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CONSTRUCT MAGAZINE

ISSUE ONE **2018**

A Quick Ten For Construct with
Kobi Burnett

Modular momentum driving construction industry in 2018

The Centre for Smart Modern Construction

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CONSTRUCT MAGAZINE
ISSUE ONE 2018

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An introduction to the Australian Institute of Building

The Australian Institute of Building (AIB) is incorporated by Royal Charter and is the preeminent professional body for building professionals in Australia and the Asia-Pacific region. The AIB has a long and proud history of supporting and serving the building profession. For more than sixty years the Institute has worked with the building and construction industry, government, universities and allied stakeholders to promote the building profession, support the development of university courses in building whilst promoting the use of innovative building techniques and a best-practice regulatory environment.

The AIB is proudly supported by:

A message from the president

BY PAUL HEATHER, AM, JP, FAIB
National President Australian Institute of Building

Happy New Year and welcome to the first edition of Construct for 2018 and an update on matters AIB.

Before outlining the many exciting and new initiatives that are either in place or in their formative stages for 2018, I take this opportunity to acknowledge and offer thanks for the effort and resolve by the National Council, Chapter Committee's and the many hundreds of volunteers across our membership base.

In late 2017 the Australian Taxation Office granted the Research Education Fund Trust (administered by the AIB) full Deductible Gift Recipient (DGR) status. In the near future, the Trust will offer opportunities to members and the broader construction community to contribute to this outstanding initiative as a way of giving back to the profession. The Trust will offer scholarships and incentives for students to undertake research with a view of advancing the science and practice of the profession within the building and construction industry.

On the topic of Work Health and Safety, I am very proud to announce that the Australian Institute of Building and St John Ambulance Australia have joined forces to deliver initially in NSW, a 2 day face to face course covering General Induction Safety Training (White Card) and First Aid to all students undertaking studies within the Built Environment. This unique offering will kick off during the second week of April 2018 at Western Sydney University. Further and in line with the AIB's Value Proposition, the team responsible in developing the resources for the General Induction Safety Training (White Card) and First Aid will expand the program nationally over the coming 12 months to take in many of the Universities that the AIB accredits.

The AIB is in the early stages of exploring a series of Master Classes that will cater to construction firms who are committed to delivering training/ professional development to their workforce. Ideally, we envisage a team of highly trained and experienced presenters who will pass on their many years of knowledge covering topics such as, Leadership, Stakeholder Management, Communications, Project Administration, Project Scheduling, Resource Management (human, materials, plant & equipment), Project Procurement, Negotiation and Conflict Resolution. If this area of continuing professional development is of interest to you or your firm we would like to hear from you.

As a membership organisation, our focus is to refresh and innovate member services facilitated through the National Council and Sub-Committees. Accordingly I welcome some new and familiar people to the leadership of some of the core committees in 2018.

Dr Robyn Hardy FAIB – Chair of Continuing Professional Development and Constructing Our World Conference – scheduled for September 2019.

Dr Ron Webber FAIB – Chair of Course Accreditation and Education

John Gaskin AM FAIB – Chair of Industry and Government Liaison

David Burnell FAIB – Chair Membership Services and Vice Chair Finance and Investments and something of a first for the AIB, I welcome Adam Rennie YBA representative and Observer to the National Council.

Lastly I will leave you with a quote from Henry Ford.

"Coming together is a beginning; keeping together is progress; working together is success."

CEO's Column

As we start a new year I am buoyed by the fact the AIB is forging ahead with fresh thinking that will continue to grow our Value Proposition.

These include:

- The launch of the inaugural 2018 Professional Excellence in Building Awards in Hong Kong. Whilst it will be a modest start this year, we will run an Awards Presentation at or around the same time as the Hong Kong Annual General meeting mid-year and hopefully see some of those entries move through to the National Awards in Australia later this year

- Meanwhile nominations and submissions are now in for the Australian Professional Excellence in Building Awards. Given the amount of entries received, it looks as though it will be a bumper year to showcase the industry

- Dr Robyn Hardy has been appointed as the new Chair of Continuing Professional Development (CPD) for the organisation. The focus this year will be to commission new material that is specifically relevant and targeted at AIB members. It's also hoped that in time to come we will be able to share material with other like - minded organisations and them with us as well

- We have welcomed Adam Rennie from NSW to our National Council line up for 2018. Adam's enthusiasm, experience and someone with youth on their side will be a great addition to our strategic thinking and forward planning with our younger current and future members

- We also welcome our National Senior Vice President David Burnell on board as our new Chair of Membership. David's experience and passion for not for profit member based association thinking will be a breath of fresh air. We welcome his ongoing review of our Membership Value Proposition

- Continued focus on advocating on behalf of the profession at the state, territory and federal level

I look forward to meeting with many of you this year and forging ahead with many operational and strategic aspects of the organisation.

Greg Hughes AIB
CEO

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A Quick Ten For Construct with Kobi Burnett

Each edition, Construct Magazine features a snapshot of a significant contributor to the building and construction sector.

This edition, we talk with Kobi Burnett, Site Engineer at Multiplex based in Sydney:

1. What inspired you to begin a career in the construction industry?

I was inspired to work in an industry where you can quite literally see your hard work take shape, and knowing that each and every project is adding value to people's lives and the wider community.

2. What's the best thing about your job?

It's ever changing; you will never work on the same type of project twice. I like that you are constantly challenged by the opportunities presented by working on diverse projects.

Kobi Burnett

3. What is the current project that you are working on?

I recently relocated from Perth, Western Australia, to Sydney and am working on the Westmead Hospital Redevelopment.

4. How do you see your career progressing from this point?

I would really like to be involved in sustainable builds, particularly construction projects targeting Green Star ratings and looking to break the mould in innovative technology. I am always keen to continue learning and not ever be stagnant in my role.

5. Why did you join the Australian Institute of Building?

I joined the AIB as a student member and continued my membership due to the opportunities, insight and exposure to the industry that I otherwise would not have had, including networking and continued professional development.

6. What is the most rewarding aspect of your AIB membership?

I have had the opportunity to sit on the Western Australian Chapter Committee and this has been very rewarding in that it has allowed me to offer my own insight and give back to the industry. I also had the opportunity to manage the marketing initiatives for the Chapter and be involved in a strategy planning session in Canberra, which I have thoroughly enjoyed.

7. Where do you see the building and construction industry in the next ten years?

I think the focus will continue to shift towards more sustainable and innovative building, making use of limited resources whilst reducing environmental impact. These methods of the built environment are starting to emerge in Australia, but I believe there is a lot of growth and long term benefits to be realised.

8. What would you like to see change in this space?

I would really like to see more gender diversity in this space and it needs to start with educating young women still completing high school who may not realise that a career in construction doesn't have to involve manual labour. There are many different paths the industry can take you, from tender and design through to construction and facilities management. The change needs to start with education during schooling years and continue with support throughout the working career.

9. Do we need to be more regulated across the sector?

I think we are on the right track in terms of regulation, however, we would benefit from aligning between States and ensuring consistency in governance and authority approvals, for example in gaining building registration and licenses.

10. What advice would you give a student of building and construction as they look to enter the profession?

I would advise them to be a 'yes' person – be flexible and open to new challenges, taking any opportunity that comes your way, whether it be trying new roles within your company, joining an institute like the AIB, attending CPD and networking events – strive to challenge yourself and be an active participant within the building and construction industry. The profession can take you so many places, if you're motivated and enthusiastic enough to allow it to do so.

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Modular momentum driving construction industry in 2018

Factories in flat-packs and homes built in factories – modular construction will build new momentum in 2018. However the industry is battling with significant skills shortages and must manage increasing globalisation. These are the three industry predictions for 2018 from Kenny Ingram, Global Industry Director of Construction and Contracting at IFS.

1) Skills shortages will force the industry to adopt new technology and business models

A shortage of one crucial resource threatens the rate of growth worldwide. Can you guess what it is? Energy? Water, maybe? Capital? Actually, it's manpower. All over the world, skills and labour shortages are hitting hard. In 2018 it could force permanent, decisive changes in how construction does business and meets demands.

In the US, the Associated General Contractors of America found that 86 percent of 1400 firms had difficulty filling available posts, with carpenters and concrete workers topping the list. In the UK400,000 skilled workers will retire from the construction industry in the next ten years (Construction Industry Training Board). Over the next five years, 182,000 new jobs will need to be filled. In Asiatoo, labour shortages loom. Over the next 30 years, China's working-age population will shrink by 180 million. The ILO (International Labour Organisation) forecasts that China's projected labour shortfall in 2030 will be equivalent to 24 percent of its current working-age population.

The recent global Turner & Townsend international construction survey shows that 23 of the 43 markets surveyed suffers from skills shortage, up from 20 the previous year. Only four global regions reported a surplus; Perth, Muscat, Santiago and São Paulo, according to the survey. Another source pointing in this direction is the World Economic Forum Report, Shaping the Future of Construction,that shows that the US construction industry's productivity has fallen 19 percent since 1964. In the same period, non-agricultural industries improved by 153 percent. This was also brought up in the UK in a recent government-commissioned report, the Farmer Review, that has rung alarm bells in the construction industry. Subtitled Modernise or die, time to decide on the industry's future, it details how skills shortages drive costs up, quality down, and lead to poor productivity.

