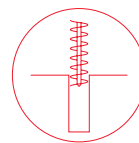


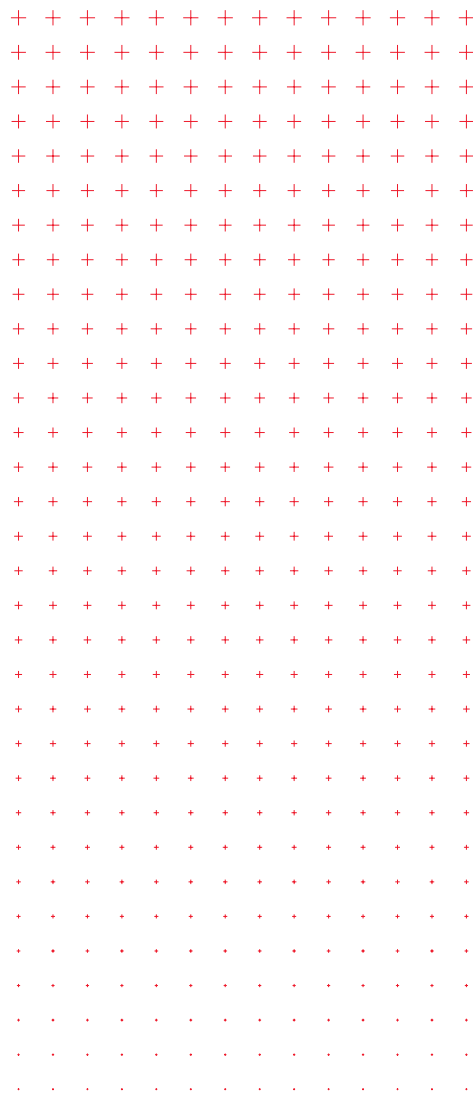
# Dawn of the disruptors

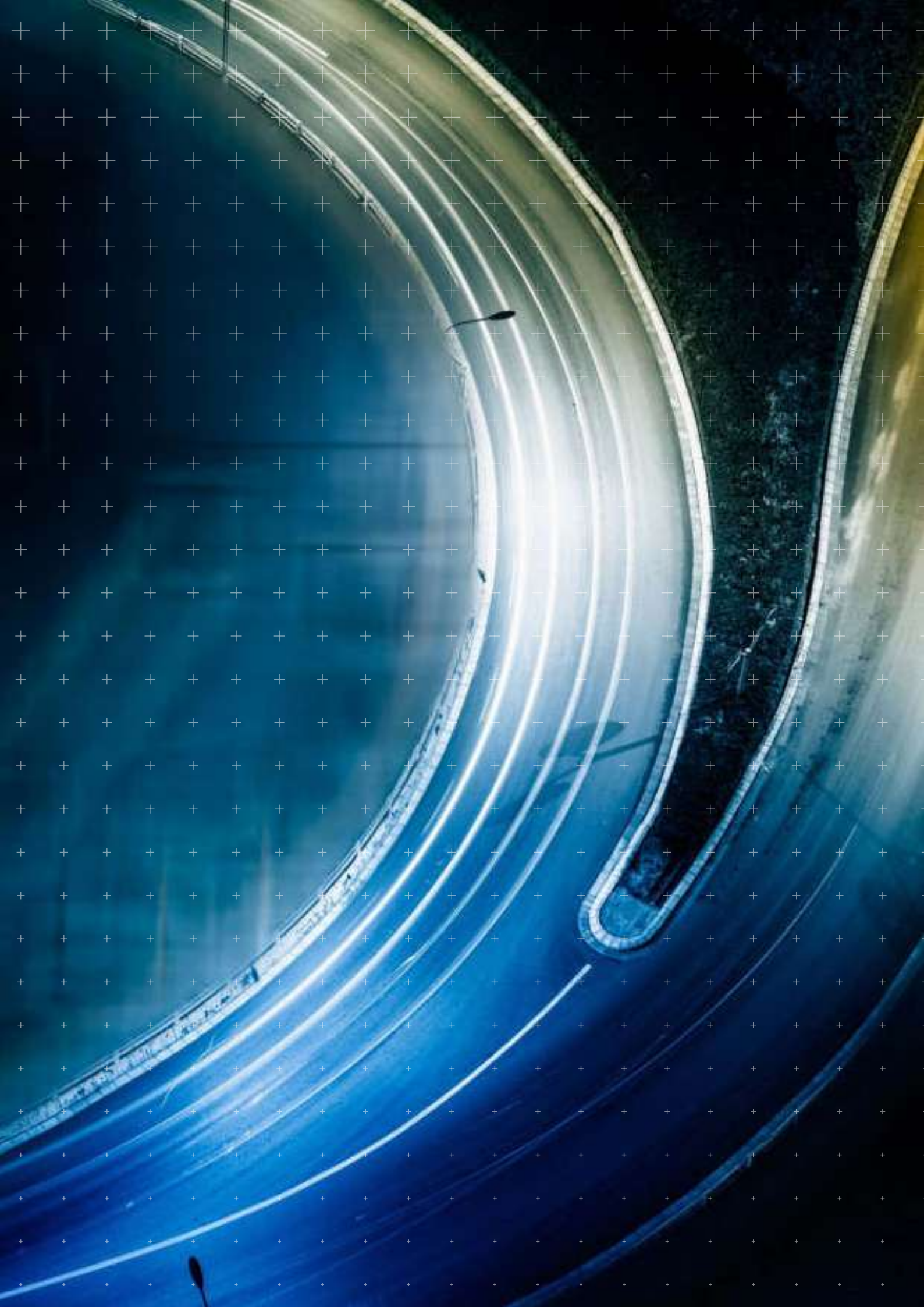


## The future of geotechnics series

What geotechnics businesses need to know about emerging technology trends as we enter an era of digital disruption.

This is the first in a series of thought leadership reports from Bachy Soletanche exploring the future of geotechnics and the technological challenges and opportunities facing the industry.





# Foreword

Disruptive innovation in business is not new. Since time immemorial industries have been shaped, for good or ill, by the emergence of new technologies, new innovations and new ways of working. We didn't invent the electric light through gradual improvement of the candle!

What is new is how fast and how frequently such disruption is now occurring. Technological advancement is accelerating at a blistering pace, with breakthroughs in white-hot areas of innovation such as Big Data, robotics and artificial intelligence happening on a seemingly daily basis.

In the world of business, entire industries are being transformed completely and irrevocably. Monolithic companies in slow-moving, traditionalist sectors – some of which have spent decades being largely untroubled by the march of technology – are suddenly finding themselves in mortal peril; their business models rendered obsolete almost overnight by a clever algorithm that they simply didn't see coming.

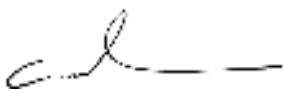
This is happening across all industries, in all walks of life. The potential to transform how we work, live and play seems limitless, and the commercial world is struggling to keep up.

Geotechnics businesses could be forgiven for feeling somewhat sheltered from this technological maelstrom. After all, an algorithm can't drill a hole in the ground and fill it with concrete. But for how long?

In the past five years we've seen Chinese companies 3D print entire houses. We've seen the invention of concrete that can repair itself and we now have a robot that can do the job of a skilled bricklayer – and do it far faster and to a higher standard. Does the concept of an AI-controlled drilling rig really seem that far-fetched?

