive
Construction Industry Council

How Altrad is building its digitised future

For too long the construction industry has relied on paper systems in the delivery of work in hazardous environments. Failing to invest in digitisation can prolong planned schedules, lead to the late completion of builds, and eat into productivity and the bottom line

Following its acquisition and integration of Cape, NSG and Hertel, Altrad realised it had a once-in-a-lifetime opportunity to invest in a suite of new technology that would bring people together as a single team to improve operational efficiency and drive future growth. So, last year, it decided to adopt a group-wide digital strategy that will bring all these technologies together to create a single picture across the UK business.

In a large, mature business this is no small feat. To help make the switch, the equipment and industrial services provider turned to technology partners 4PS and IAMTech.

4PS develops enterprise resource planning (ERP) software based on the Microsoft Dynamics platform and tailored specifically for the construction industry. The solution 4PS supported Altrad in implementing, 4PS Construct, provides Altrad with total visibility of site-based activities at their various stages. In addition, it means that the back-office teams can receive and monitor data in real time through the platform.

Second project partner IAMTech delivered ATEX-rated tablets and smartphones with iPlanULTIMATE™ installed. These devices allow users to scope, plan, estimate and progress work, all at the worksite.

More importantly, they enable supervisors to spend more time on site, supervising, increasing productivity and monitoring safety where work is happening, instead of having to spend time sat at computers. The data is delivered into planning hubs which use innovative touch-screen technology to enable contractor and client swift access to performance information so decisions can be made about resource planning, equipment logistics and asset uptime.

“With this accurate and instantly accessible information, decisions can now be made immediately to the benefit of all stakeholders. Our people can take appropriate actions without hesitation, eliminating the risk of bottlenecks which can cause both on and off-site delays, and lead to rising costs. All this allows our teams time to focus on efficient and timely delivery, making full use of their skills without the frustrating administration delays,” says Tony Jester, managing director of Altrad Service’s maintenance, modifications and overhauls division.

Lead sales consultant at 4PS for its partnership with Altrad, Mark Egan, adds: “As data is captured at the beginning of a project or contract, this information can then be reused throughout the process. For example, data from the approved estimate or tender can be used to form the project budget, then again for procurement, cost control and forecasting, and ultimately the invoicing. This improves accuracy and reduces expensive errors.”

For too long the industry has relied on paper systems in the delivery of work in hazardous environments. Altrad, together with their strategic partners, are investing in removing those inefficiencies and frustrations by embracing new technologies to create a workspace where data becomes the driving force of contractor and client performance.

The iPlan system is used by 4,800 personnel, which accounts for roughly 75 per cent of Altrad Service’s UK workforce. It will deliver an estimated £650-million worth of shutdown and maintenance cost activities across more than 100 sites a year.

Ross Coulman, IAMTech’s managing director, says: “We have deployed our platforms across the world working in many differing environments. Working with Altrad offers the opportunity to showcase our mobile planning and execution technology with a partner that sees the opportunity it will create for their customers and their people.”

Failing to invest in digitisation can prolong planned schedules, lead to the late completion of builds, and eat into productivity and the bottom line.

In contrast, a big benefit of investing in bespoke digital ERP and on-site software is that stakeholders no longer have to worry about such issues. They can focus instead on high-priority tasks that are likely to drive higher profits, with customer experience and the quality of the products and services being delivered.

Creating a workplace where people can make decisions in a more agile and focused way, Altrad aims to improve service delivery and enrich the overall experience for its employees and customers alike.

Altrad is investing time and energy not only in technology, but also in it’s people. By inspiring their people to embrace change, the simplified ways of working will only lead to more wins for Altrad and its clients.

4.8k
personnel use the iPlan system, which accounts for roughly...

75%
of Altrad Service’s UK workforce

100+
sites use the system

For more information please visit www.altradservices.com/digital-future

ALTRAD

HOUSING

Five innovative ways to combat the housing crisis

From modular commuter villages to innovative finance models, developers are finding new, inventive solutions to tackle the UK housing crisis

Heidi Vella

Modular commuter villages

Smart, quickly constructed modular commuter villages, located on the periphery of overcrowded urban centres, can provide affordable new housing stock while alleviating the inner-city accommodation crisis, according to Project Etopia.

Its first modular village, under development in Corby, Northamptonshire, includes 47 turnkey homes equipped with in-home internet of things technology, renewable energy, and intelligent heating and cooling systems.

The houses, which are fully mortgageable and have a lifespan of 60 to 100 years, are constructed offsite – four houses can be built in 34 days – and shipped worldwide. They are also affordable; a four-bedroom house in the Corby development costs between £320,000 and £350,000, compared with £450,000 to £575,000 for new, nearby brick-and-mortar houses, according to the company.

"Modular commuter villages offer younger would-be homeowners the wage benefits of working in the capital, but without the high property costs," says founder Joseph Daniels.

Etopia Corby is the company's first project, but it is already developing others in the United States, Spain, Namibia and Kuwait. Mr Daniels says the company is also acquiring land in the UK to build a series of connected eco villages that will facilitate smart energy-sharing.

Mortgage-free part-home ownership

A house in the UK typically costs eight times more than the average wage, which means mortgage deposits are often prohibitively expensive for average earners.

Startup Unmortgage hopes to tackle this problem and help alleviate the housing crisis by offering first-time buyers gradual home-ownership without a mortgage.

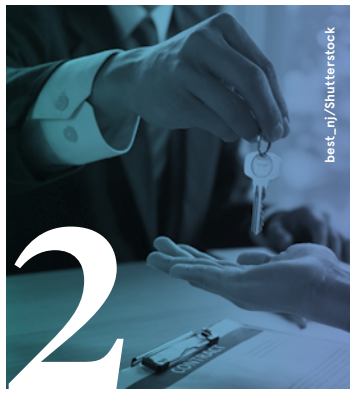
Instead of saving for a full mortgage deposit, which at 20 per cent of the house price can be around £80,000 in London on average, Unmortgage customers can enter into a shared-ownership partnership with the company to purchase as little as 5 per cent – at a minimum cost £12,500 – of an Unmortgage-approved home. They then pay market-rate rent on the rest of the property.

Buyers can then increase the equity they own in their home by up to 5 per cent a year and, when they have enough to secure a mortgage, the property can be purchased outright.

Conrad Holmboe, chief information officer at Unmortgage, says the finance model can bridge the gap between renting and buying, while also providing long-term housing security.

"We aim to create a virtuous cycle where the more someone buys, the less rent they pay and the more equity they have," says Mr Holmboe.

Unmortgage is financed by Allianz Global Investors, which is reported to be providing £500 million, connecting pension funds and properties in a new way in the UK. With the first tranche of money, Unmortgage intends to fund "a couple of thousand" properties.



Building up, not out

Using existing rooftops to build upwards instead of outwards could provide 180,000 new homes, including 60,000 atop public assets, in London alone, according to housing developer Apex Airspace.

The company currently has plans to build 3,000 new homes in the capital, half of which will meet the government's affordability guidelines.

By mitigating the need to purchase land for development, airspace projects are on average 35 per cent cheaper, according to the company. Furthermore, units are developed 95 per cent offsite using modern construction methods and then craned on to buildings which reduces construction costs.

A project under consideration in Bermondsey aims to deliver 31 residential apartments on two Lambeth and Southwark Housing Association-owned and currently occupied buildings by incorporating a double-storey rooftop extension and "bookend building" at either side.

As well as adding value to existing buildings for councils and private owners, managing director of the company Val Bagnall, says rooftop development can help pay for or share the cost of building upgrades, such as replacing building cladding post-Grenfell.

Apex aims to deliver 10,000 homes over the next ten years, but Mr Bagnall says the potential for airspace homes could be increased by 25 per cent with a revision in planning permission law.

Specialist senior housing

Providing good quality accommodation for over-65s can free up large under-occupied family homes for younger generations to help tackle the housing crisis. Yet only around 3 per cent of homes in the UK are built specially for older people, even though around 18 per cent of the population, around 12 million, are aged 65 and over.