However, there is hope too. The Farmer Review details many innovative high-quality cases where the merger of manufacturing and construction has opened up new markets and revenue streams with creative construction solutions. One such modular construction is GSK's 'factory in a box', designed by modular and BIM construction studio Bryden Wood. The solution is a colour-coded, easy-to-assemble pharma factory that can be shipped in a crate and put together in emerging markets with demanding local compliance standards, high potential, but limited money available for large specialist onsite teams. Designed with business information modelling (BIM), the factory in a box is a great example of how design-led innovation in construction can produce more assets with fewer resources.

In 2018 I believe we will see a perfect storm of factors (an ageing global workforce, a lack of new entrants, and growing restrictions on free movement of labour) begin to decisively accelerate the uptake of construction-integrated manufacturing such as this. Governments, regulatory bodies and the industry alike will start to realise that, while getting more people into the industry is important, as well as trying to increase the number of people onsite, the most strategic solution would be to fundamentally change the way we build in the first place.

2) With construction-integrated manufacturing, 10percent of traditional contractors could disappear over the next five years

It is beyond doubt that modular construction and construction-integrated manufacturing is playing an increasingly important role all over the world.

Modular is expected to rise 6 percent globally by 2022, with some countries already leading the prefab charge. Sweden is a model for modular home building. Around 84 percent of detached homes built in the Scandinavian nation use pre-fabricated timber elements. Compared with Australia, the US, and the UK, where the figure is just 5 percent, Sweden is practically a modular world leader. Meanwhile, developing countries are also considering how pre-fab can meet their housing shortages and cost constraints. Nigeria is one example that is taking a long look at modular housing to meet its crippling housing shortage – close to 20 million units at the last count.

In Japan, around a quarter of all new houses are prefabricated. Japan's success shows both the quality of assets manufactured in controlled conditions, and how many new entrants they attract. As well as market leaders Sekisui House and Daiwa House, Japanese retail giant Muji recently started developing construction modules, and Toyota has manufactured prefabs for over 20 years. Japan particularly prizes prefab construction for its quality and efficiency. Offsite modular construction removes the last-minute changes that can plague onsite construction and reduce the quality of the finished asset. Small wonder that from1963 to 2014 manufacturers built nine million prefab homes in Japan.

With growing skills shortages and a need to build faster and more cost-effectively, it will become a crucial competitive advantage to be able to invest in the

Kenny Ingram

right technologies and people and find the right business partners to leverage construction-integrated manufacturing.

3) Globalisation will increase the foreign content of construction projects by 20percent within five years

Offsite, logistics-centric construction will be a catalyst for increased globalisation too. Currently, 95 percent of construction projects are carried out by local firms sourcing local materials. But we see that this is changing. Customised, large-scale components and elements will increasingly be sourced globally, meaning increased competition and, potentially, margins. It's a big shift for an industry that has traditionally been highly country-specific. But for operators agile and disciplined enough to start planning and handling logistics, and invest in new joint ventures, the gains could be huge.

Take Spain. With a similar GDP to Australia, seven of the world's top 100 construction companies are Spanish. Yet while the country's recent economic difficulties took out many companies, Spain's construction sector fared remarkably well. One of the main reasons is that Spanish construction companies often partner globally and thereby reduce the risks of exposing the business to domestic economic challenges. Here, the Spanish construction industry's strong tradition of joint ventures and global partnerships was a powerful competitive advantage.

New technology is making it easier to work profitably on a global level as well. With 3D printing, for example, costs for both material and long transports are decreasing substantially. Using technologies such as these, the partnerships will focus more on global competence exchange rather than long-haul transports.

All three of these trends are woven tight together. Contractors need to work hard to ensure that the right competences are secured while considering how to implement new business models for modular buildings and construction-integrated manufacturing – all this in a construction industry that is becoming more global and offers new forms of partnerships. The players who master this balance act will be the winners in 2018.

About the author

Kenny Ingram is the Global Industry Director for Construction and Contracting at enterprise applications company IFS and a key member of its Product Direction Board. Kenny has been with IFS for 17 years and is now regarded as one of the top specialists in Project Based Business systems.

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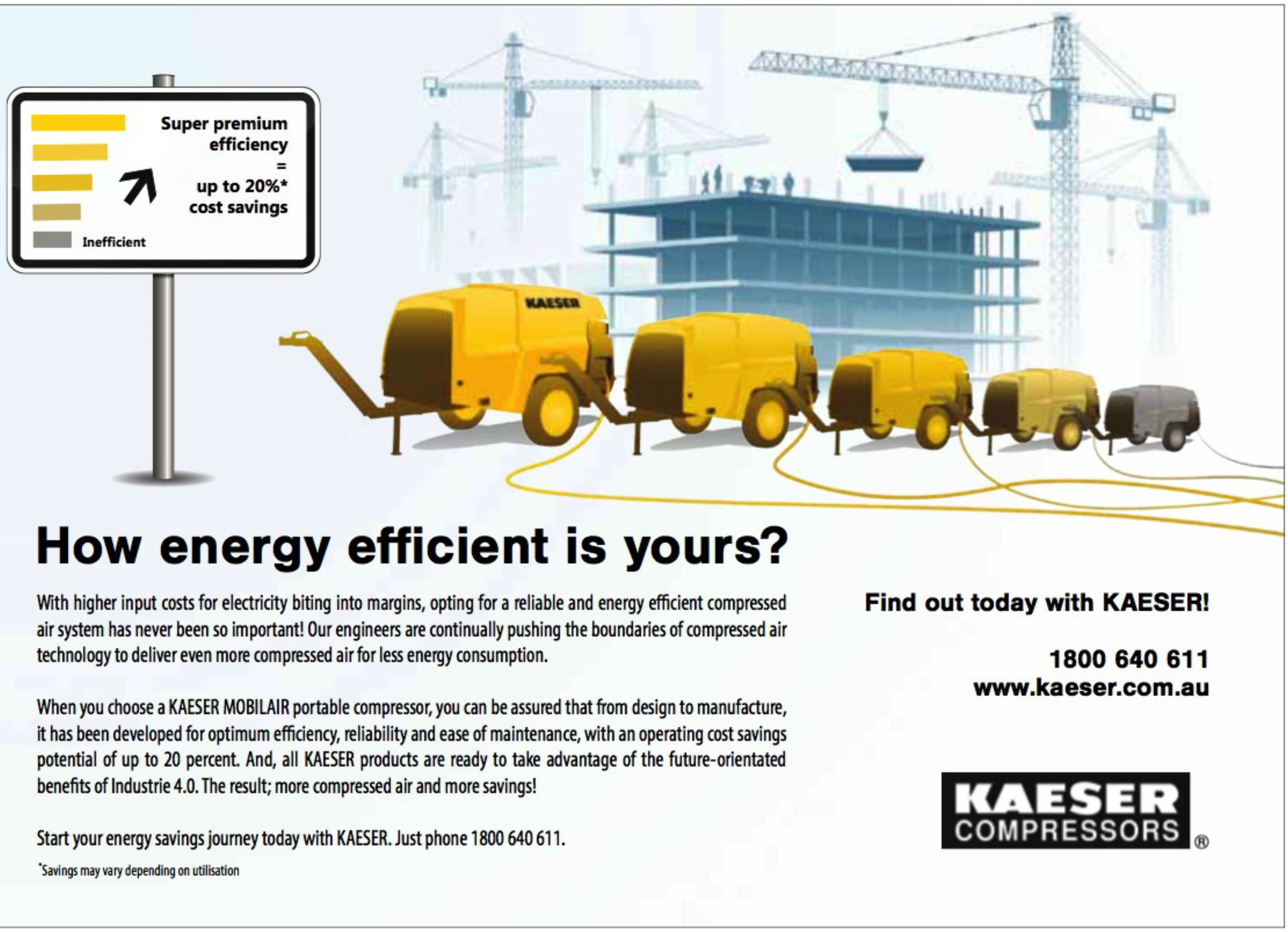

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The Centre for Smart Modern Construction hosted internationally respected US academic Professor Chimay Anumba as keynote speaker to the Construction Management Colloquium

Professor Chimay Anumba hosted at the University of Western Sydney

Professor Anumba's current visit to Australia was too good an opportunity for the Centre not to invite Chimay to share his insights in the field of Cyber-Physical Systems in Construction with the University's academic team and invited guests.

The Centre's Director Professor Srinath Perera and Industry Engagement Lead Adjunct Professor David Chandler OAM used this occasion to show Professor Anumba over the Parramatta South campus of the university including the many historical buildings which feature as part of the high-quality experience students and academics enjoy. Chimay is the Professor and Dean of the College of Design, Construction and Planning at the University of Florida in the United States. Amongst his many distinguished achievements Professor Anumba is a Fellow of the Royal Academy of Engineering. He was very impressed with Western Sydney University's campus and facilities.

Professor Anumba reacquainted with Professor Simeon Simoff, Dean of our School of Computing, Engineering and Mathematics and home of the university's Construction Management Program. The Dean outlined the many cross discipline centres of excellence that exist at the University, spanning Data Sciences, Technology Entrepreneurship, Health Sciences, Artificial Intelligence, Industrial Design, Law and Urban Transformation Architecture. Professor Simoff outlined the unique opportunities that Western Sydney University was now embracing like those of the Centre for Smart Modern Construction, which was especially focused on leading-edge construction developments in the region. Professor Simoff invited possible future collaboration between both universities.