Our sector is ripe for disruption. It may not be immediate and it may not be quite as seismic as we've seen through an Uber or an AirBnB, but it's coming – and probably sooner than you think. The geotechnics businesses that survive and thrive in this era of disruption will be the ones that embrace the possibilities it offers, rather than just sitting there waiting for change to happen.

I hope this report kickstarts a much-needed conversation with our colleagues and peers about change and disruption in our industry – one which helps geotechnics businesses to embrace change, seize emerging opportunities and, ultimately, make our industry more efficient, more productive and more profitable.



**Chris Merridew**

Managing Director  
Bachy Soletanche and Westpile



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# Dawn of the disruptors

Innovation and imagination in business is changing the way we live and work – but the geotechnics industry is in danger of being left behind. Which new technology trends and digital disruptors will see the industry breaking new ground, and where do we need to focus our time, effort and investment?

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The last time you hailed a cab, booked a holiday, ordered a takeaway or bought a concert ticket, there's a good chance you did it with the help of a so-called 'disruptor'.

Entire industries and their well-established business practices are being shaken to their core by digitally-enabled, innovative companies that are ready to do things a little differently. Uber, AirBnB, and Spotify grab the headlines, but new advances in technology are driving innovation in every sector imaginable.

Technology-led disruption is changing the way people buy and behave. It's changing the way we interact with each other. It's making whole sectors more cost-effective and efficient. Could it change the way we design, plan, build and manage our built environments too?

"It's proven tough to change the way we do things in our industry", says Scott Bennison, leading Bachy Soletanche's Computer-Aided Design (CAD) and Building Information Modelling (BIM) programmes. "Design technology is a good example. Over time we've seen a shift from 2D to 3D design techniques, from 3D to modelling and more recently 4D, but that process has been gradual.