ExtraCare Charitable Trust has developed several affordable retirement villages that it claims have freed up more than 750 local family homes.

To make its projects viable, the trust has focused on economies of scale and being a dedicated healthcare provider, which means it has access to government funds to help pay for often uneconomic communal spaces.

4

For example, it's £48-million Longbridge Retirement Village in Birmingham, built on a disused car factory, comprises 260 one and two-bed apartments, plus a village hall, bar, bistro, gym and more.

"Good retirement living requires community spaces, but funding this while making units affordable can be challenging. However, we're seeing exciting models enter the market, such as providing other services such as healthcare," says Louise Drew, head of real estate at law firm Shakespeare Martineau, which worked on the Longbridge development.

Besides freeing up housing stock, senior housing can have other benefits. According to a recent study with Aston University, ExtraCare residents reduced their dependence on GP and hospital services, resulting in a 38 per cent reduction in NHS costs per person each year.

Pocket homes

Housing developers Pocket Living are helping the so-called squeezed middle get on the housing ladder by offering specially designed "Pocket homes" at a 20 per cent discount compared to the market rate.

The 38-square-metre modular factory-built apartments are cleverly designed for compact living. Each has an open-plan kitchen-living room, separate double bedroom and a wet room.

The company subsidises these homes by selling two and three-bedroom properties in the same developments at full market price. Costs are kept down with off-site, modular construction and modern manufacturing methods, according to the company.

5

Modular off-site construction has also enabled it to develop heavily constrained sites. Pocket Living's latest project, a 27-storey, 89-home tower in Wandsworth, London, called Mapleton Crescent, was possible to develop because the housing units could be craned into the heavily restricted riverside site.

"Modular homes are better quality than traditionally constructed ones because they are made in factory-controlled conditions and they also create less disruption for neighbours as they come completely finished," says associate and project architect on Mapleton, Jonathan Drage.

To date the company has developed 650 Pocket homes and plans to build thousands more over the next 18 months.

Transformation based on transparency, technology and talent

If the first step in achieving positive change is to acknowledge the true extent of the problem, then the transformation of the construction industry must start with a reality check

The situation in the construction industry is serious, if not critical, says Josh Murray, global director for human capital at Laing O'Rourke.

"For construction, and especially its supply chain, this is one of the most challenging times in the modern era. Established, prime contractors have proved vulnerable, with an unprecedented collapse of major employers across the European market," he says.

The underlying problems are as much cultural as technological. Under its traditional, adversarial contracting model, the industry has typically tried to push as much risk as possible down the chain, so splitting responsibility between multiple players and holding all individually to account.

In the current climate, this approach is no longer fit for purpose. "In the UK, in particular, we are witnessing a quite dramatic market trend away from that competitive tender process. The upshot is a new and emergent, collaborative business model, founded on early engagement," says Mr Murray.

Early engagement and collaboration

Opening the door to early engagement unlocks opportunities to adopt new technology, digital tools and manufacturing knowhow. Sharing available and accessible data enables project transparency and boosts client trust.

"These are the collaborative skills needing to be bred into the next generation in construction; old, outmoded, adversarial standpoints will not deliver the infrastructure of the future," he says.

90k

industry-wide skilled jobs could be created by adoption of digital and manufacturing technologies

10

years ago, Laing O'Rourke began production in its leading precast concrete facility

340+

DfMA-led projects delivered by Laing O'Rourke

Effectively peeling back the hoarding wall, with tools such as artificial intelligence and augmented reality, provides clients with 20:20 vision on-site, but also calls for a mindset shift. Such a culture change cannot be expected to happen overnight, though, in an industry the size of construction, which employs more than three million people in the UK and contributes almost 10 per cent to the national economy. The revolution must be planned.

DfMA and digital data

So, ten years ago, Laing O'Rourke demonstrated its commitment to offsite construction via design for manufacture and assembly (DfMA) by investing in Europe's leading precast concrete facility, in Nottinghamshire, which is complemented by its mechanical and electrical manufacturing capability in the West Midlands. The firm has since spearheaded more than 340 DfMA-led projects and can now guarantee an offsite manufacturing mandate in-house on every one of its schemes.

Then, three years ago, Laing O'Rourke set itself the task of responding to the Industrial Strategy from the UK government, challenging construction to be on a productivity and technology benchmark with aviation and automotive engineering, by 2025.

Next up is digital-twin technology. Mr Murray says: "We are not just building off the digital model; each physical component is actually in it, replacing the digital design element in the construction model. Straight off the production line, its progress is mapped and measured every step of the way."

Core to this new integrated way of working is the availability and accessibility of digital data, which will drive procurement and standardisation of design plus, ultimately, delivery on-site.

Working with clients in the early engagement sphere gives them an understanding of the transparency benefits of digital data updated daily. The ability of Laing O'Rourke to translate money spent into progress on site and evidence certainty of delivery can help unlock new value streams for the client and fresh rounds of investment, potentially being held back by the concerns of funders about the industry's ability to plan.

The final, vital piece in the jigsaw is human resource, adds Mr Murray, with the latest Construction Leadership Council report highlighting direct employment as key to developing new skills.

> **For construction, and especially its supply chain, this is one of the most challenging times in the modern era**

"People entering the industry now overwhelmingly need to have a digital-first mindset and the skills to match. We would still see the need for traditional skills in terms of tradespeople becoming technicians, but placed in high-value roles, not commoditised," he says.

Hinkley: a modern megaproject

The first of a new generation of nuclear power stations to be built in the UK, Hinkley Point C is the epitome of a modern megaproject, says technical director at Laing O'Rourke, Sarah Williamson.

"Any large infrastructure project is at risk of suffering cost and programme overruns, so a big part of the job has been working with the client for the best part of a decade to show how certainty can be built in, whether through DfMA, componentisation or digitisation," she says.

The civil engineering works for this groundbreaking infrastructure scheme are being constructed in Somerset by the BYLOR joint-venture of Bouygues Travaux Publics and Laing O'Rourke.

For Dr Williamson, the project is about demonstrating that it is possible to do things differently and at scale. "This is not just a question of geometry, but the data that sits behind it. Everything is done to make sure when the thing hits the site and the cost in pounds per minute really matters, the client gets zero delay and maximum certainty: no surprises," she says.

The client has absolute transparency, even sharing access to the project data tool, with all records in the same space. With every component and element modelled before going to site, the teams effectively have a kit of parts with which to construct the project in alignment with the four guiding principles of delivery: safety, quality, programme and cost.

People power is a gamechanger

Hinkley carries the promise of 25,000 employment opportunities plus secure, low-carbon energy for some six million homes. For us, it all starts with building the dedicated team required to deliver such a project, says Dr Williamson. "We need data engineers, coders, creative thinkers, systems and process-oriented specialists, along with the more traditional skills of on-site organisation, implementation and management," she says.

"As a team, we need people who can both see the problem and solve it, rather than continue to operate in the same old ways the industry has done for the last 50 or 100 years."

Competing in a tough marketplace for young talent, Hinkley is attracting valuable individuals from the likes of the gaming industry, applying their transferable skills to support infrastructure and real-world development goals.

Looking ahead, the gamechanger for construction will arguably not be technology, but people. Dr Williamson concludes: "I want the whole spectrum of skills. So, if as an industry, we can start to pull in that broad mix of people and attract a rich diversity of thought and thinker, then this might provide the perfect melting pot we need to get ideas really flowing and solve the complex challenges faced by our industry and society as a whole."