Professor Anumba also reacquainted with Professor Kerry London, Deputy Dean, of School of Computing Engineering & Mathematics. To commence the colloquium Professor London presented the profile of research at the school and how these connect with other work across the University. Chimay was also introduced to Deputy Vice Chancellor Professor Scott Holmes. He also met Mr. Scott Lyall the Development Manager in the Office of Advancement, who support the Centre.

Professor Anumba's keynote presentation: Cyber-Physical Systems in Construction – Development Lessons and Future Directions contributed to the Centres goal to bring leading-edge smart modern construction insights to the university and to share these with the teaching and research team.

Cyber-Physical Systems (CPS) enable the synergistic integration of virtual models and the physical environment which are now being increasingly recognized as vital for improved construction project information management, more efficient project delivery, and enhanced facilities management. A critical aspect of the deployment of CPS in construction is ensuring bi-directional coordination between the physical components and their virtual representations. Professor Anumba's presentation offered many applied examples from research prototypes to highlight the key features and benefits of these systems, and the steps involved in their development. He discussed the lessons learned from developing a variety of these systems for various stages of a constructed facility's lifecycle. Following his presentation, the academic team discussed the future directions for CPS in modern construction.

Professor Anumba has authored over 450 scientific publications. His work has received over US $150 million in investment from a wide variety of supporters. These achievements show that the Australian construction industry has some way to go to support the sector's growing need for quality research and academic knowledge. The c4SMC initiative now enters 2018 with a clear mission to close this gap.

Professor Srinath Perera, also used the colloquium and Professor Anumba's visit to present a status report on c4SMC achievements, and to point to the strong correlations between the many developments that are now defining the modern construction era. Professor outlined the scope of five PhD scholarships that the University and Industry were now able to implement. The colloquium was an ideal start to the Construction Management research and academic activities for 2018. The occasion was well attended and Professor Anumba was impressed with the Centre's work.

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BUILDING INNOVATION AT ARBS 2018

The future of the built environment, with a focus on innovative responses to existing and emerging trends, will be on show at ARBS 2018, Australia's only international air conditioning, refrigeration and building services trade exhibition which returns to Sydney on the 8-10 May 2018 at the International Convention Centre (ICC).

With more than 350 exhibitors and in-excess of 9,000 visitors, the exhibition is forecast to be the largest ARBS to date and will offer the industry unrivalled access to the latest in HVAC&R in the southern hemisphere.

The building and construction industry, more than ever, needs to be proactive and engage in the debate at all levels to change the paradigm. 'The industry continues to face some serious challenges including the changing nature brought upon though innovation and automation, government regulations, affordability and environmental concerns. Therefore, it's vital to keep connected and remain current in the approach to how we design and build infrastructure and buildings', says Ian Hopkins, ARBS Chair and industry advocate.

The exhibition facilitates this through the exploration of cutting-edge intelligent building technologies and solutions in the brand-new show floor precinct, IBTech@ARBS. Data and technology is transforming our built environment and as smart building solutions continue to evolve, they allow property developers and owners to reduce costs, improve energy efficiency and enhance occupant comfort. Recent advancements have meant greater integration and interoperability between key systems, resulting in highly sophisticated building control strategies. IBTech@ARBS examines this and more through a series of displays, presentations and hands-on sessions.

Alongside the exhibition, and of interest to the building and construction industry, will be the Speaker Series – a full seminar program which will see industry leaders and experts present on an array of topics and management issues whilst facilitating discussions on how we can better design, control and innovate to sustainably and efficiently transform our built environment.

Sydney ICC Central Energy Case Study

A case study highlighting the unique features of Sydney ICC's central energy plant. Presentations will be delivered by the lead consulting engineers and contractors behind the $1.5 billion redevelopment and will explore challenges faced throughout the project and key lessons learnt.

Sydney ICC Central Energy Plant Tour

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Barangaroo South District Cooling from concept to operation

A significant contributor to achieving the carbon positive goal is the district cooling system that provides chilled water to all types of building within the development. Explore challenges including laying the foundations of a workable sustainability strategy; the precinct wide cooling design concepts and strategies employed; integrating the detailed design of the commercial building's cooling systems; and the transition from construction to the required operating performance.

Barangaroo South District Cooling Site Visit

Join us in a tour of Barangaroo South, a landmark development on the shores of Darling Harbour and one of only 18 projects globally to be a part of the Clinton Climate Initiative's C40 carbon positive development programme.

The Speaker Series presentations enable you to connect with peers and remain informed and inspired by exploring the future of HVAC&R and the built environment. At ARBS 2018, see all the latest products, talk to manufacturers and distributors about new innovations and enjoy many of the social activities including the awards presentation dinner.

Since 1998, ARBS has provided a unique forum for the entire industry to connect and develop mutually beneficial business relationships, to source and discover the latest products, systems and service evolutions and to share knowledge of emerging technologies, methodologies and best practice. If you are involved in HVAC&R or building services, then you cannot miss this major industry event. Quick and easy pre-registration is available online which grants free entry across all three days – visit **www.arbs.com.au.**

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As they get older, some master tradespeople evolve subtle techniques of movement that reduce wear on their joints and muscles, allowing them to do more work with less effort than novices, a study has shown.

Using a load's momentum rather than their own brute force and avoiding bending their backs are some of the ways wise old hands stay fit and productive, say researchers at Canada's University of Waterloo, who put experienced masons in sensor suits to study and record their ergonomics.

The research shows master masons sometimes do not follow standard ergonomic rules taught to novices, but develop their own, previously unidentified ways of working quickly and safely.

Researchers say the knowledge can now be passed on to apprentices in training programs, and to middle aged workers to keep them fit and healthy longer, keeping valuable skills in the industry.

"The people in skilled trades learn or acquire a kind of physical wisdom that they can't even articulate," said Carl Haas, a professor of civil and environmental engineering at Waterloo. "It's pretty amazing and pretty important."

"They're basically doing the work twice as fast with half the effort – and they're doing it with higher quality," said Haas, who leads the research with Eihab Abdel-Rahman, a systems design engineering professor at Waterloo. "It's really intriguing."

In their first study, the researchers analysed data from bricklayers of various experience levels who wore sensor suits while building a wall with concrete blocks. The data showed experts put less stress on their bodies, but were able to do much more work.

A followup study was done to determine how master masons work so efficiently. It involved the use of sensors to record their movements and computer programs to identify patterns of body positions.

The researchers now plan to do more in-depth study of how the experts move on the job.

"Skilled masons work in ways we can show are safer, but we don't quite understand yet how they manage to do that," said Hass, who compares their skill to a professional golf swing. "Now we need to understand the dynamics."

Musculoskeletal injuries are a significant problem in bricklaying, causing many apprentices to drop out and many experienced workers to prematurely wear out.

As part of their work, the researchers are now developing a system that uses sensor suits to give trainees immediate feedback so they can modify their movements to reduce stress on their bodies.

"There is an unseen problem with craft workers who are just wearing out their bodies," he said. "It's not humane and it's not good for our economy for skilled tradespeople to be done when they're 50."

The much-heralded era of 3D-printed buildings took a tiny step closer this month with what is being claimed as Europe's first printed, inhabitable building – a small, single storey office structure in Nordhavn, Denmark.

The main structure of the less-than-50-sq-m flat-roofed building, which will contain rentable hot-desking spaces, was reported to have been complete after 50 hours printing time on 21 November by the 3D Printing Industry news site.

Called Building On Demand (BOD), the curvy workers' enclave is a demonstration project by Danish company 3D Printhuset. It was printed on site by a printhead squirting a cementitious material supported by a gantry measuring 8m x 8m x 6m.

Foundation and preparatory work began in September and the building was due to be opened for use yesterday, but the team ran into trouble with "severe difficulties with the whole material handling prior to printing", which caused equipment failures, 3D Printing Industry reported.

That means BOD's planned opening will be delayed as fit-out and finishing proceeds.

In spite of the delay, 3D Printhuset hopes BOD will shake up the way buildings are constructed.

"We hope to inspire others with this project and welcome any chance to discuss with interested parties how 3D construction printing can be applied in Europe on a grander scale," said the company's chief executive Henrik Lund-Nielsen at the start of the project.

He added: "The construction sector is ripe for disruption, so let's get going."

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The Corrosion Conundrum

Durability Risks and Protection to Bridge Structures

Over the past few decades, the desire of extending the useful service life of buildings has become of paramount significance. The accelerated deterioration of strata titled assets is a serious problem faced by countries across the world. The premature deterioration has resulted in reduced service life of the reinforced concrete structures. Corrosion of reinforcing steel is one of the most prevalent deterioration processes. The construction industry has recently been witnessing ambitious designs and specifications to achieve this desired design service life. The adoption of high standards of design and construction of new concrete structures has become a major focus. Despite the ambitious project specifications and design parameters, reinforced concrete structures are always subjected to numerous durability risks. This article attempts to highlight the carbonation and chloride attack risks to the buildings. The life expectancy of high-rise buildings varies from country to country. The failure of a building to react to change makes it obsolete which might justify the need for a new building, Shabha (2003).

The Environment - Understanding the Climate Change and Carbonation

Concrete deterioration rate depends not only on material specifications and construction practices, but also relies on the on-going climatic environment during the life cycle of the structures. Atmospheric CO2 is a main culprit of corrosion in bridges, buildings and other concrete infrastructure in Australia, United States, United Kingdom and other countries. Using probabilistic and reliability-based approach, Stewart et al. researched on "Climate Change Impact and Risks of Concrete Infrastructure Deterioration" and concluded that carbonation-induced damage risks can increase by over 400% by 2100 for inland arid or temperate climates in Australia.