"Historically, there's been a reluctance in the industry to move from the drawing board age," he adds. "But that's what we have to do if ground engineering is going to progress as an industry and embrace the possibilities that this new digital age offers us."

## Artificial Intelligence: from sci-fi to reality

It's taken decades to get there but artificial intelligence, or AI, is now moving from the realm of science fiction into daily life. We'll soon be at the

stage where your car can operate itself and 'learn' in real time how to react to the world around it. The world's leading companies are already using machine learning to change how they do business, from self-improving advertising algorithms to programmes that analyse medical scans for signs of diseases.

Matt Walpole is the Business Unit Manager for Westpile, part of the global Soletanche Bachy Group – and a finalist for Ground Engineering magazine's 2017 'Rising Star' award. He believes we're not far from seeing AI and machine learning transforming drilling and operations, and is looking at how geotechnical operations work will change as a result.

**"I don't think we're far off the robotics revolution people have been predicting. For us, it's a case of investing now so we're ready when it arrives."**

*Matt Walpole, Business Unit Manager*

"Driverless cars are a great example of how new developments in other industries have changed the way we approach our own work", Matt says. "We thought: if a car with access to live data streams can make driving safer, or if you can use an unmanned vehicle to deal with an explosive device, then why can't we use this technology to improve our own operations?"

"Drilling rigs are becoming increasingly automated," he explains. "Can we arrive at the solution where human involvement in the process on site can be removed, making the piling operations far safer?"

This is about far more than speeding things up, though. Bachy Soletanche's plant team estimates that within five to ten years, it will be possible for on-site equipment to learn for itself how to operate, freeing up engineers to think more strategically about their projects – at a safe distance.

As Plant Manager Andrew Eggesden explains, live data could be fed back remotely to engineers, who are examining metrics in real time from another part of the country.

“It’s really about using our resources more strategically,” says Andrew. “Our team is more valuable to us and our partners when we’re thinking about how to work more efficiently. That’s why we’re looking at engineering our machines so that they can take care of themselves.”

## **Eyes in the sky: Bringing UAVs into the mainstream**

Any piling expert will tell you that the most frustrating obstacle to the timely delivery of a project is inadequate information on the nature of a site. For decades, unexpected elevation, water, or even buildings have been a thorn in the side of technicians unable to get an accurate picture of how the land really lies before a job kicks off.

It’s one of the main issues Scott Bennison faces as he models a new prospect. “Ultimately, our work is about calculations. If the information you’re using in the first place is off by even a fraction, it can have a huge knock-on effect. Any delay is multiplied along the supply chain and those delays can add weeks, or even months, to the course of a programme.”

As in many areas of construction, it is disruptive technology that could hold the key to solving the problem. “We have been looking at the way some leading companies outside of our sector are using unmanned aerial vehicles, or drones, to streamline their work – or to shake up their models completely,” says Matt Walpole.

“Amazon is a great example. They’re literally flying past their obstacles to deliver better service to their customers – using drones to cut out travel time. We are now trying to explore something similar.”

**“Instead of dispatching a team of engineers to examine every nook and cranny of a site, we could send a single drone operator. In an hour we would be able to complete a process that would normally take half a day.”**

*Scott Bennison, BIM Co-ordinator*

Like so many disruptive ideas, the concept is simple. Instead of relying on a team of contractors visiting the site ahead of a job – which is time-consuming and open to human error – Matt’s team is looking at the use of UAVs for site surveys, aimed at supporting the overall project, capturing site layouts and planning set-ups.

“I’ve worked on projects where you would turn up on a site and find it was completely different to what the surveying team had told you. Trees, walls, lakes – you name it. We would have prepared our plan for the site specification, only to find that it wasn’t at all suitable!”

Matt and Scott have trialled their use on site and are now working with the R&D team to explore further applications. Once up and running, a UAV programme of this nature would change the way that Bachy Soletanche approaches the start of a project. Engineers who would otherwise spend hours investigating a site can use that time to prepare – fast-tracking the entire programme.

Of course, innovations such as this are not without their challenges. “There are times when we’ll not be able to use UAVs, for example because we’re near to residential sites and there are legitimate privacy concerns,” says Scott. “Our clients are understandably keen to make sure that everything we do is in keeping with the wishes of the communities we work around, and so are we.”

The benefits that a full UAV programme could bring the business are potentially endless. As Scott points out, there are further opportunities for drone use throughout the project lifecycle: “We need to be able to monitor progress once the work is underway, too, without sending multiple teams all around the country. UAVs can play a huge role in this.”