For more information please visit www.laingorourke.com or follow us on Twitter @Laing_ORourke

LAING O'ROURKE

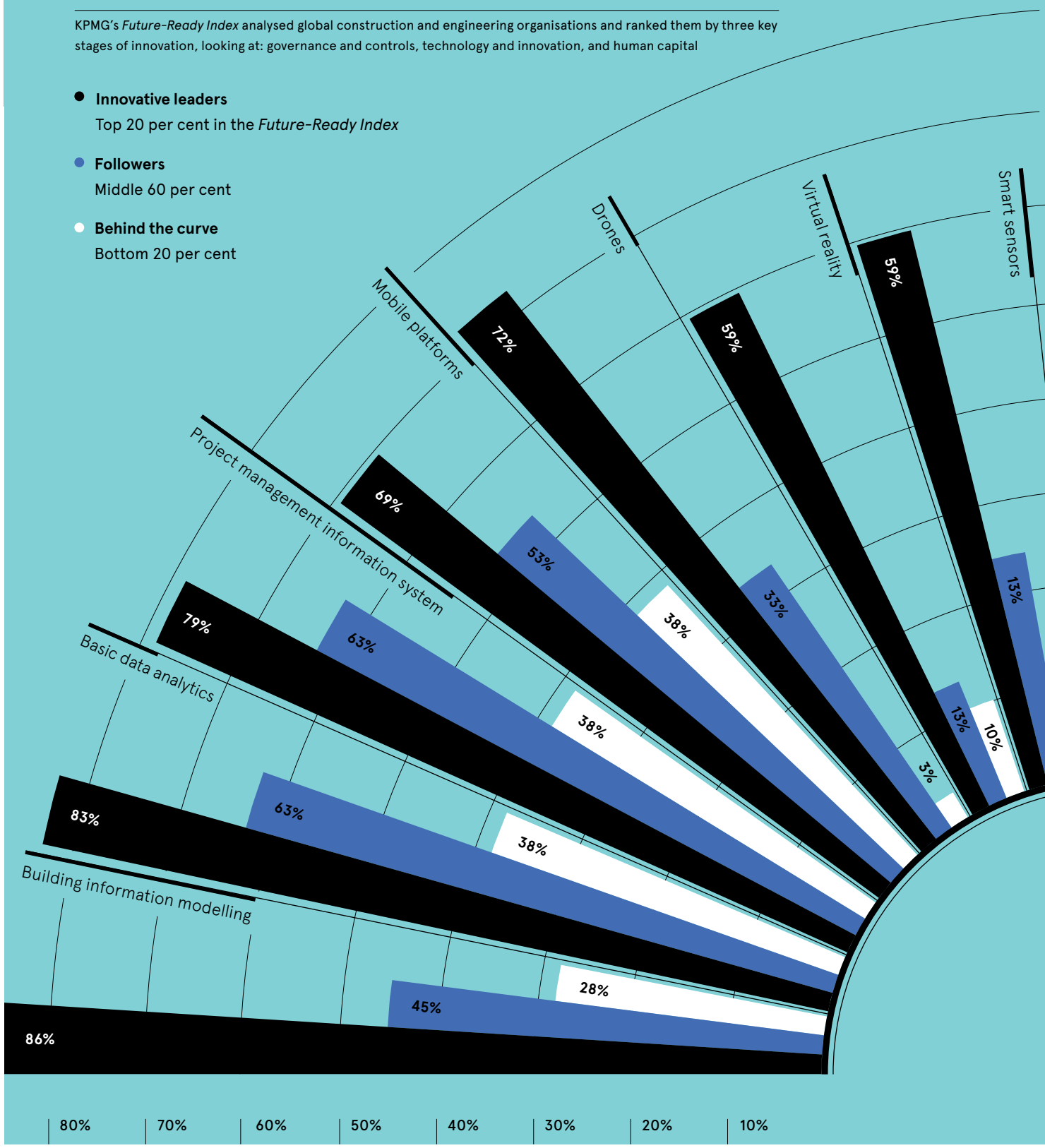
CONSTRUCTION DISRUPTION

While building information modelling and data analytics are widespread among most large construction companies, a host of emerging technologies are starting to have an impact on the wider sector, and it is the early adopters who are racing ahead of the competition

TECHNOLOGY ADOPTION BY INNOVATION STAGE

KPMG's *Future-Ready Index* analysed global construction and engineering organisations and ranked them by three key stages of innovation, looking at: governance and controls, technology and innovation, and human capital

- **Innovative leaders**
  Top 20 per cent in the *Future-Ready Index*
- **Followers**
  Middle 60 per cent
- **Behind the curve**
  Bottom 20 per cent



KPMG 2019

IMPACT OF DIGITISATION ON THE C

Where construction companies agree or disagree with th

● Agree ● Neutral ● Disagree

Improve the productivity of the construction sec

Improve the speed of delivery

Help the construction sector meet the challenges of sustainability

Improve construction health and safety

Help us export more

52%

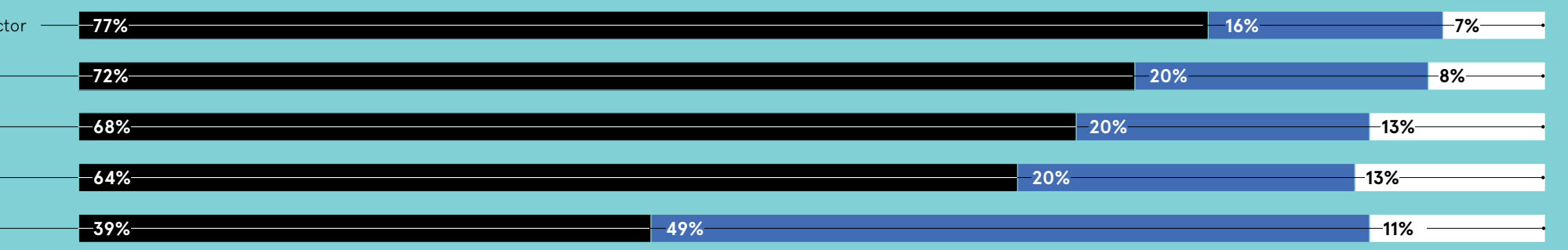
of innovation leaders (ranked among the top 20 per cent) say that machine-learning and AI will be commonplace in the sector within five years

KPMG 2019

CONSTRUCTION SECTOR

he following statements about digitisation

BNS 2019



70%

of construction companies believe those who do not adopt digital ways of working will go out of business

62%

believe the sector is behind others when it comes to adopting digital technologies

89%

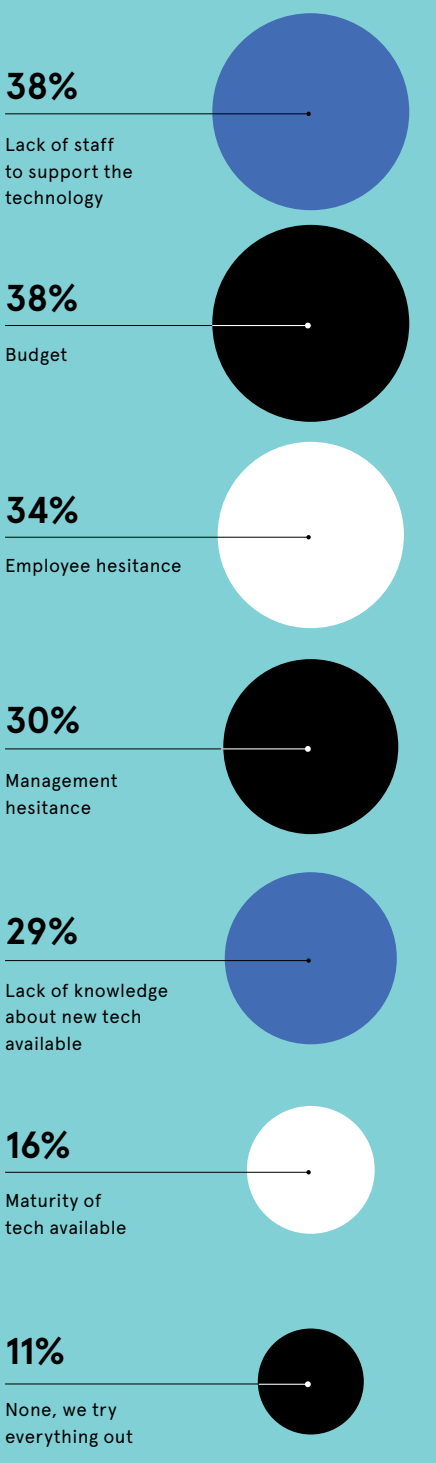
agree that digitisation will transform the way they work