During the last two and half centuries, the concentration of carbon dioxide in the atmosphere has significantly increased by 36% from 280 ppm to 380 ppm. An interesting article in Sydney Morning Herald, 2015 by Nicky Philips highlighted the detrimental effects of carbon dioxide to something as simple as a loaf of bread. A nicely risen loaf of bread (Figure 2, right) might turn to a 'not so appealing' bread (Figure 2, left) due to the high concentration of carbon dioxide effecting the grains quality if greenhouse gas emissions are not abated significantly. WithCO2expected to rise from 380ppm to 550ppm by 2050, the future bread would be like the loaf of bread on left.

Interestingly enough, one of the most damaging agents to the concrete structures, CO2,is produced as a by-product during the cement production. Concrete, being the second most consumed material after water, contributes to more than 5% of annual global CO2 emissions. Such large amount of undesirable CO2 emission can be reduced by the use of new concrete additives and supplementary cementitious materials to increase the durability and workability of concrete. Repair mortar manufactures such as Fosroc, have also started manufacturing high performance repair materials based on supplementary cementitious materials making it environmental friendly and sustainable with lower carbon foot print.

Figure 2: *The larger loaf on the right was made with wheat grown in standard conditions.*

The loaf on the left was grown in high carbon dioxide conditions. Baked at the Australian Grains Free Air CO_2 Enrichment facility (AgFace) in Victoria by a research group. Photo: Simone Dalton, Source: The Sydney Morning Herald, 2015

Buildings are subjected to risks of carbonation – the process that results in reduction of the concrete pH. The formation of the passive layer protects the steel in concrete due to inherent alkaline environment in concrete. As a result of carbonation, the passivity of steel is disrupted and electrochemical process of corrosion is initiated. The protective film around the steel reinforcement is broken down through 'carbonation'. Carbonation takes place as a result of the penetration by atmospheric carbon dioxide, which reacts with the calcium hydroxide in the concrete to form calcium carbonate. This consumption of calcium hydroxide drops the pH level of concrete which is the primary effect of carbonation. This process begins almost as soon as the concrete structure is built but takes time for the carbonation

Table 1: A comparison of the life cycle of high-rise buildings in different countries

New Zealand	Australia	Britain	USA	Japan
50-60 years	50-60 years	60 years	35 years	20 years

Source: Shabha (2003)

process to change the alkalinity at a depth to effect the concrete.

As a secondary effect, carbon dioxide could also cause leaching and additional shrinkage due to the transformation of CO2 into carbonic acid (H2CO3) and its reaction with calcium hydroxide to form calcium carbonate and water. The reaction is described by:

$H_2CO_3 + Ca(OH)_2 \rightarrow CaCO_3 + 2H_2O$

Figure 3. *Carbonated reinforced concrete - Spraying freshly broken concrete with phenolphthalein indicates pink, non-carbonated areas.*

The external relative humidity range of 40% to 80 % increases carbonation. The carbonation below 30% relative humidity is almost negligible. The diffusion of carbon dioxide is, however, hindered under higher relative humidity due to water filling the concrete pores and low rate of CO2 diffusion in water. In addition to other factors such as relative humidity, time, temperature, atmospheric CO2 concentration, design, the rate at which the carbonation front progresses through the reinforced concrete is reliant on the quality of the concrete (porosity, permeability, water-cement ratio). By using high quality concrete and adequate depth of concrete cover,the risk of corrosion due to carbonation is reduced. The high quality concrete mix design is achieved with the presence of supplementary cement materials such as fly ash, slag and micro silica. These similar standards of quality are important while using cementitious repair materials for remediation of concrete. The carbonation resistance of repair mortars used for remediation and rectification of concrete should conform to EN 13295:2005. Repair mortars and engineered protective coatings such as Fosroc Renderoc and Dekguard provide an effective barrier against atmospheric carbon dioxide and other corrosive agents.

Chloride Induced Corrosion and Additional Factors – Salt Bae vs Salt Spray

The role of the chloride ion in inducing reinforcement corrosion is well documented. Chloride ions can enter into the concrete from de-icing salts or from salt spray in marine environments. Other sources include chloride containing admixtures, contaminated materials and water, air born salts and chlorides in ground water. Higher concentration of chlorides, disrupt the passive film and subject the reinforcing steel to corrosion. Chloride attack form pitting action to the reinforcement that could result in sudden collapse of a structure if remained unattended.

Salt Bae, (renowned Turkish chef Nusret Gokce with millions of followings), brings out the best flavours in steak by sprinkling salt on it in his iconic way but the same salt spray brings out the worst of concrete durability. Where sprinkling salt on meat leads to a scrumptious and succulent steak, sprayed salt on structures leads to a disastrous concrete.

Figure 4: *Salt Bae (Chef Nusret Gokce) sprinkling salt on a piece of meat is sensational. Source: Instagram*

Figure 5: *Salt spray is detrimental for concrete. Source: www.fosroc.com*

The strength degradation mechanisms can be classified as affecting either the concrete or the steel reinforcement, or both. Concrete deteriorates due to the chemical reactions in the cement (sulphate attack) and the formation of internal pressure. Concrete also gets challenged by chemical reactions between the cement and aggregate (alkali-silica reaction), or by freeze-thaw cycle attack. The deterioration of reinforcement steel results primarily due to the initiation stage of ingress of chloride ions or carbonation process and the propagation (material loss) stage. Additionally, the internal pressures formed by corrosive agents can lead to cracking and spalling of the concrete.

Conclusion

Corrosion in concrete structures is an alarming situation of serious concern. The scope of this article is to highlight the risks of carbonation and chloride induced corrosion. However, all risk factors are important and affect the performance of a structure, over a period of time. Failure of a building cannot be attributed to a single factor. All the stages in the life cycle of a structure are important and need to be taken into consideration during planning and designing stages. Any defects during the new construction, concrete structures should be rectified using sustainable, high performance, high strength and high resistivity mortars.

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About the Author:

Hamid Khan working presently as Product Segment Manager – Repairs and Grouts at Parchem, Australasia, holds a bachelor degree in Civil Engineering discipline. He also holds a double Master in Business and Strategy from the University of Wollongong. Hamid is certified in Concrete Technology and Construction, by City & Guilds of London Institute (UK) and is a qualified expert in concrete repair and refurbishment with 20 years of experience in the industry.

Hamid is a regular presenter at various industry related National and International Conferences and Seminars. Hamid contributed to articles for Australasian Concrete Repair Association (ACRA)-Concrete Connection, Concrete Institute of Australia (CIA) – Concrete in Australia, Australasian Corrosion Association (ACA) – Corrosion and materials, The Australian Institute of Building (AIB) – Construct for Chartered Building Professionals and other leading construction magazines.

Hamid is also an active board member and President of Australasian Concrete Repair Association (ACRA). He was associated with Fosroc International in Dubai for 14 years taking up various roles in technical and management. Hamid's experience comes from the Gulf, Middle East, Europe, East Asia and Central Asia.

3D modelling, sensors, drones and automatic plant are becoming more common in the groundworks sector as consultants and contractors embrace new technology. Stephen Cousins from Construction Manager reports.

Ground engineering projects may stand at the grimy front end of construction, but pioneering firms are showing how 21st century digital technologies can transform the way excavation and concrete foundation works are being designed, monitored and delivered.

Consultants and contractors are showing how advanced computational design can provide deeper insights into geotechnical conditions and the likely impact of new foundation structures. Expanding use of 3D modelling and BIM is helping improve design coordination and the communication of complex programmes of work.

Sensor technology is making monitoring structures simpler and more cost effective, increasingly becoming a requirement rather than an optional add-on. Meanwhile, emerging techniques such as the use of drones for machinery inspections, auto-erecting plant and 360 vision cameras on vehicles promise to make operations more efficient and safer.

Uptake of BIM has grown significantly over the past couple of years, but the focus is typically on above-ground structures, with site geology and subsurface often left out of the equation.

Ground engineers and contractors are still often reliant on working with paper and pen, but forward-thinking teams are trying to push the boundaries and apply specialist digital databases and 3D software to simulate and solve groundworks issues and improve design collaboration and coordination.

Owen Francis, divisional engineering manager at geotechnical company BAM Ritchies, tells CM: “Like most contractors, we don’t tend to receive digital models of projects from the scheme designers. Far from being put off by this, we have taken the opportunity to train staff to create models from a range of information sources.

“Clash detection is one of the key processes we use, whether selecting the most appropriate item of plant or reviewing the risk of striking services or known obstructions prior to constructing foundations.”

Capturing data in the field

The use of data-rich 3D models enables BAM Ritchies to communicate complex information to site teams and capture site data digitally in the field, to monitor progress.

“As the works progress, as-built data is added to the model and our customers are becoming more used to receiving a digital model of the as-constructed assets at the end of the project,” adds Francis.

Mott MacDonald recently teamed up with software developer Software House to create an advanced 3D geological modelling tool able to more accurately communicate ground conditions and risks to project teams when planning work.

The process involves building a 3D model of existing ground conditions, based on data from borehole logs, geological mapping and trial pit data, then exporting it into BIM tool Autodesk Navisworks where construction planners superimpose details of excavation and foundation works to be carried out on site.