## **Safety and innovation: Not mutually exclusive**

Many in our industry associate innovation with risk. There is little appetite for going beyond the 'tried and tested' – especially in ground engineering, where you are literally laying the foundations on which the rest of the project will be built.

If construction has a reputation for being risk-averse, it's with good reason. This was once a very dangerous profession, and is only becoming less so through a relentless commitment to reducing risk. But there's no reason why innovation and disruption can't change the way the industry works to make it safer for its staff, as well as more profitable for ground engineering businesses and their customers.

Andrew Eggesden and Steve Ako oversee much of Bachy Soletanche's technical equipment development – always with the aim of developing or completely re-designing equipment to make it safer, more reliable, and easier to use.

"That includes everything from making rigs accessible without the need for a step-ladder, all the way through to developing new systems for remotely operating Soilmec machinery," Andrew explains. "It's about going back to the basics and saying: How can we make this better? How can we make this safer? It's an ongoing process without an end-point."

**"It's proven tough to change the way we do things in our industry. But that's what we have to do if we're going to embrace the possibilities that this new digital age offers us."**

*Andrew Eggesden, Plant Manager*

In the company's efforts to take staff health and welfare to new levels, Andrew is also looking at ways to take advantage of new developments in 'wearable' technology.

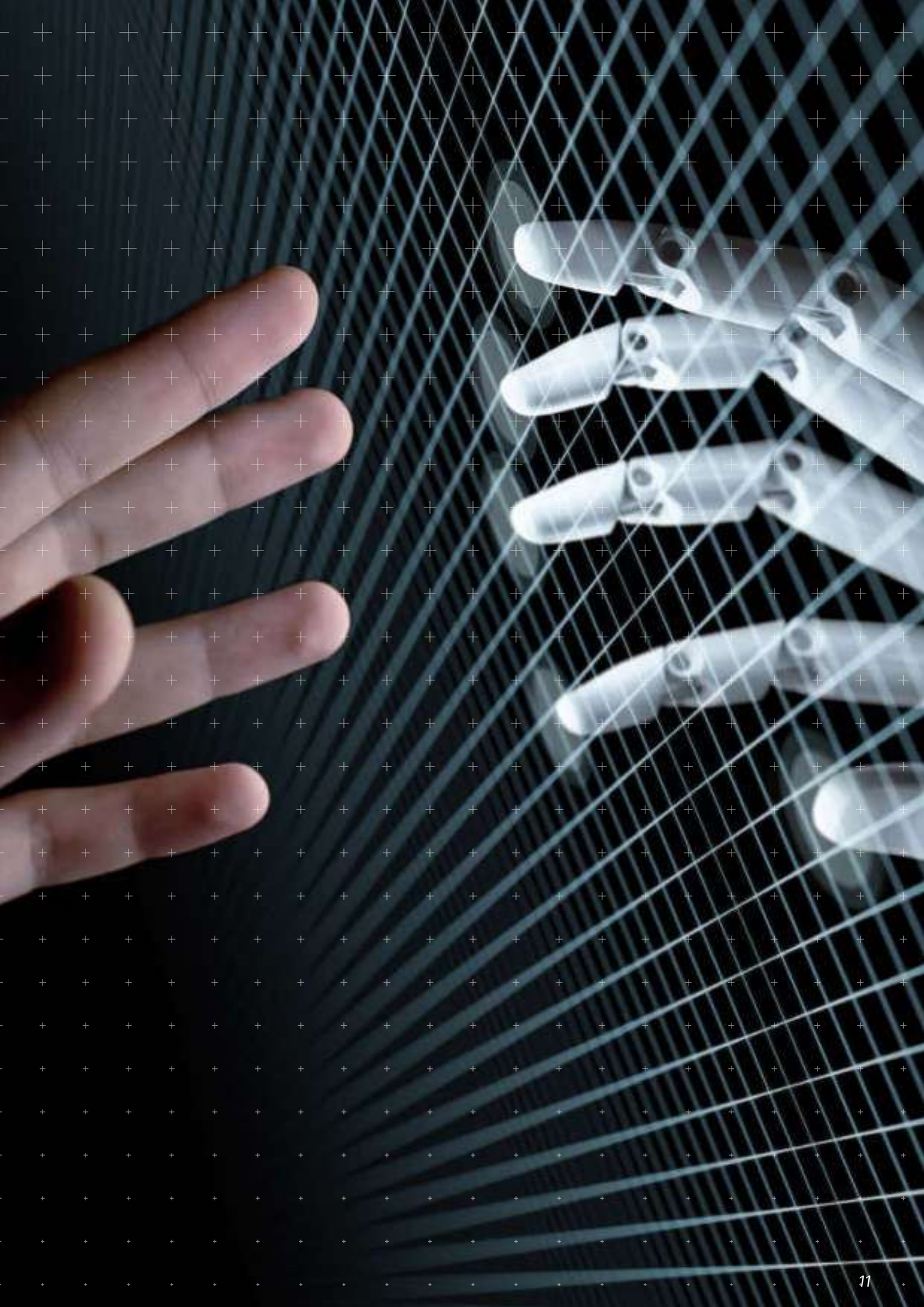
"You already have wearable devices capable of monitoring the impact of vibrations on the body from heavy machinery, to prevent conditions like Hand Arm Vibration Syndrome," says Andrew. "There's no reason that similar technology couldn't be used in other areas too."