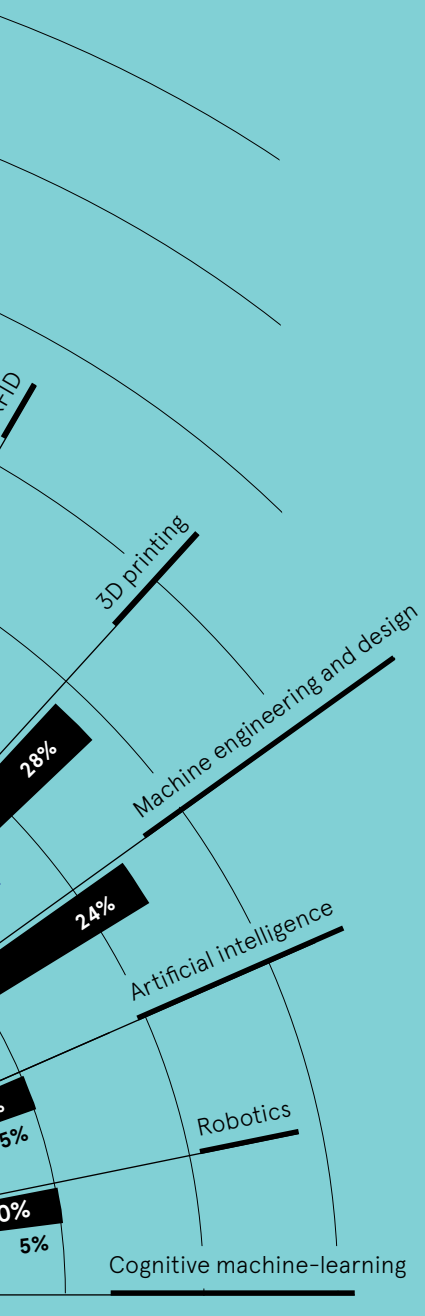
NBS 2019

BARRIERS TO ADOPTING NEW TECHNOLOGIES

Percentage of construction companies who said the following are limiting factors to adoption of new technology

JBKnowledge 2018

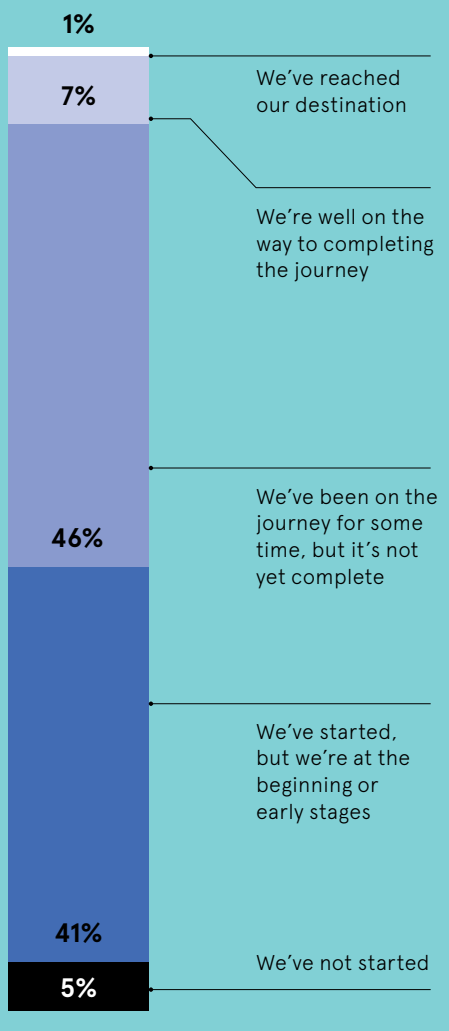




STATE OF DIGITAL TRANSFORMATION

Where construction companies self-identify in the digital transformation journey

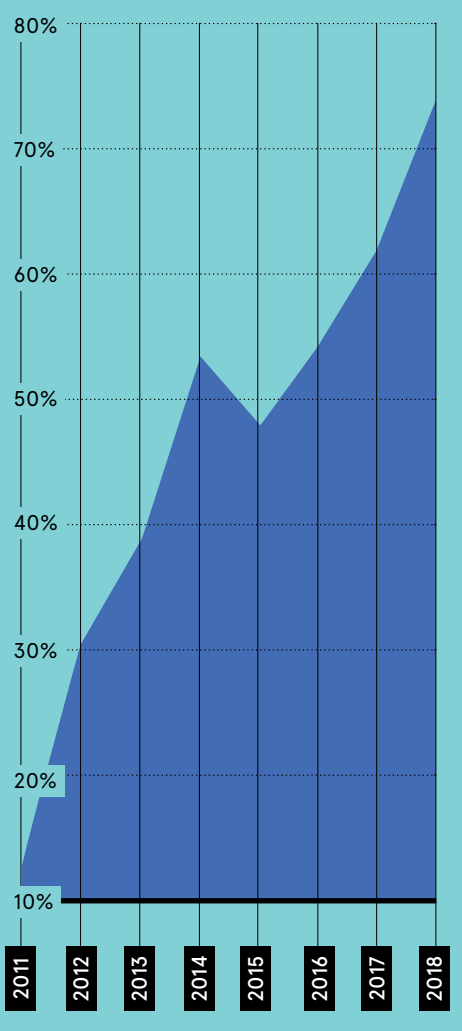
NBS 2018



BIM ADOPTION RATES HAVE SURGED IN RECENT YEARS

Percentage of construction companies that are using building information modelling or BIM

NBS 2018



Wrenbridge spans millions of square feet

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Strong track record in sport & leisure

Wrenbridge Sport knows how to deliver incredible, commercially sound facilities

£1bn+

Cumulative end value of our latest projects

Bright ideas for science parks

We put our minds and hearts into creating places for world-changing thinking

More than industrial units

We're specialists in developing warehouse and logistics space, with a focus on wellbeing and sustainability

+

Offices, residential and mixed-use schemes

Property development | Asset management | Joint ventures | **wrenbridge.co.uk**

WELLBEING

Innovation needed to create spaces with wellbeing in mind

When building offices and homes that take mental health and wellbeing into account, cost remains the ever-present challenge for the construction industry

Jessica Brown

With an increased awareness of how our surroundings can impact health and productivity, and its potential to cut healthcare costs and help businesses flourish, companies are focusing their attention on how architecture can directly impact mental health and wellbeing.

Buildings designed to make us happier and healthier, however, can be costly. And while technology unicorns and high-net-worth individuals have the firepower to spend millions on creating wellbeing-centric havens, can creative mental health and design ever be implemented for the masses?

Offices have constantly evolved to meet and pre-empt changes in how we work, and there is now a huge incentive for companies to invest in architecture for mental health and wellbeing, including alleviating turnover and recruitment costs.

This means encouraging choice, movement and relaxation, controlling temperature, noise levels and air quality, and adding breakout areas, ergonomic furniture, plants and even nap pods where workers can rest during their lunch break.

David Watts, managing director of CCD Design & Ergonomics, says companies are also increasingly understanding the variety of employees' personality types, such as introverts and extroverts.

"More organisations are questioning whether open plan encourages collaboration, as everyone thought. Open plan is better suited to extroverts, while different design solutions are needed for introverts," he says.

> **The industry is notoriously conservative, so innovation tends to come from the affordable sector or by government regulation**

But large-scale office refurbishments need not be the only solution and low-cost solutions can be easily implemented.

"The principles are achievable for lots of different organisations; put art up, allow staff input over their own environment," says Mr Watts.

Another affordable option is to use nudge theory to encourage people to make healthier choices, such as providing healthier food for staff and making water easily available, says Ann Marie Aguilar, International Well Building Institute's director of operations for Europe, whose organisation's WELL standard launched in 2014 and operates in 55 countries.

WELL incorporates concepts to help improve the health of people working inside buildings, including air, water, nourishment, light, movement, comfort, materials and sound. Projects are showing reduced absenteeism and increased happiness and productivity after 12 months. Air quality is the most important concept, says Ms Aguilar.

"Indoor spaces can be five to ten times worse than outside, so materials are really important. This allows us to put pressure on architects to ensure they're only specifying materials that don't bring volatile organic compounds, associated with new furniture and laminates, into internal environments, where people breathe it in."