The approach has been applied on a range of multi-sector projects, including oil and gas and metro schemes. It was recently used to visualise and plan sensitive remedial works for an existing embankment dam in the north of England that was affected by landslip and surrounded by complex geology.

Anthony O’Brien, global practice lead for geotechnics at Mott MacDonald, says: “Having this 3D visual tool enables the whole team, whether specialists or not, to more readily understand the issues so everyone is talking the same language when planning work. We will be using it as our day-to-day tool to communicate the 3D geological environment and ground risks to project managers and clients and construction managers.”

Balfour Beatty Ground Engineering is expanding its 3D capabilities to create detailed animations of work sequences on the most challenging foundation projects. This enables teams to scrub back and forth in time through the programme of works, and proved critical when planning specialist temporary works for a 22m-deep basement at Marble Arch Place, a £400m mixed-use tower being built next to Hyde Park in London.

Diaphragm walls needed to support basement excavation are typically built between two “guide” walls positioned on either side. However, proximity to an existing structure meant a single guide wall could only be installed, so all the equipment needed to build the diaphragm – such as support works for the cage, tremies needed to gravity-feed concrete into the wall and supports for temporary access platforms for workers – had to be cantilevered from one side of the guide wall, instead of spanning between two guide walls.

Mark Pennington, technical director at Balfour Beatty Ground Engineering, says: “The animation enabled us to identify where issues or clashes might occur before the work commenced on site. Projects aren’t typically interested in animating groundworks construction because the structures are not easily visible, but this was a great communication tool for the guys doing the job and for the client.”

Cutting-edge sensors

As projects come out of the ground, cutting-edge sensor technologies are being deployed to monitor the integrity and strength of concrete foundations and other structures, with positive knock-on effects for the programme and the quality of the built asset.

Cementation Skanska has rolled out fibre optics for pile and wall integrity testing on a number of projects, with plans afoot to extend the method across its entire project portfolio.

CemOptics was developed in collaboration with the Cambridge Centre for Smart Infrastructure and Construction as a robust alternative to existing point sensing methods that require connection to numerous sensors.

Standard telecoms fibre optic cables are attached to the sides of reinforcement cages and temperature measurements obtained – based on recorded levels of backscattered light – at close spatial intervals along the cage. Measurements are taken at short time intervals to track the changing temperature during curing.

Cementation Skanska is deploying CemOptics during construction of stations and tunnels on the Northern Line extension in London. Over 50km of fibre optics was laid to build over 600m of deep basement diaphragm walls and 74 large-diameter bearing piles required for the new Battersea underground station. The contractor is pushing the technology forward, using 3D printing to develop bespoke components to improve durability and simplify the installation process.

Andrew Bell, chief engineer for Cementation Skanska, says: “We see this technology as an essential part of our approach to improving safety and quality on our projects. Over the last 18 months, the system has delivered tangible safety, quality and technical benefits.”

An alternative foundation and pile integrity monitoring system, based on the use of wireless sensors embedded in concrete, is being trialled by Keltbray in collaboration with Arup and other partners. The firm claims that the technique is cheaper and easier to set up on site than fibre-optic technology and enables the follow-on trades to begin work more quickly.

The system is designed to accurately predict the in-situ curing strength of concrete after a period of just seven days, compared to around 28 days using conventional cube strength tests in a lab.

Stuart Norman, managing director of Keltbray Piling, explains: “There are challenges making the sensors and technology durable enough for the harsh conditions on site; they have to be able to withstand concrete in its liquid and solid forms, as well as the weight of 100-tonne piling rigs tracking over the top, you couldn’t have a more harsh environment. However, it’s rapidly developing and within three months I expect we will be there.”

Wireless monitoring data from sensors is also being exploited by projects to assess the impact of excavation sequences on ground

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conditions and structures and, based on that, modify the design as the work progresses.

"Technologies give us the ability to wirelessly collect data on things like movement in retaining structures, changes in groundwater pressure, heave at the base of excavations and propping loads – and bring it back into our software to validate design assumptions as work progresses," says Paul Stewart, regional director at Aecom. "The monitoring tech is always improving and giving us more data back, we can exploit it to help maintain the economy and safety of the design."

Ongoing efforts to improve productivity and reduce downtime on ground engineering projects is driving advances in the design of new plant, machinery and related equipment.

The latest piling rigs, such as the Soilmec SR-75 hydraulic drilling rig, are able to engage an automatic mode to dismount from the low loader and quickly self-erect, including the mast, without human involvement.

Transmitting real-time data

The Bauer BG39 multipurpose drilling rig is able to function like a mobile wifi hotspot and transmit real-time data on aspects such as location, drilling conditions, or concrete production to service management systems.

Norman comments: "Some rigs enable us to see exactly what a driver sees and troubleshoot problems remotely from an office that may be hundreds of miles away. We are working on development of a client dashboard that would enable a client to view online, via a webcam in a cab, progress on site. It's a more direct way to engage than having to wait for weekly progress meetings."

Efforts to spearhead new approaches don't end there. Balfour Beatty is assessing the viability of 360 vision cameras on vehicles that warn the driver when people or other vehicles come too close, to prevent accidents, and the use of augmented reality headsets to assess how to manage large pieces of plant inside constricted spaces like basement excavations. Time will tell if these exciting emerging technologies become business as usual for groundworks projects of the future.

Lock, Stockholm and one smoking BIM platform

An innovative cloud-based BIM platform is helping contractors plan and execute a massive piling operation to rebuild a lock complex in Stockholm.

The £1bn New Slussen project in Stockholm is one of the largest urban transformation projects in Europe. The existing locks, built in 1935 and now suffering from subsidence and damage, are being demolished and rebuilt to create a new civic quarter connecting the islands of Södermalm and Gamla Stan (the Old Town of Stockholm), with public areas, an accessible quayside, pedestrian and cycle routes.

The piling operation will consume around 20% of the overall construction budget and take until 2022 to complete. Some 3,600 steel piles, each unique in shape and costing around €20,000 each to produce, will be driven down 70m to reach solid bedrock on the seafloor.

The piles were modelled in the project's 3D BIM environment with attached information on the specific pile number, location coordinates, orientation and length. This data was synced to the data management platform BIMeye, where the foundation contractor, Skanska, inputs extra piling information covering 80 separate parameters, needed by the design team, and 30 parameters for its own use.

Real-time access to information

As each batch of 50 piles is drilled and installed, Skanska feeds as-built data into the software on factors such as location, depth, the number of extra steel sections that had to be welded, and technical data on ground pressure.

The structural engineer on the project, ELU Konsult, checks against the data against the original design for any anomalies, and everything is synced back to the BIM models to give other users real-time access to the information.

Digital coordination of the foundations is an early success story in the project's efforts to entirely eliminate the use of paper drawings. Johan Stribeck, BIM project manager for ELU, explains: "Having a single source of data in several locations, in BIMeye, in Revit models and in Navisworks, guarantees accuracy and removes the possibility of information gaps that can occur when information in paper drawings is sometimes not entered into spreadsheets."

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Despite builders best efforts, leaking showers are consistently listed in the BSA's top ten defects.

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Mr Fred Meddings, Managing Director
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Mr Glen Whitehead, Managing Director
BJM Developments

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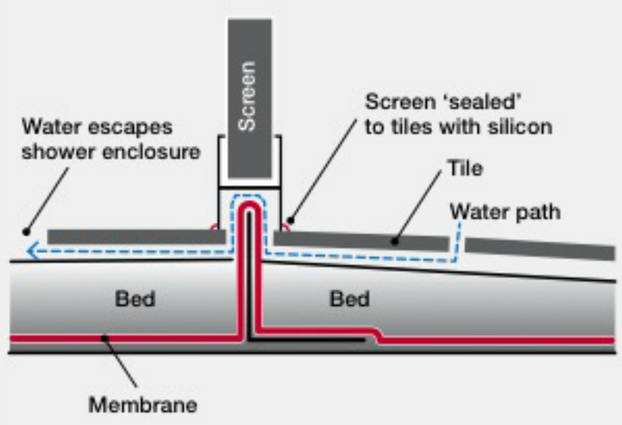

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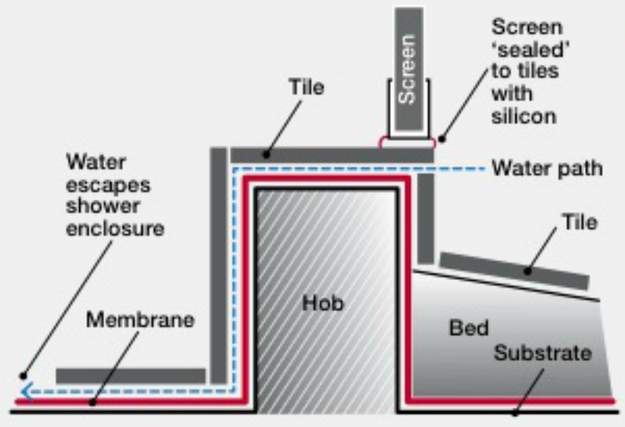

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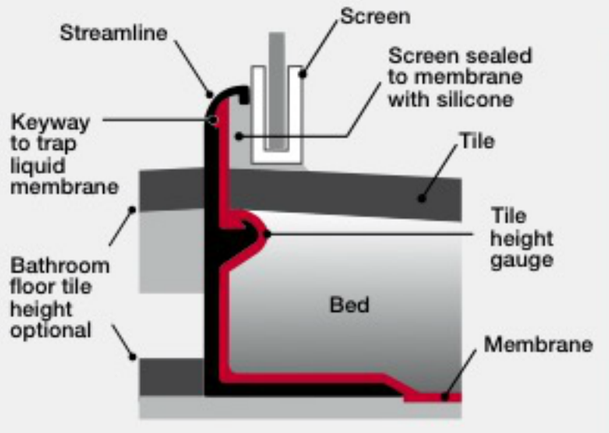

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A US start-up has invented a robot that can tie together steel reinforcement bars before a concrete pour, saving many back-breaking hours on bridge and other construction projects.