The research team is currently looking at technology capable of monitoring the noise construction workers are subjected to in the course of a working day. "We have very strict rules on noise levels, as you'd expect," says Steve Ako, Bachy Soletanche's Plant Design Manager. "But again, it's about going back to the drawing board and looking at how we can make things even better. It's possible that you could integrate a sound monitoring device into a vibration monitoring wearable, to combat HAVS and noise-related conditions."

Thinking more conceptually, Andrew Eggesden believes there's an opportunity to use wearables to go further when it comes to worker wellbeing. "As an industry we've done well in focusing on safety, but we need to consider general health and wellbeing too. It's not just physical hard work – it's working away from home, working long hours, mental pressure and stress. If you don't manage it, it will take its toll on people."

It's a point echoed by Steve. "Incorporating life management and fitness applications into wearable tech at work could have a huge positive benefit when it comes to general health and wellbeing," he explains. "It also sends an important message that your company cares about its workers beyond its lost time accident statistics – truly caring about how they feel throughout their working day."

Having been involved in Bachy Soletanche's research and development activities for two decades, Steve believes that ultimately the challenge is cultural as much as technical. He concludes: "We need a change in mindset. To recognise that innovation is actually the key to reducing risk. The challenge for us is to show that by introducing new technologies, new ways of doing what we've always done, we can actually make our work safer and more cost-effective too."



# Ready for a Big Data revolution

Big Data is going to bring sweeping changes to the construction industry. Westpile Business Unit Manager, Matt Walpole looks at what geotechnics businesses need to do to get ahead of the curve.

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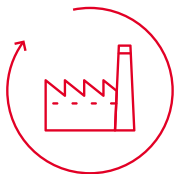
The ability to generate, gather and interpret huge amounts of data, or Big Data, is changing the commercial world in ways we wouldn't have thought possible just a few short years ago.

Some industries have been transformed completely and irreversibly. The finance sector – dominated for centuries by traditionalist, monolithic corporations that moved, technologically-speaking, at snail's pace – has seen radical change in the past five years in the lightning-quick emergence of the innovation and data-led FinTech industry. Retail, likewise, has been revolutionised by data, with everything from marketing to payments now driven by the gathering and analysis of customer data.

Construction has lagged behind for some time. At the turn of the decade, a report by McKinsey Global Institute recorded the total data stored by the construction industry at 51 petabytes (a petabyte being one million gigabytes). It sounds a lot – but when compared with the manufacturing sector (966 petabytes) or government services (846 petabytes), that number is remarkably low.



**51**  
petabytes



**966**  
petabytes



**846**  
petabytes

While there are signs that things are changing, it's not happening quickly enough. The construction industry needs to wake up to data's potential to transform how we do business, and take steps to invest in a more data-led approach to projects.

## Supply chain collaboration: Partnerships built on data

Collaboration between the different parts of the supply chain, or lack of it, is one of the perennial challenges of the construction sector. It hinders project programming, eats profit margins, damages reputations and devalues our industry in the eyes of our clients.

The sharing of information between construction businesses has always been poor, which is partly down to how we use and understand data. As an industry, we're not great at gathering it, bad at interpreting it, and even worse at sharing it.

Big Data is coming, and it's closer than most people think. It will be the construction businesses that embrace the disruptive potential of data that will survive and thrive in this digitally-enabled era.

Building Information Modelling (BIM) has the potential to change that. In many ways BIM embodies the spirit of Big Data. Its concept is built on collecting information from multiple sources to create a model that helps all parts of the supply chain to work together more effectively and become more than the sum of their parts.