Housing is another huge opportunity for wellbeing, mental health and design. WELL is shifting its focus to architecture for mental health and wellbeing in social and affordable housing, but it's not an easy task.

"It's challenging for us to get to someone who's willing to trial a new approach; everyone defers back to way before. We just need one brave housing association to put their head above the parapet and try something new," she says.

But standards for affordable social housing have been steadily eroding since their emergence in the 19th century, argues Richard Turkington, director at Housing Vision.

"It's all about standards set by the state with adequate resources to build homes though subsidy, and powers to monitor and take action if required," he says.

"Our research shows that rent is often not the primary source of stress," say Steve Rolf, research fellow at the University of Stirling. "It's the unpredictable costs associated with moving, furnishing and redecorating.

"For tenants moving into properties that need a lot of work, this can mean getting into debt or living in a property that doesn't feel like home, which can negatively affect health and wellbeing.

"Although it costs more to provide tenants with properties of a good standard of design, they're more likely to stay longer in better quality properties, which reduces turnover costs."

Mr Turkington says cost is the biggest challenge for the construction industry. "For housing to be affordable, it needs to be subsidised, either as a direct grant from the government to reduce build cost, or direct or indirect cross-subsidies," he says.

This could be, for example, the profit on market-value schemes where a housing estate is redeveloped or some new market housing is used to support affordable housing.

The construction industry can take steps to bring costs down and to get more for the same money, adds Mr Turkington.

"The main innovations with materials are greater use of wood, concrete and composites, and achieving a high level of thermal efficiency through double or triple-glazing solar energy."

While prefabrication of houses is a good example of this, Mr Turkington says there needs to be more innovation.

"The construction industry is notoriously conservative, so innovation has tended to come from the affordable sector or by government regulation," he says.

Mr Watts agrees that a major obstacle for the construction industry is designing and building for flexibility and change.

"The infrastructure of our homes and workplaces aren't easy to change; some of these issues are demanding that it becomes easier to adapt them," he says.

While it may seem more challenging to invest in architecture for mental health and wellbeing with affordable housing, it can have huge returns on investment.

"By building to better standards now, we're avoiding constructing slums. Better housing that lasts longer is better for everyone's health, allows people to stay in stable communities and saves money for the public purse," says architect Sarah Wigglesworth.

"If we want to make the greatest difference to future NHS budgets, it's social housing we should be concentrating on."

40%

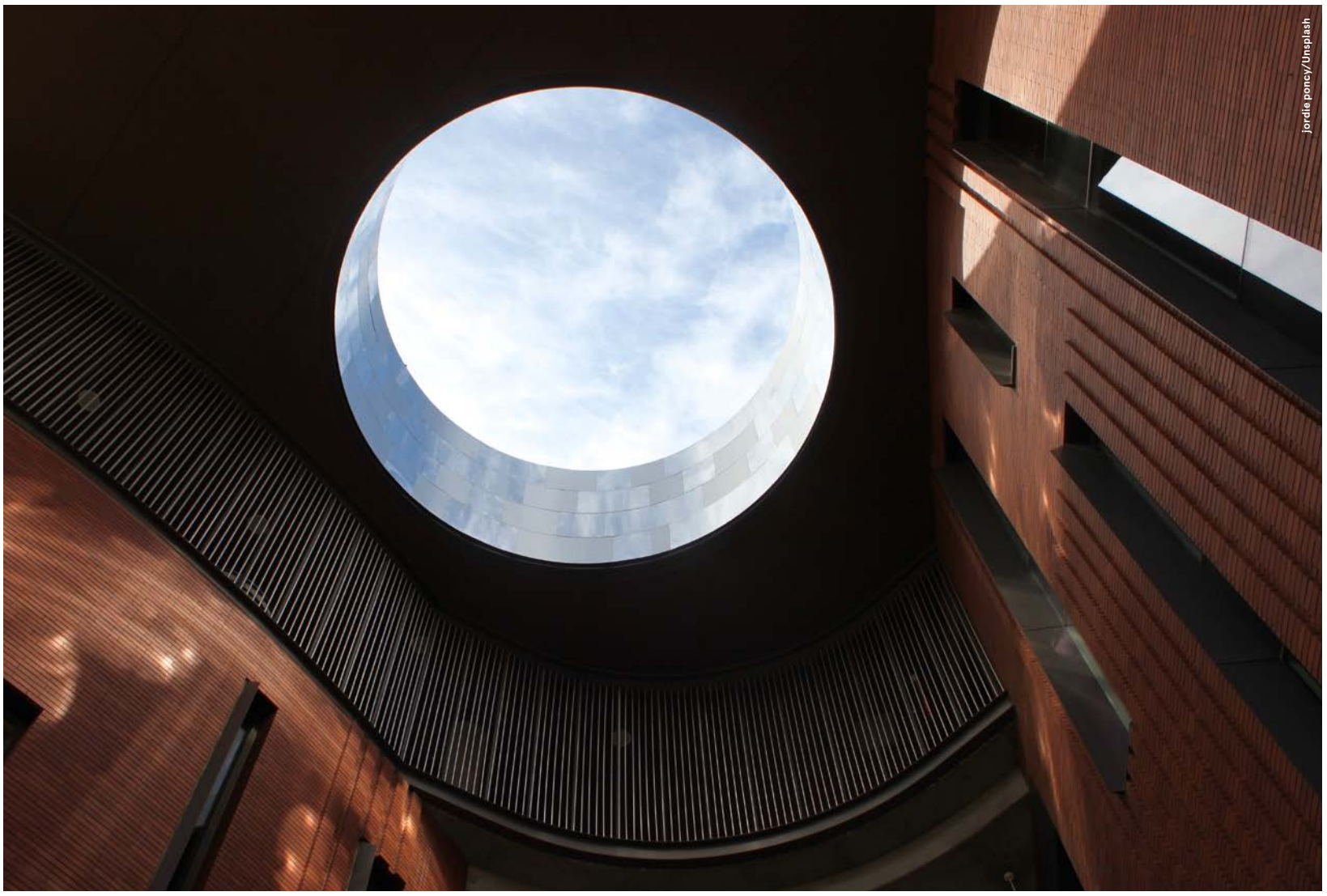
of 7,000 office employees surveyed across Europe are working in poor lighting every day

Staples 2018

SUSTAINABILITY

Why incentives are key to a circular future

Sustainability requires a change in mindset as it's not just a process of replacing materials with green alternatives. But can a circular economy ever be the norm for mass construction?


jordie poncy/Unsplash

Jim McClelland

The circular economy in construction can be a challenging concept to comprehend fully, cradle to cradle, but it might just hold the key to unlock that other big idea: sustainability.

"For many years, sustainability has been perceived as a cost increase, rather than a value enhancement," says Phil Kelly, head of UK sustainability and building physics at Ramboll.

Mainstreaming, however, is busting that myth. Ramboll's recent *Sustainable Buildings Market Study* shows sustainably designed buildings not only perform better for the environment, but for occupants too, in metrics beyond cost, energy and carbon.

There remain lessons in sustainable construction to be learnt from Scandinavia, though. The Nordhavn development, in Copenhagen, for example, is certifying an entire new district to the DGNB sustainability standard through the Green Building Council Denmark.

According to Rebecca Palmer, senior associate head of construction at Prettys Solicitors, contractors seeking differentiation do see sustainability as a potential showcase, but the context must be conducive.

"The circular economy in construction will work where the party holding the purse strings creates an environment that not only permits, but proactively encourages and incentivises its supply chain to cultivate the long-term, value-driven, recovery and regeneration-related motivations necessary," she says.

Collaboration is key to generating market-driven incentives, UK innovation manager for Celsa Steel, Eoin Bailey, agrees. "The 'race to the bottom' is the epitome of the linear economy. Western society's focus on value achieved at point of sale is the reason the planet is in the situation it is today," he says.

> **Beyond the construction phase, building maintenance, management and decommissioning are vital in incorporating circular principles**

"With a supply chain in collaboration for shared responsibility and shared benefits, the ultimate outcome is shared value."