The machine, called the Tybot, uses a robotic arm rigged to a gantry crane that locates rebar junctions and attaches a tie.

Since deck bridges and other structures can have thousands of such intersections, the robot could circumvent a labour-intensive, expensive and injury-prone process – although one of its inventors joked that it was "boring".

It is the first offering of the firm Advanced Construction Robotics (ACR), launched by construction firm boss Steve Muck and robotics expert Jeremy Searock, formerly of Carnegie Mellon University's National Robotics Engineering Centre.

"What we're trying to do at ACR is methodically look at the most difficult critical path challenges, and our first product reflects that, because one of our big challenge is finding people to tie deck rebar," said Muck, who has experience of building bridges as chief executive of Pennsylvania contractor Brayman Construction, of which ACR is a spin-off.

Muck told the Pittsburg Post-Gazette that when his company, Brayman, built the Hulton Bridge in 2015 it took a crew of up to 10 workers 7,400 man hours between April and September to lay 113,000 square feet of rebar, tying just over 2 million joints.

"[Tybot] both speeds up the work and reduces the number of people to do it," Muck told the newspaper. "This is the construction industry looking to the robotics industry for a solution to a business problem."

He added that Tybot tie rebar at night or when workers are needed elsewhere.

Academic Jeremy Searock told the paper: "This is a very boring robot that has great application and profitability."

Elsewhere Searock said that although the robot requires a frame, it is still convenient to set up. "It's easy to integrate into operations. You can transport it to the project in a 40ft trailer, it takes half a shift to set up, it can deal with decks between 20ft and 145ft wide using the infrastructure already on the bridge."

Once the robot is in position it can operate autonomously with one worker supervising.

Brayman tested the Tybot on a project in Pennsylvania early last year and now plans to begin selling its product next spring.

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Geniebelt's Anastasios Koutsogiannis and Nikolaj Berntsen describe how Blockchain – the technology everyone is talking about – could impact construction.

The discussion about the potential impact of the Blockchain on the construction industry is getting more and more intense lately. It's true that it could help the industry in a number of ways if used smartly. However, there are still many steps that need to be taken before we can claim the Blockchain is a vital part of the building process.

Before we analyse further how the Blockchain could affect construction, it would be a good idea to provide some insight into what it actually is.

What is the Blockchain?

The Blockchain technology dates to 2008, as a result of the endeavour for establishing a digital currency. The cryptocurrency called Bitcoin is probably the most representative example.

The Blockchain is a new way to store and record transactions. To put it simply, we could define the Blockchain as a peer-to-peer controlled distributed transactional database.

A digital ledger where different types of agreements (eg contracts, financial transactions) are recorded and confirmed as completed.

Its main difference to traditional databases is that it lacks the need for a central authority. There is no middleman, such as a bank transferring money or a lawyer to confirm the conditions of a contract. In that sense, there is no single database or company on which it hinges.

Every node in the Blockchain is containing some type of information, which in a nutshell could be categorised to the following:

- Evidence of a bank's fiscal transaction;
- Contract;
- Ownership certificate;
- Authenticity statement.

What makes the Blockchain unique, in terms of data safety, is that every piece of information in this database is "chained" to the rest through a digital signature. This allows for a faster and more secure way of data exchange. In other words, it encourages the exclusion of intermediary parties in a transaction which takes place between two distinct members of the same peer to peer network.

What the Blockchain could mean for construction.

The Blockchain is continuously attracting more and more attention due to its incredible versatility. In some ways, it could help construction and add more transparency to every type of agreement and transaction in a construction project.

Below are some of the main reasons why the Blockchain could be, under certain circumstances, a beneficial technology for construction – and many other industries:

Smart contracts

Construction is "the land of disputes" the majority of which are inextricably connected with payments. The Blockchain technology could function as a trustworthy contract administrator by introducing an error-free process based on which the contracts would be both built and monitored.

A smart contract is nothing more than a digital protocol built within the Blockchain network in order to implement the conditions of a contract. Every node is containing all the necessary information about the contractual agreement and the conditions under which the contract will be regarded as completed.

Smart contracts can help the construction industry to get rid of intermediary parties (eg lawyers) as they function under the if/then concept. If a bricklayer is done with building the wall, then he asks for it to be inspected. If the inspection is successful then the bricklayer is paid.

Smart contracts can cover these if/then schemes. They can be registered on the Blockchain and cryptocurrency can be used in order for these contracts to be collateralised.

In a nutshell, more direct transactions can be encouraged through smart contracts. Nevertheless, the question, why the Blockchain is a necessity for a process like that to be established, remains.

Improved workflow

The Blockchain could optimise significantly the project workflow and enhance collaborative working. More analytically, it could incentivise transparency during the construction process and push project members to perform better.

Increased transparency signifies increased accountability and a better control of the project in general. A more open building process will eventually lead to a better alignment of industry and client interests while minimising disputes and risk.

If we take into consideration the way in which construction is structured today (many joint projects, shared equipment etc), we can see that the Blockchaincould allow for a faster and more data-driven decision-making process, similarly to what it's already done with the use of construction software.

On top of that, updates about the project could be delivered to everyone in real-time (eg delivery of materials on site). This would considerably decrease project delays and the need for rework (30% efficiency rate - 10% rework in construction at the moment).

The implementation of BIM technology might also be more effective thanks to the Blockchain. That's because it heavily relies on information peer-to-peer networks. Additionally, the instant updates to every single team member would encourage the creation of a "Panoptican effect" where every project agent constantly remains focused on the given tasks as a result of the continuous monitoring of progress. This element can allow for a more up-front approach in terms of decision-making and increase liability between the various parties.

Bitcoin for construction

As a continuation of the discussion about smart contracts, the Blockchain could boost collaboration and transparency

with the use of bitcoin for construction. According to Construction Manager magazine, there are already two projects, initiated by DotBuiltEnvironment, towards that direction: the ConstructCoin and the TraderTrasferTrust (project banking app).

Regarding the ConstructCoin, the project is mainly focusing on the production and proper management of data related to construction. Similarly to the bitcoin, a reward will be introduced for anyone who generated construction information. As Neil Thompson (CEO of dotBuiltEnvironment) explained at CM magazine: “A spreadsheet of construction information might include a line for data that costs £1 to produce, which the client could buy for £2 when it is completed. This approach could do a lot to incentivise collaboration”.

As far as the TraderTransferTrust app is concerned, the main idea is to put together a system that could digitally provide valid proofs of task completion and based on these proofs it will be able to trigger payments. A precise “pay as you deliver” method.

Lastly, the Construction Blockchain Consortium is a public research umbrella which explores the potential benefits that the Blockchain could have for construction. Its mission is based on three main pillars:

- knowledge transfer;
- research and development;
- education and training.

With more than 60 participants at the moment, the Construction Blockchain Consortium initiative has the potential to pull great weight. But so far it is mostly a structure to start discussing opportunities.

Is the construction industry ready for the Blockchain?

Of course, it’s not everything perfect when it comes to the Blockchain and the potential impact that it could have on construction. It’s no secret that the construction industry is very resistant to change. In that sense, the advent of the Blockchain in construction may not be as effective as we might think.

Administration gap

In terms of infrastructure and administration systems, construction does not seem fully-prepared to embrace the Blockchain. It’s simply not mature enough for implementing crypto-technology at its full potential. We are talking about the least digitised industry where 95% of the produced data is thrown out of the window, according to Klaus Nyengaard chairman of GenieBelt.

It is evident, then, that before we introduce smart contracts, for example, we have to build the right context that will accommodate them. There is a strong demand for the building process to be restructured and come closer to the needs of the supply chain. Only then, we can introduce smart contract technology as a supportive rather than a punishing measure.

For instance, one thing that the Bitcoin (or some other established crypto-currency) could do is to cut the invoice, payment path. A smart contract could be created involving data generated by real-time project management software, an inspection checklist app and drone imagery certifying that a part of a 3D drawing stands built as designed.

Currently, the exchange rates are probably too fluctuating to be interesting for this case, but in the future, they can reach to a stabilised state.

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Construction isn't digitised enough

It's not long ago when Mark Farmer's review of the UK construction was published. The title of this review was "Modernise or Die". A strong but in any case representative title regarding the present and future of construction. Lack of investment in innovation, limited collaboration, and structural fragmentation are only a few of the problems that the UK (and global) construction are battling against.

With this problematic situation in mind, it becomes evident that an extensive implementation of the Blockchain technology in construction may not be realistic before we heavily invest in digitization.

A representative example could be smart contracts. They could be an amazingly useful element for construction if we get to a point where the generation of a building's real-time digital twin is an integral part of the construction process. That could happen with the help of drone technology and real-time data connected to project and inspection management.

Every industry is different

The fact that the Blockchain has already a successful application in other industries, such as accounting and Esports, doesn't necessarily mean that the same will happen in construction. This claim can become stronger if we consider that some of the advantages (eg. real-time project updates, data-driven decision making etc.) that the Blockchain is providing can be acquired without the use of crypto-technologies.