BIM is a long way from perfect and there are still huge inconsistencies in terms of adoption levels between projects, with many disagreeing on how to deploy it most effectively, what systems to use, and so on. But the potential is huge and revolves around the very principles of Big Data.

*Read the Q&A with our BIM expert on page 16*



## **Data and AI: The next frontier for construction**

The widespread use of AI and machine learning in construction is not too far away, and it's how we manage data that's going to decide how well we navigate this new frontier.

The first area where we will see data-driven AI truly take hold in our sector is in how we operate our plant and equipment. The use of machine learning is simply the next logical step from the automation that we are already bringing to our drilling rigs and other plant.

There are already robotic devices being used in construction, for example, in automated bricklaying, that are utilising elements of artificial intelligence and machine learning. It's not long before this moves to larger, more complex plant.

Perhaps even more impactful is the role that AI can play in back office functions. Software is currently being developed that could analyse data from hundreds of thousands of lost time accidents and use this to predict when and where injuries are most likely to occur. It is this predictive functionality –

using historic information to foresee future events and either avoid problems or improve outputs – where we will see AI having the biggest impact on our industry, and it's data that will drive it all.

## **Data gathering: The foundations of the future**

As construction businesses finally wake up to how important data is to the future of our industry, improving how data is gathered from across day-to-day operations needs to be top of our agenda. For this, we need to see more investment and R&D from everyone across the supply chain.

At Bachy Soletanche, we are investing heavily in building data capture into our everyday activities. Part of this is about getting as much data as possible out of our plant, from using telematics to optimise fuel consumption to analysing ground strength based on the power output of drilling rigs.

**“Our industry’s use of data is poor. We are not great at gathering it, bad at interpreting it, and even worse at sharing it.”**

*Matt Walpole, Business Unit Manager*

The use of sensors is another key area of focus for us; one which could yield huge amounts of invaluable data. For example, we’re putting thermal sensors in foundation piles to gather data about how concrete changes and degrades during the hydration process. Interpreted correctly, this data can be used to predict failure, improving the longevity of concrete piling and potentially saving millions of pounds worth of remedial work.

It’s clearly not just in ground engineering where sensor technology and data can transform projects. Through the construction of an office block, for example, you could have sensors within the piling, gathering information about foundation strength, sensors in the structure, collecting data about stresses on the building itself, and sensors on every piece of HVAC (Heating, Ventilation and Air Conditioning) and building management equipment within the building, truly understanding how the office is being used. Collectively, the data from these sensors would create a true picture of the building over its lifetime, which would be invaluable to inform how we design and manage similar buildings in future.

## **An unmissable opportunity**

While the sort of disruption seen in finance or retail may not seem immediately applicable to the geotechnical sector, we are certainly not immune to the changes it will bring. It will be the companies that embrace the disruptive potential of data that will survive and thrive in this digitally-enabled era.

Bringing our industry up to speed will require commitment. We need to break free from our traditionalist mindset, develop and support new technologies, bring people with digital skills into our sector, and make a conscious effort to shift towards a data-led approach to our work.

If we recognise Big Data for what it is – a transformational opportunity to improve how we work – and wholeheartedly embrace it, there is a strong future for geotechnics businesses. However if we continue to bury our heads in the sand we may find ourselves, like businesses in so many other industries, quickly becoming obsolete.



# Digital construction: a bright future for BIM?

After a long and arduous journey, Building Information Modelling (BIM) has finally established itself firmly in the construction mainstream and is beginning to fulfil its potential to transform the way our built environments are designed, constructed and maintained.

In this exclusive interview, we ask Bachy Soletanche BIM specialist Scott Bennison what we can expect from BIM in the future, where the opportunities and potential challenges lie, and what impact it will have on the ground engineering industry and its customers.



## Where do we stand on BIM from a legislative perspective?

April 2016 saw the mandate on Level 2 BIM for all Central Government construction projects come into force, but there has been a big push on BIM for a number of years now – really since the plans for the mandate were formalised in 2011.

There have been a few companies, usually the smaller supply chain trades, who've been slow to get up to speed but broadly speaking the major players are routinely delivering projects through Level 2 BIM – not just on Government contracts, but private sector projects too. The mandate did a great job of kicking the industry into gear.

## Are there plans by the government to take things further with BIM?

In the 2016 Spring Budget, then-Chancellor George Osborne gave very clear signals that the Government would be mandating Level 3 BIM as part of a strategy called Digital Built Britain.

The momentum is still strong but the focus has perhaps understandably shifted away in light of Brexit, but Digital Built Britain is still very much on the Government agenda and we can expect further development of the strategy later this year.