Celsa Steel UK recycles 1.2 million tonnes of scrap, end-of-life


patrick hendry/Unsplash

Carbon, carrots and sticks

Addressing its responsibilities around global greenhouse gas emissions, the UK government became the first major economy to commit to achieving net zero by 2050. By the same point mid-century, it also has an 80 per cent carbon-reduction target.

Looming large in just six years' time, though, is the Construction 2025 deadline for a 50 per cent cut. That clock is ticking, fast, acknowledges group chief executive at BRE (Building Research Establishment) Gillian Charlesworth.

"In the face of what many now term a climate emergency, there's an ever-growing urgency to tackle head on the built environment's very substantial carbon footprint, an alarming 40 per cent of total emissions," she says.

Progress is slow. A 2016 update to the *Low Carbon Routemap for the Built Environment* revealed the industry had 39 per cent of savings still to find. Goals, metrics and certification all have a role to play, but so do hearts and minds, adds Ms Charlesworth.

"We will only achieve our targets through major culture shift right across the construction sector, with all companies, large and small, doing their bit and showing real ambition," she says.

In the current economic climate, collaboration is key, agrees Simon Richards, head of sustainability at Sir Robert McAlpine. "Pressures are high and profit margins narrowing, therefore cutting emissions cannot be laid solely at the contractor's door," he says. "We need an holistic approach."

On the upside, the industry already knows some of the answers to the decarbonisation dilemma, whether that means design for manufacture and assembly (DfMA), accounting for "embodied" carbon or, simply, efficient logistics. More is both doable and affordable, says Mr Richards.

"It is a total misconception that sustainability costs money. We've already found the quick wins when it comes to cutting carbon. Significant improvements and opportunities are out there, however they are still not widely adopted," he says.

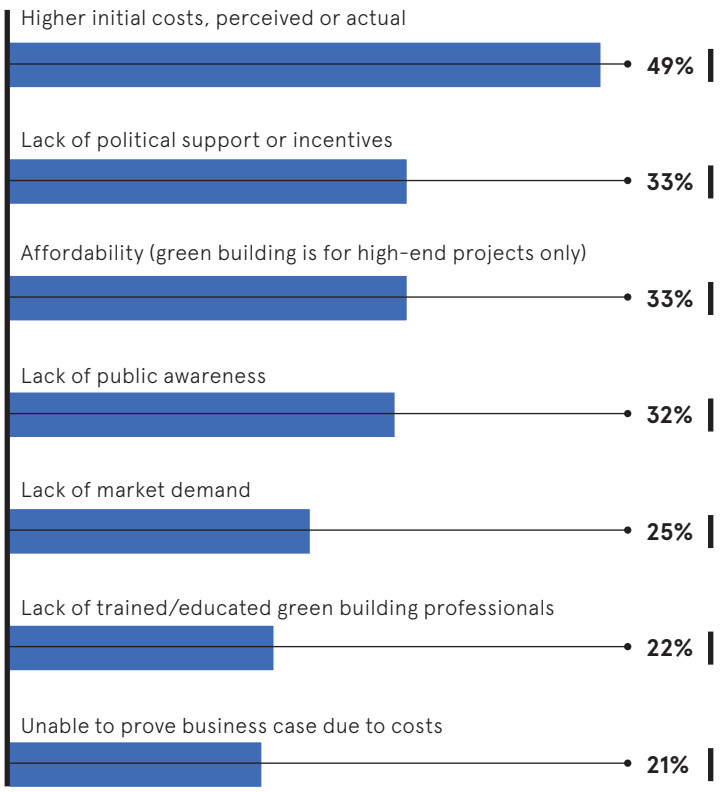
The issue perhaps is an urgent lack of "carrots", argues Richard Twinn, senior policy adviser at the UK Green Building Council.

"The main incentives for businesses to slash emissions are actually coming from the investor community, with pressure increasing to understand and minimise climate impacts," he says.

As a major procurer, Whitehall could and should be leading the way. Ultimately, though, if construction truly believes in net zero, it comes down to really wanting to change, says Keith Waller, programme director of the Construction Innovation Hub: "Put simply, if you don't value it and don't measure it, you won't deliver it. Lip service alone just won't cut it."

BIGGEST BARRIERS TO INCREASED GREEN BUILDING ACTIVITY

Global survey of architects, engineers, contractors and construction professionals



Dodge Data & Analytics 2018

material a year, which goes towards manufacturing around one million tonnes of steel products for industry. More than 60 per cent of that steel is supplying UK construction.

So, not just new, but radical thinking is needed. Sustainability calls for construction to change its mindset to consider the entire life cycle of a building beyond its operational phase, plus every component in it, complete with extended and embodied carbon footprint. The fact Rolls-Royce now sells flying hours instead of engines and Phillips sells light not luminaires points the way ahead, says Mr Kelly.

"Elements of the construction industry could be wholly circular, especially if new business models are considered. Heat, coolth, air and hot water could be commoditised, instead of boilers, air conditioning units, fans and pumps, so enhancing recyclability of equipment and contributing to a circular mindset," he says.

Leading on circular economy in construction is Buildings as Material Banks (BAMB), the European Union-funded Horizon 2020 programme of 16 partners from seven European countries pursuing a systemic shift in sustainable building. Promoting tools such as electronic materials passports, BAMB reimagines a building as a dynamic data-tracked repository of tradable value.

Mandated in many countries, including the UK, building information modelling (BIM) also supports circular design by enabling efficiencies that fast forward innovation capacity. As does design for manufacture and assembly (DfMA), with the 2016 launch by the Royal Institute of British Architects (RIBA) of a DfMA overlay to the RIBA Plan of Work, helping concepts formally embed.

Ultimately, circular economy in construction neither truly starts nor stops at the site gate, but exists before and after build, says Naomi Warr, group environmental manager at McLaren.

"Beyond the construction phase, building maintenance, management and decommissioning are vital in incorporating circular economy principles, and we should take a long-term view of materials usage at design stage," she says.

In effect, the design phase is the entry point and foundation of the circular economy in construction, argues Zoé Bezpalko, sustainability strategy manager at Autodesk.

"With a circular design approach, we can change components to be reused continually in future projects, with less waste. We can also improve the process with industrialised and modular construction, as well as the supply chain, to reduce transportation costs and emissions," she says.

A whole-world view of circularity, however, tells the tale of the scale of the task. Published by Circle Economy, the annual *Circularity Gap Report* reveals how differing rates of ongoing urbanisation underpin dramatic divergence in material consumption, continent to continent, and all within a world which is only 9 per cent circular.

The mass imperative is in the maths, says Ms Bezpalko. She concludes: "Construction needs to build an average of 13,000 buildings every day through 2050, particularly in China, Africa and southern parts of the globe. Yet the industry is currently estimated to be using two fifths of the world's energy and materials flow, while contributing 13 to 30 per cent to total waste. Circularity is now a must to meet demand and reduce impact."

TECHNOLOGY

Can 3D printing truly revolutionise the construction landscape?

Dubai is pioneering the use of 3D printing in an effort to drive property sales and significant savings. But whether this marks the beginning of worldwide adoption remains to be seen

Richard Brown

Squeezing a house through a nozzle, like a pâtissier pumping fondant cream from a piping bag, may not be everyone's idea of cutting-edge construction. But in Dubai, it's all part of the plan.

The glitzy emirate aspires to have a quarter of all new buildings constructed via 3D printing by 2030. Emaar, one of the Arabian Gulf's leading property developers, is heralding its nascent Arabian Ranches III residential project as offering Dubai's first such dwelling.

3D printing, or additive manufacturing, itself is not a new technology, harking back to the 1980s. Fabricating a three-dimensional model, or prototype, from a computer-aided design by adding successive layers of material is now standard practice in many industries, ranging from aerospace and architecture to medicine and high-end manufacturing.

McKinsey, the consultancy, estimates the technique could have an annual economic impact worth $550 billion by 2025.