In that aspect, maybe the Blockchain isn't necessary for construction given the way in which the industry is built. In the end of the day, maybe it's not so much about changing completely the way construction agents work but making an effort to establish an efficient two-way communication channels.

All in all, the Blockchain is undoubtedly a very interesting technology regardless of the industry you are in. When it comes to construction there are some aspects of it which could be proved to be extremely useful, such as the smart contracts and the bitcoin.

Nevertheless, we have to consider whether the construction industry is ready to embrace crypto-technologies and whether it's all that necessary for construction eventually. Only then, we can be sure that we can take the most out of it.

Anastasios Koutsogiannis, Content Marketing Manager, and Nikolaj Berntsen, CTO, of GenieBelt.

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For more information check out www.bosch-pt.com.au/professional

ADVERTORIAL

Great acoustic qualities support great learning environments

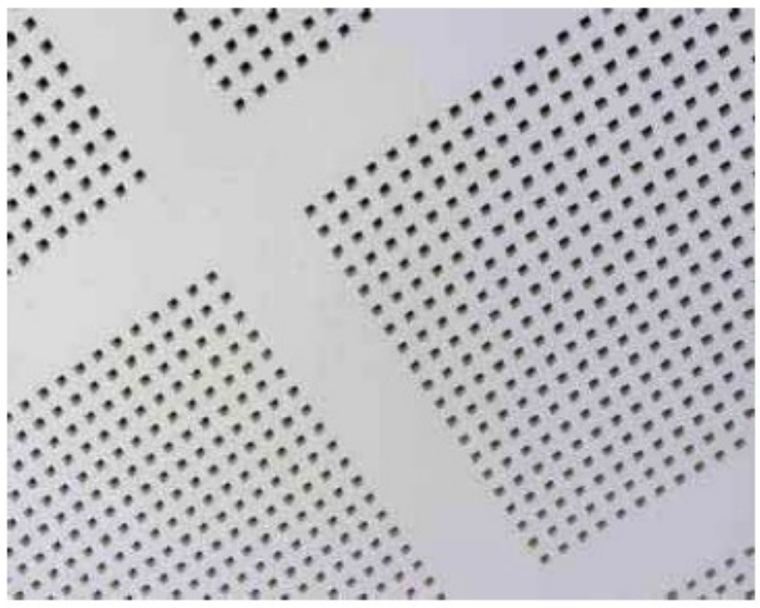
Investing in functional design for classrooms proves essential to enhancing a student's learning experience and their overall engagement. There is a demand for classrooms to become more modern and fundamentally advanced to meet the latest educational needs.

Modular Learning Spaces are becoming increasingly popular as they emphasise an open plan collaborative learning approach – designed by architects to deliver quality classrooms and meet the demand for modernisation.

With a strong focus on functional design, St Luke's Catholic College in Marsden Park, NSW, contracted MBS Modular Buildings Systems to create, manufacture and install Modular Learning Spaces throughout their new school to accommodate 180 students.

The major design requirement was to provide three high-performing learning spaces with optimal acoustic parameters. Classrooms are greatly affected by acoustic quality due to design, excessive background noise such as traffic and other factors within the building including air-conditioning, hallways and adjacent classrooms. It is important to take into consideration the effects acoustics can have on student's listening capabilities and overall learning experience.

With this in mind, the design incorporated a ceiling structure using Gyprock's Gyptone Perforated Plasterboard due to its superior sound absorption, ability to minimise echoes and noise reverberation, and visual aesthetics.



A great additional feature of Gyprock Gyptone Perforated Plasterboard is Activ'Air, a patented technology that helps to improve indoor air quality by converting formaldehyde into non-harmful inert compounds that are permanently locked in the board and cannot be released back into the air. This can reduce the concentration of formaldehyde with an environment by up to 60 per cent when installed in ceilings, even when there is continuous airflow containing formaldehyde.

The design also included soft furnishings, plush carpet with underlay and floor to ceiling pinnable acoustic fabric walls that all help to combat background noise and reverberation, enhancing the overall acoustic performance of these learning environments "We know that good acoustics support great learning along with quality air and lighting, and these are the key elements that we want to address in today's learning environments that weren't addressed in traditional learning spaces," explains Paul Meldrum, Head of Learning Innovations, Catholic Education Diocese of Parramatta.

Acoustic testing for St Luke's Catholic College demonstrated that the reverberation times for the learning spaces met the design criteria of 0.4 – 0.6 seconds, which suggests a low reverberation time – indicating that the rooms are of a high performance in controlling reverberation.

"The acoustic performance of the modular buildings are the best we have ever experienced to date, spanning across 80 schools in our education system. We will continue to use the same design concepts with other structures, ultimately creating comfortable environments for our students," says Meldrum.

For more information about Gyprock, visit the website at www.gyprock.com.au

Japan is building a magnetic levitation (maglev) railway that will get passengers from Tokyo to Nagoya faster than a jet plane, and now the public has been treated to its first glimpse of the Tokyo station slowly taking shape deep underground.

Japanese Central Railways (JR Central) invited media to view the painstaking work – which can only happen at night – going on 40m below the platforms of Tokyo's Shinagawa Station.

Construction began in February last year, but progress is slow because work is restricted to a four-and-a-half hour window between the last train of the night and the first of the morning, according to the Japan Times.

On their nocturnal visit Saturday reporters watched a 12.4m girder being installed before work begins to remove soil beneath it.

When work is complete in three years' time, the station will have four maglev platforms.

Shinagawa will be the southern terminus for Japan's first commercial maglev line, a system that in 10 years' time will begin firing trains at 500km/h over 286km between Tokyo and the southern port city of Nagoya. Journey time is expected to be about 40 minutes, an hour faster than the bullet train and 20 minutes faster than a jet plane.

The total construction cost is estimated at 5.5 trillion yen ($50bn).

The cost of the line is increased by the need to build it in as straight and level a line as possible, which means that it has to tunnel beneath the Japan's Southern Alps. In all, about 90% of its length will be below ground.

In subsequent stages, the line will be extended another 200km to Osaka.

One question raised by this is what should be done with the 20 million cubic metres of rock and soil that the excavation will produce in the first phase, a problem that Japan's Environment Ministry is still pondering.

There will be four stations on the route between Shinagawa and Nagoya.

The Shinagawa and Nagoya stations will be about 40m underground. The first station after Shinagawa will be Sagamihara in Kanagawa Prefecture, Kofu in Yamanashi Prefecture, Iida in Nagano Prefecture and Nakatsugawa in Gifu Prefecture.

ADVERTORIAL

How data can grow your building business

By KYLIE DAVIS

Most builders and contractors win new clients in two main ways – they are either recommended by word of mouth or advertise broadly through letterbox drops or local papers to generate leads.

The problem with both of these approaches is that you have no control over activity or the number of leads coming through your door. You can book more ads and hope the increased activity results in more inquiries, but there is no certainty in the results.

A different approach and a good way to reduce this uncertainty is to use 'big data' to win more business. Big data helps you understand not just what is happening about your own business, but the broader residential and construction market so you can better understand your performance.

It will help you to better understand clients, how to offer them service that delights them, and how to identify potential clients faster than your competitors. Used properly, big data allows better quality decisions to be made based on fact, not assumptions.

Here's how to use Big Data:

1. Understand what your past clients "look like"

You have a database of past clients so what is that telling you? Identify behaviours, spends, types of work and demographic of your past clients to create profiles of future clients by analysing your current database. Look for the similarities in terms of where they lived, income levels and their lifestage. Or is your best business done when you subcontract or supply to other businesses? Either way this helps you understand who to promote yourself to.

2. Identify smarter ways of targeting future clients

There's two ways to do this. You can use lead generation databases – such as Cordell Connect – that will help you identify construction projects and will outline the trades and services that are needed that may be a match for your business so you can pitch and tender for those contracts

Or you can use social media such as Facebook to target more domestic customers.

Having a client 'profile' will help you know who to target and match the behaviours and demographics to target promotions and advertising in social media. The cost of promoting and converting through tools such as Facebook can be a fraction of traditional media when you get the targeting right.

3. Target prospects who live nearby

The downside to a straight out letterbox drop is that there is a lot of wastage. But once you know the profile of your past clients, you can use databases such as RP Data Professional to search for similar prospects and who live near your past clients.

RP Data shows you more than just who lives nearby. It tells you the value of the property, the age of the property, and how long the current owners have lived there, plus much more. Tools within RP Data Professional allow you to market to many within the database.

So if you know your best source of business comes from people who have owned 1940s cottages for 20 years and are now looking to renovate them, you can zero in on exactly the right people. Or alternatively, if you know people who are about to move are a great source of business, you can reach them. The possibilities are endless.

For information about how Cordell Connect or RP Data Professional can help your business, contact: 1300 734 318 or email ask@corelogic.com.au

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Millennials need encouragement to transform construction

By ROB STUMMER, Managing Director, IFS Australia and New Zealand

In talking to construction companies about technology, they often tell us how keen they are to attract millennials and improve the technology engagement of their workforces.

That was one of the big takeaways from a recent construction industry roundtable we hosted in Sydney. Attendees told us that by finding technology champions, including millennials, they can influence technology-resistant "dinosaurs" and drive adoption of new systems.