## What will Level 3 mean in practical terms?

Level 3 is the BIM holy grail. It means achieving complete collaboration on a project using one centralised BIM model, which can be accessed and adapted by any part of the supply chain at any time throughout the construction programme.

In principle, BIM holds truly remarkable potential. The badly-managed paper trails, poor inter-disciplinary communication and programming clashes between trades could be all but eliminated, yielding huge efficiencies for all parties, known as 'Open BIM'. It could also bring significant benefits to those managing the building after completion, with facilities management professionals potentially able to use this all-encompassing single model as the blueprint for maintenance and management activities throughout the lifetime of the building.





## **Level 2 has been very challenging to achieve for some firms. How difficult will Level 3 be?**

Having a Government-mandated BIM Level 2 has pushed the construction industry on great strides in terms of collaborating more across different disciplines, but we've still got a long way to go. There are still a lot of siloes out there.

Some parts of the supply chain – typically those at the front end of the process like main contractors and architects – are much further forward in their understanding and deployment of BIM. A survey of 557 construction professionals for the Chartered Institute of Building, undertaken last year when the mandate went live, showed that only 5% felt “fully confident” with BIM – and while the research didn't split that figure out, it's highly likely that those lacking in confidence were the smaller sub-contractors and consultants who do not work on large, centrally-funded projects.

One of the biggest challenges and a key reason for such disparity across the supply chain is around software. While there are standard file formats (IFC & COBie) there is no standard platform: different companies use different systems, making it extremely hard to share models and information quickly and effectively. Clients need to drive BIM and encourage their supply chain to adopt the practice, ensuring a fully collaborative approach.

For Level 3 to work, we need some standardisation. We're not going to be able to mandate everyone to use the same system, the market wouldn't allow it – but we will need to agree common practices and clear, unbreakable rules on how information needs to be packaged, processed and managed. Otherwise that panacea of a single BIM model simply won't work.

## **What's the single biggest thing the industry can do to get ready for Level 3 in the future?**

For me, it's a case of getting private sector clients fully bought in to BIM. Large publicly-funded projects have achieved cost efficiencies of up to 30% across the supply chain thanks to mandated Level 2 BIM, which should have been enough to make a business case for it on all large construction contracts – but it just hasn't happened.

Partly I think this is the fault of the industry. If private clients aren't requesting the use of BIM, most don't push for it. If they do it's been lacklustre: a “have you considered using BIM?” rather than a clear and compelling recommendation based on the significant, tangible benefits and efficiencies it can bring. The Government invested a lot of time and money educating the industry through BIM Hubs and various briefing papers and reports. It's our responsibility in turn to educate clients on the benefits that this can bring.

BIM Level 3 is coming, there's no doubt about that – 2025 is the target date for a Government mandate on it, and how quickly that will trickle down to private sector projects remains to be seen. Rather than wait for this to happen, we as an industry should be taking the initiative. If we work together and with our clients to embrace BIM and drive forward its adoption, we will not only prepare ourselves for the inevitable – we will achieve significant operational improvements and cost savings, benefiting both us and our clients.



# Skills shortage: tackling the tech talent challenge

Louise Pugh, Group HR Manager for Bachy Soletanche outlines her thoughts on addressing the recruitment challenge facing geotechnical companies.

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As Group HR Manager for Bachy Soletanche, our team makes sure that we're bringing in the talent we need to not only deliver our projects on a day-to-day basis, but to drive our innovation and R&D programmes.

We're fortunate at Bachy Soletanche to have a workforce with decades' worth of experience and wisdom, but we're also keen to supplement the team with fresh, new talent – especially where they can bring the skills to drive change and push the business forward in the modern age.

We source the talent we need to drive our digital development through a number of channels including student bursaries, training schemes and apprenticeships across our plant, piling, and engineering programmes. But what unites everybody we bring on board – and which needs to be the focus for all geotechnical businesses going forward – is a passion for technology and innovation, and a will to do things differently.

It's no secret that there's a looming skills gap in construction and ground engineering and that's why we place so much importance on our apprentices. The way we work with them is collaborative: we share our expertise and experience with them, and they bring new ideas, new skills, and new ways of doing things. We encourage them to challenge our processes and practices from day one. They are a regular presence on site, and can also provide valuable insights, examining our modelling or piling technology, saying "have you thought about trying this?", or "why are we still doing that?"

We find that our apprentices adapt quickly to complex or technical areas of our work. This flexibility and hunger to embrace the new and innovative is what's needed if we're going to be able to attract the talent we need into the geotechnics industry and exploit the opportunities that disruptive technologies offer us.