Construction, however, is proving a tougher challenge. It is thought that 20 commercial buildings around the world have been built using 3D printing so far, the first being by COBOD International, in the Danish capital Copenhagen, in 2017.

In practice, concrete is squeezed out of a nozzle attached to a computer-programmed robotic arm, either stationary or travelling along rails, in successive strips, layer upon layer, to produce the desired building structure, such as an exterior or interior wall, or component, like an archway or void.

As with many other superlatives, such as the world's tallest skyscraper and "smartest" smart city, Dubai is adamant in its ambition to be crowned leader of high-tech construction. It already boasts the world's first 3D-printed office and a 3D-printed drone research laboratory. The 3D-printed office is reported to have cost only $140,000 to build.

Advocates claim the technique offers construction that is faster, cheaper and more environmentally friendly than traditional building methods. They point to accelerated delivery of homes, greater flexibility in design, reduced cost of construction, more efficient use of materials and higher levels of sustainability by reducing waste typical of construction, and even less noise pollution.

Specifically, industry experts identify seamless production of objects from a numerical design and access to a wide range of geometries for the final object, most impossible or very expensive to realise with traditional processing techniques, as being the prime advantages of 3D printing.

Plus, the commercial appeal to big builders seems irresistible. According to SmarTech Publishing, a market forecaster, by 2027 the 3D-printed construction industry will be worth $40 billion.

01
Emaar Properties has announced plans to build its first 3D-printed home in the Arabian Ranches III development in Dubai

02
An Apis Cor 3D printer working on a house at the Stupino Aerated Concrete Plant in Moscow

Henrik Lund-Nielsen, chief executive of COBOD International, works with customers in Dubai. He claims the potential cost-savings in Europe or the United States, where building-site labour is more expensive, could run into billions. According to Mr Lund-Nielsen, the Dubai government's drive will help boost 3D printing's appeal to the construction industry as it reveals major cost-savings.

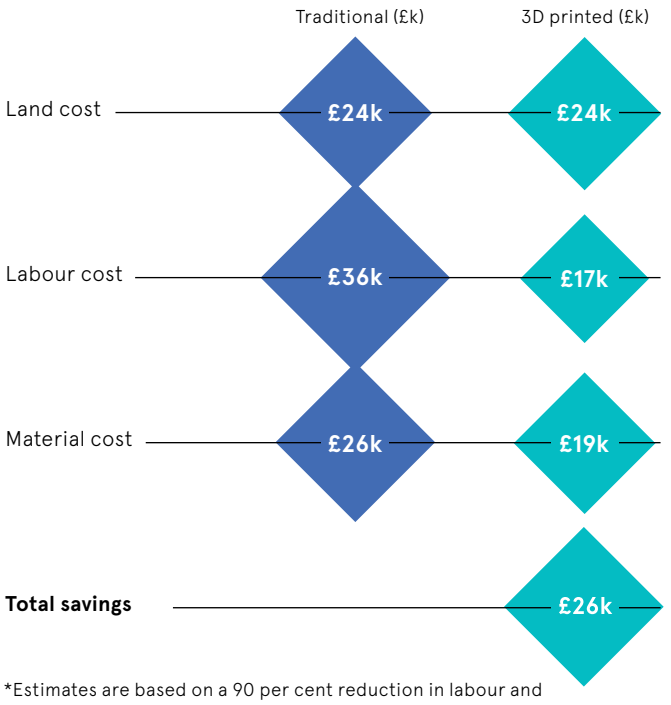
But some take a less breezy view of 3D printing's attraction to the worldwide construction industry. Sergio Cavalaro, reader in infrastructure systems at the School of Architecture, Building and Civil Engineering, Loughborough University, is currently engaged in proprietary research into 3D printing's application in the global construction sector.

He says the very structure of the sector itself mitigates against widespread adoption. "Inertia is higher in the construction sector than in other industries, such as automotive. It is not so vertically organised. Profit margins are also smaller, meaning it is harder to introduce radical change," he says.

> **Profit margins in construction are smaller, meaning it is harder to introduce radical change**

COST SAVINGS OF 3D PRINTED HOUSES

Hypothetical model, comparing an average house price of £180,000 under traditional construction methods and a 3D printed house*



*Estimates are based on a 90 per cent reduction in labour and a 50 per cent reduction in materials costs, under cost models from Chinese 3D printing construction company Winsun, and factor in potential cost savings to construct the internal and external walls, and the foundation only

Winsun/A L Mohd Tobi et al, IOP Conference Series: Materials Science and Engineering 2018

Dr Cavalaro also believes the novelty factor in owning a 3D-printed home may soon wear off. He points out: "Customers paying a premium for a 3D-printed home might not realise a profitable resale value once the technology has become commonplace."

Having said that, Dr Cavalaro is a convert to the promise of the technology, albeit adding a caveat to its cost. "3D printing is excellent for complex shape elements, such as voids. Its advantage is that it can be used to reduce material consumption and deliver optimum components. But given the technology, it's likely to be more expensive than the traditional method of construction," he says.

Given that concrete is the prime construction material extruded in building 3D-printed structures, LafargeHolcim, one of the world's largest concrete manufacturers and suppliers to the global construction industry, has a keen eye on the developing market.

Edelio Bermejo, head of research and development at the Switzerland-headquartered firm, describes the application of 3D printing to the industry as "emerging", but with "huge potential". He says: "3D printing will, in fact, open the market for more cement-based materials in construction systems and this is in line with our strategy of growing our value-added business."

In 2016, LafargeHolcim entered into a partnership with French 3D-printing systems provider XtreeE to explore ways of collaborating on the technology.

Mr Bermejo stresses the technical challenges in deploying 3D-printing technology for residential and commercial building purposes are manifold. "The main challenges for concrete 3D printing are related to reinforcement, further understanding of material processing and properties, for example durability, and robustness of the process. The construction industry will also need to understand how to best design structures with this new technology and all will have to be reflected in design codes," he says.

Construction is, typically, a very labour-intensive industry; just observe any major building site. Understandably, building workers will be wary of technology that ultimately obviates the need for skilled or semi-skilled staff. Should employees or contractors fear the impact the adoption of 3D printing across the construction industry will have on their jobs and employment prospects?

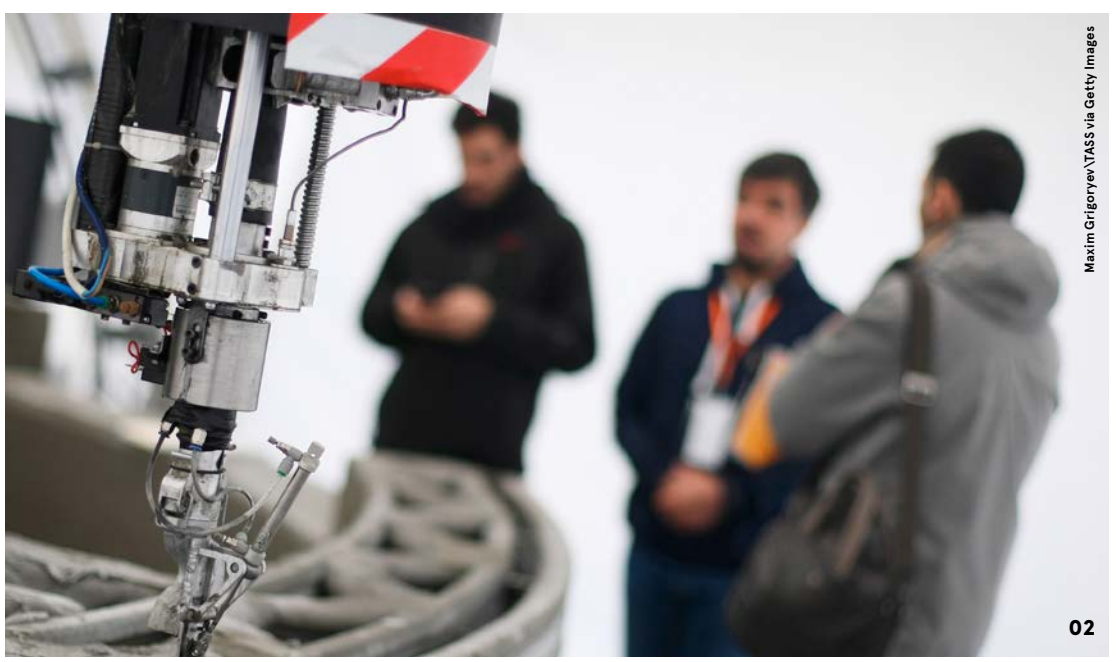
LafargeHoclim's Mr Bermejo is sanguine, pointing to 3D printing being just one element in the overall industrialisation and digitisation of the construction industry. "As was the case in other industries, this will lead to a shift to higher-skilled workers and newly emerging job profiles along the construction value chain," he says.

"Education and training are key for workers to adapt to this change, and digitisation can also help in this aspect. We also envisage the potential for 3D printing and digitisation to improve site safety for construction workers."

Overall, though, concrete 3D printing is still in its infancy. But ambitious targets, like those set in Dubai, will certainly help boost the development of the technology and bring it closer to the mass construction market. ●

25%

of all new buildings in Dubai will be constructed via 3D printing by 2030, the government hopes

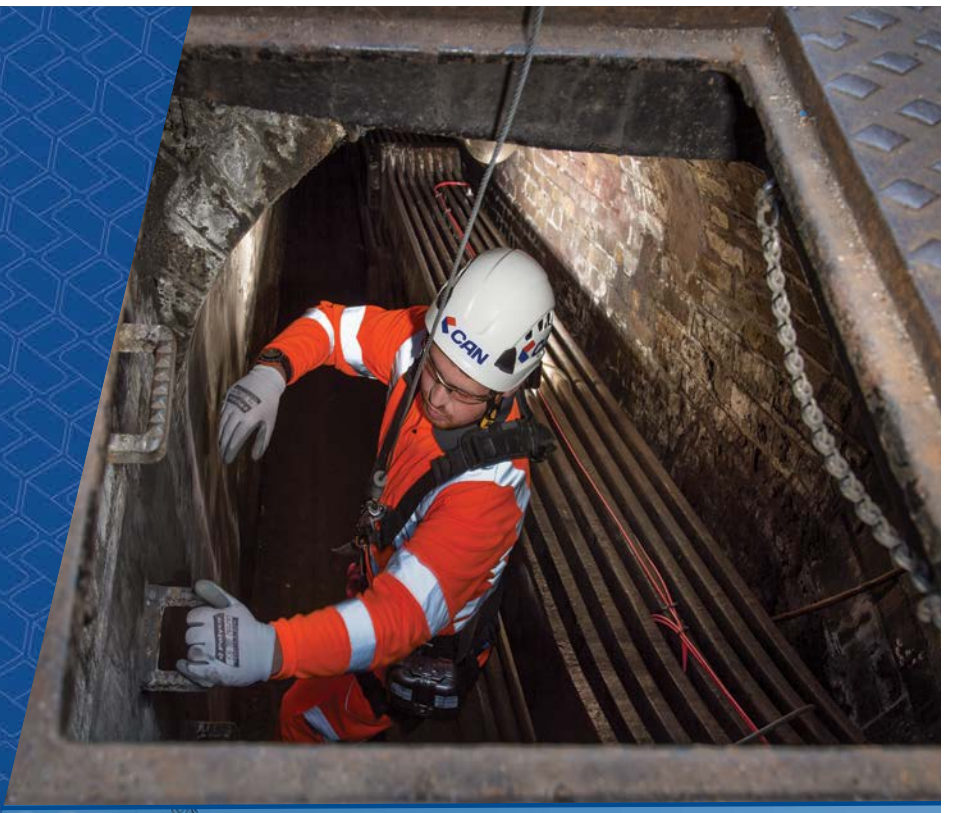


Maxim Grigoryev\TASS via Getty Images

02

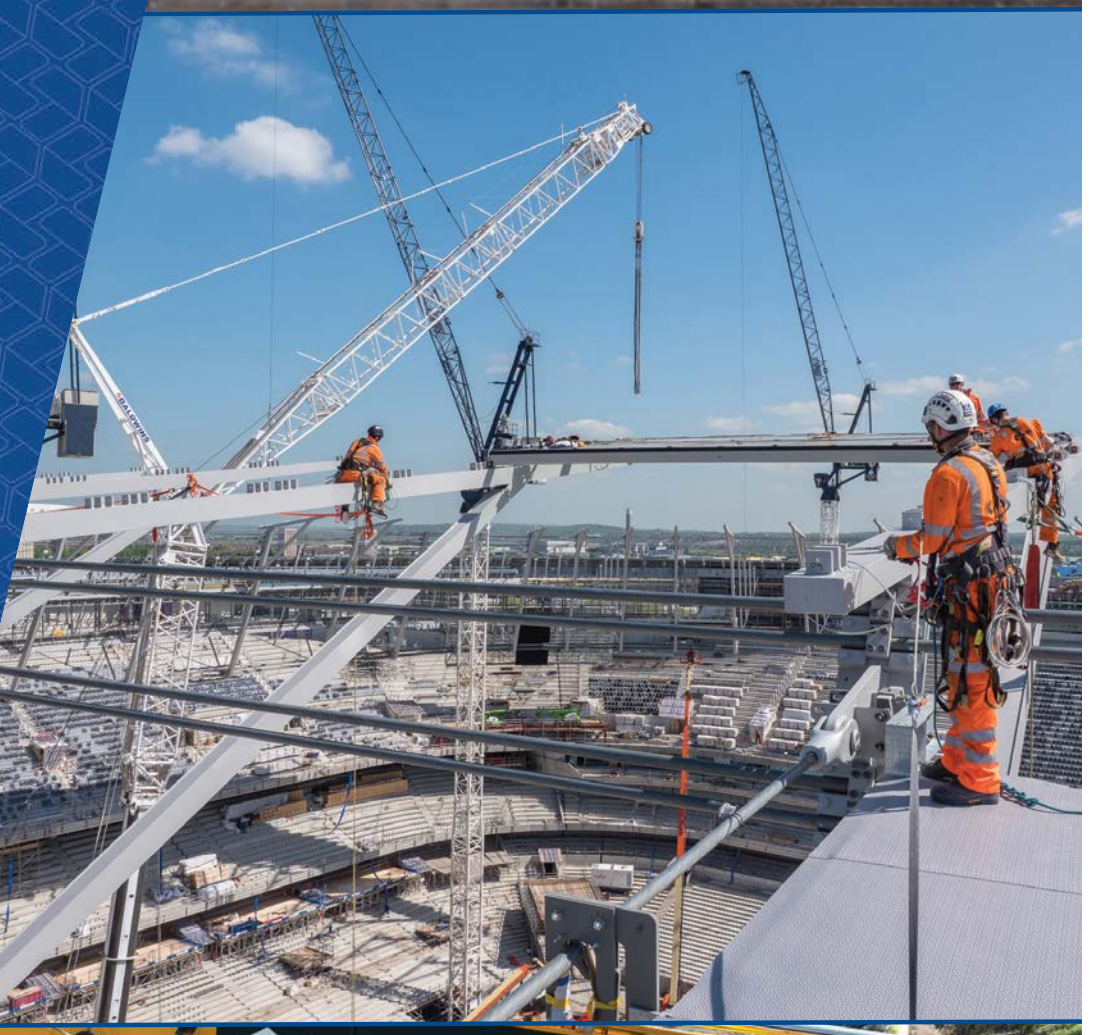
Engineering Certainty

CAN is one of the UK's leading geotechnical and structural engineering contractors, with over 30 years of experience specialising in difficult access, complex and high-profile projects.



CAN Geotechnical

- Soil slope stabilisation
- Rock fall protection measures
- Retaining walls
- Anchors, mini piles & tie bars
- Sprayed concrete & dentition
- Design & Build Solutions



CAN Structures

- Rigging, lifting & installation
- Brickwork, masonry & concrete repairs
- Sealant, cladding & glazing
- Cleaning, painting & bird deterrent
- Mechanical & electrical services
- Inspection & testing

CAN Confined Space

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