## 60 seconds with... Niamh Pritchard

Niamh is studying Civil Engineering at the University of Surrey through Bachy Soletanche's scholarship programme. Here she outlines the benefits of such a scheme and what the future holds.



### *Why did you choose the Bachy Soletanche scholarship?*

Bachy Soletanche was offering funding for certain students taking on my degree, with the opportunity to work for the company during summers and for a full year placement. It gave me the opportunity to apply what I was learning at university in real life situations and get a head start in the industry. It was an easy choice!

### *You receive the funding and the industry experience – what does Bachy Soletanche get in return?*

One of the things that attracted me to the programme was the fact that Bachy Soletanche were specifically looking for young engineers who would see things differently to the conventional way of working. I'm encouraged to bring the new skills and techniques to the workplace, which I guess helps Bachy Soletanche to be a more forward-thinking and innovative company.

### *Can you give an example?*

Well, the technical aspects of ground engineering especially are always developing. My degree has taught me cutting-edge methods when it comes to the essentials like structural drawing – but also in more specialist areas like, say, water engineering. This can be invaluable on some of the more challenging sites we work on.

### *Where next, once you've completed your studies?*

I'd like to stay on here! Even in a relatively short space of time I've worked on some incredible projects, including Crossrail, one of the biggest ground engineering projects in the world. The opportunities you get with Bachy Soletanche are fantastic!

There are also new groups of graduates coming in each year, so I'm getting to work with other young people who are starting out on their careers and bringing new ideas into the company – it's something I really want to stay a part of.

### *Any words of advice for aspiring civil engineers?*

Find a company where you're not discounted because you're inexperienced, but actively encouraged precisely because you're not used to doing things like everybody else does!



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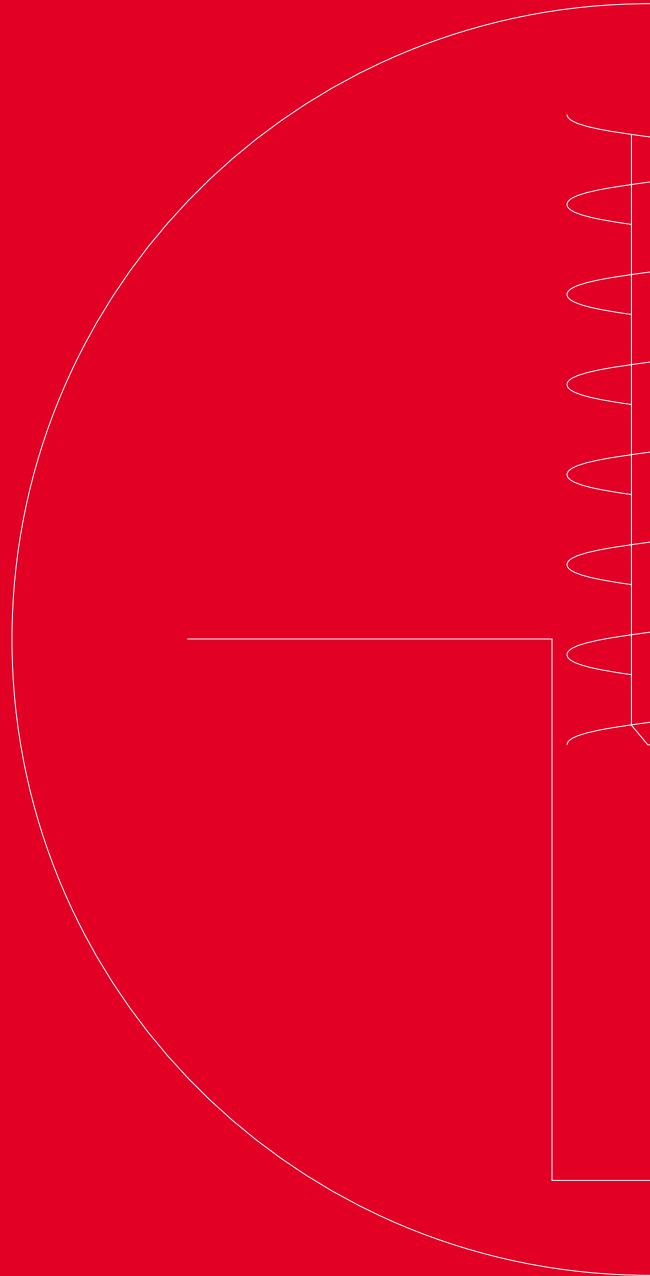
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