Attracting millennials is a great idea, with new technology set to change the face of construction as we know it. Roundtable participants told us, for example, that they expect traditional "man and machine" jobs will soon start being replaced by robots and other advanced technologies.

In this changing environment, the industry needs new skills and talent. Companies stand to benefit enormously from the energy and innovation younger workers can bring. But what's the best way to attract them? And is it really the answer to construction companies' technology issues?

Five constraining factors

IFS sees five information technology (IT) related factors constraining Australian and New Zealand construction businesses in their performance and ability to innovate. Poor visibility of project performance, lack of on-site data collection, double handling of information, delayed project actuals and forecasts, and inefficient management of people, safety and compliance are all holding companies back.

Most companies could improve their competitiveness right now with modern, integrated enterprise software providing a single, centralised system to connect business, people and processes. This would address the main IT issues constraining their businesses and also set them up to adopt disruptive technologies.

Hiring more tech-savvy workers, however, is not enough in itself to drive the changes construction companies need. Some degree of digital transformation will be required, both to attract the millennials that construction companies are looking for, and to stay competitive.

Promoting new technology

Construction companies at the roundtable told us that their IT teams needed to get more creative with enabling technology to better attract and retain talent. This meant taking on board the latest in consumer technology and applying it to the business.

A few companies described how they were promoting the use of new technology. They found it relatively easy to put shiny new devices in the hands of their field staff, for example. One firm had purchased Microsoft Surface Pros to give staff access to information in real time and take photos on site.

But companies said they often struggled to drive adoption of new business systems. They found it difficult, for example, to replace the Excel spreadsheets that are used across the industry to manage people, safety and compliance. These make onboarding of staff costly and cumbersome and result in business bottlenecks that negatively affect projects.

Overcoming resistance to change

Senior employees were often resistant to more efficient enterprise systems, with the mentality, "If it works, why change it?" But spreadsheet solutions are not working. One of our Australian customers has seen average staff onboarding costs fall from nearly $1000 to under $100 with an enterprise workforce management solution, with significant improvements in staff retention rates.

Firms cannot assume that if something is good for the company, that staff will automatically embrace it. One of the companies at the roundtable was looking at smart ID tags and perimeter tracking to monitor staff time and attendance and identify new people on-site for induction. Privacy issues, however, quickly put a stop to that.

By the end of the roundtable, participants agreed that strong leadership was required to drive top-down change to adopt the modern business technology that millennials and other tech-savvy workers are looking for to make their working lives easier.

Providing a good user experience

Support for the latest mobile devices is only the start. You also need enterprise software that provides a good user experience – not just access to a bunch of Excel spreadsheets – to make everyday tasks easier. Without that, tech-savvy workers will only get frustrated and disheartened and companies will still lack the real-time data and efficiencies they need.

In the construction industry, the key to success appears to be starting with modern enterprise solutions that offer benefits to companies and their staff, and building up from there.

Another local customer, for example, has implemented an IFS enterprise solution to increase visibility and control over project costs and revenues. As a result the company has increased efficiencies in managing contracts, subcontractors, purchasing and materials, and can deliver better services to its customers.

A range of improvements – including consistent processes, a modern user interface and a single repository for all information – has streamlined many everyday tasks. Staff including quantity surveyors and site managers report significant time savings accompanied by benefits to staff morale and team dynamics.

Organisations like this have no difficulty attracting millennials to come and work for them. These younger workers thrive in an environment where a combination of enabling technology and staff empowerment leads to constant improvements in how things are done.

Generational change by itself will not transform the construction industry, but it should certainly be encouraged.

About the Author

Rob Stummer is the Managing Director, Australia and New Zealand for global enterprise applications company IFS. He has held this position for the past nine years, continually achieving significant growth annually in both revenues and EBIT. Rob holds several degrees, including a Masters from Melbourne University. See: www.ifsworld.com/au

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US chipmaker Nvidia is to team up with Komatsu, Japan's largest maker of construction machinery, to create a generation of products with embedded artificial intelligence (AI) as a step toward unmanned equipment.

ChikashiShike, president of Komatsu's smart construction promotion division, said at a recent announcement: "We predict that construction sites will be unmanned in the future."

Nvidia chief executive Jensen Huang commented: "Future machines will perceive their surroundings and be continuously alert, helping operators work more efficiently and safely."

Nvidia will supply AI chips that allow Komatsu machinery to "see" the site around them, and react automatically to developments as they take place. They will be complemented by drones equipped with similar graphics processors.

The alliance is the latest in a number of deals between technology companies as they prepare for the arrival of AI in the worlds of transport and construction.

Nvidia, which is best known for making graphics cards for computer games, has expanded into AI in recent years, with a particular emphasis on autonomous vehicles. In May 2017 it announced a deal to install its Nvidia Drive PX chip in Toyota's self-driving cars; other deals have been done with BMW, Audi and Tesla.

Meanwhile, Komatsu has long been developing its AI-enabled machinery. Back in 2015 it teamed up with Skycatch, the San Francisco-based maker of drone imaging software, to develop ways of integrating drone images into its smart machinery.

An investment firm owned by Microsoft founder Bill Gates has spent $80m on 104 sq km of land in Arizona and has announced plans to create a "Smart City".

The proposed settlement, to be called "Belmont" is 45 minutes west of Phoenix, with planned construction work including 80,000 homes, 3,800 acres for retail, industrial and office space, 3,400 acres of open space and 470 acres set aside for public schools.

At present the area has few residents or amenities, however its communications will be improved by the proposed Interstate 11, although this project is still somewhat speculative.

Real estate firm Belmont Partners commented: "Belmont will create a forward-thinking community with a communication and infrastructure spine that embraces cutting-edge technology, designed around high-speed digital networks, data centres, new manufacturing technologies and distribution models, autonomous vehicles and autonomous logistics hubs."

Despite Gates not being officially named a backer, an office for the Bill and Melinda Gates Foundation is listed as the mailing address for the investment.

No start date for the project has been announced.

Norwegian timber specialist Moelven has announced that it is building an 80m-tall mixed-use building in its home town of Brumunddal, about 100km north of Oslo.

Moelven says its building, the Mjøstårnet, will be the tallest all-timber tower in the world, arguing that a taller, hybrid tower in Vienna cannot claim the title.

The Mjøstårnet will be 30m higher than The Tree in the Norwegian city of Bergen, which presently has the title of the tallest all-timber building, and 28m higher than 5 King Street in Brisbane, which is due to become the world's tallest when complete next year, and the 73m-tall HAUT in Amsterdam (see further reading).

The Tall Wood Residence at the University of Vancouver is 53m high, but this height does include some concrete in its podium and lift cores.

Moelven dismissed any claims from the unfinished 84m HoHo-tower in Vienna, designed by RLP RüdigerLainer + Partner.

Rune Abrahamsen, a director of Moelven, said: "For a start, Hoho is not a timber building according to how the definition of this will be. It's a wood-concrete-hybrid. Secondly, the building will not be completed until a month after Mjøstårnet is completed. But the latter is a moot point if the first is correct. And there is little doubt that this will be the case."

The Mjøstårnet will be erected next to Lake Mjøsa, the country's largest. Its 18 floors will include apartments, an indoor swimming pool, a hotel, offices, a restaurant and communal areas.

Arthur Buchardt, the client for the project, said in a press statement: "Mjøstårnet sets new standards for timber constructions. The building is the closest we've come to a skyscraper in timber."

He added: "The assembly and construction of the Mjøstårnet is nothing short of world-class engineering, and will be managed without external scaffolding, despite the complexity of working at heights. We are primarily using cranes and supplementing with lifts as needed. We have reached 33m to date, meaning we have 48 to go."

Buchardt argues that the forms of wood such as cross-laminate timber will take over from concrete in the same way as electric vehicles look likely to eat into the market for petrol and diesel cars, and for the same reasons: wood reduces the carbon footprint of a building's materials by 30%.

He said: "In 15 years' time I believe it will be illegal to produce and sell cars that run on fossil fuels. Similarly, I expect that climate-friendly materials will become an international statutory standard."

Moelven is supplying timber for the project from a local spruce forests. Construction is scheduled to be completed in December 2018.

UK probes fuelling towns and cities with hydrogen

UK engineer Arup will conduct a feasibility study into replacing natural gas with hydrogen in heating UK homes to cut the country's carbon emissions.

The $32m Hydrogen for Heat Programme, commissioned by the Department for Business, Energy and Industrial Strategy (BEIS), will look at installing district heating systems based on hydrogen for villages or estates.

The company will work with hydrogen energy specialist Kiwa Gastec.

The study will look at the design of hydrogen-fuelled appliances like cookers and boilers as well as the supply of the gas.

"The UK has an opportunity to lead the way in using hydrogen as a domestic fuel," said Arup's project director Mark Neller. "This project will help establish the feasibility of converting towns and cities to it in a cost-effective way, making use of the current natural gas network."

THE UK's climate change minister Claire Perry said the study would "explore the feasibility of the transition from natural gas" and gauge "the opinions of the people who could be using this zero-carbon fuel".

Earlier this year, it was announced that Liverpool and Manchester would be host a trial that may lead to a £600m project to supply hydrogen to domestic industrial users.

Cadent, which operates about half of the UK's domestic gas distribution hopes to undertake the trial in the 2020s using hydrogen.

Industrial users would receive an all-hydrogen supply, for which they would have to replace their boilers; domestic users would receive a blend of hydrogen and natural gas, which is mostly composed of methane.

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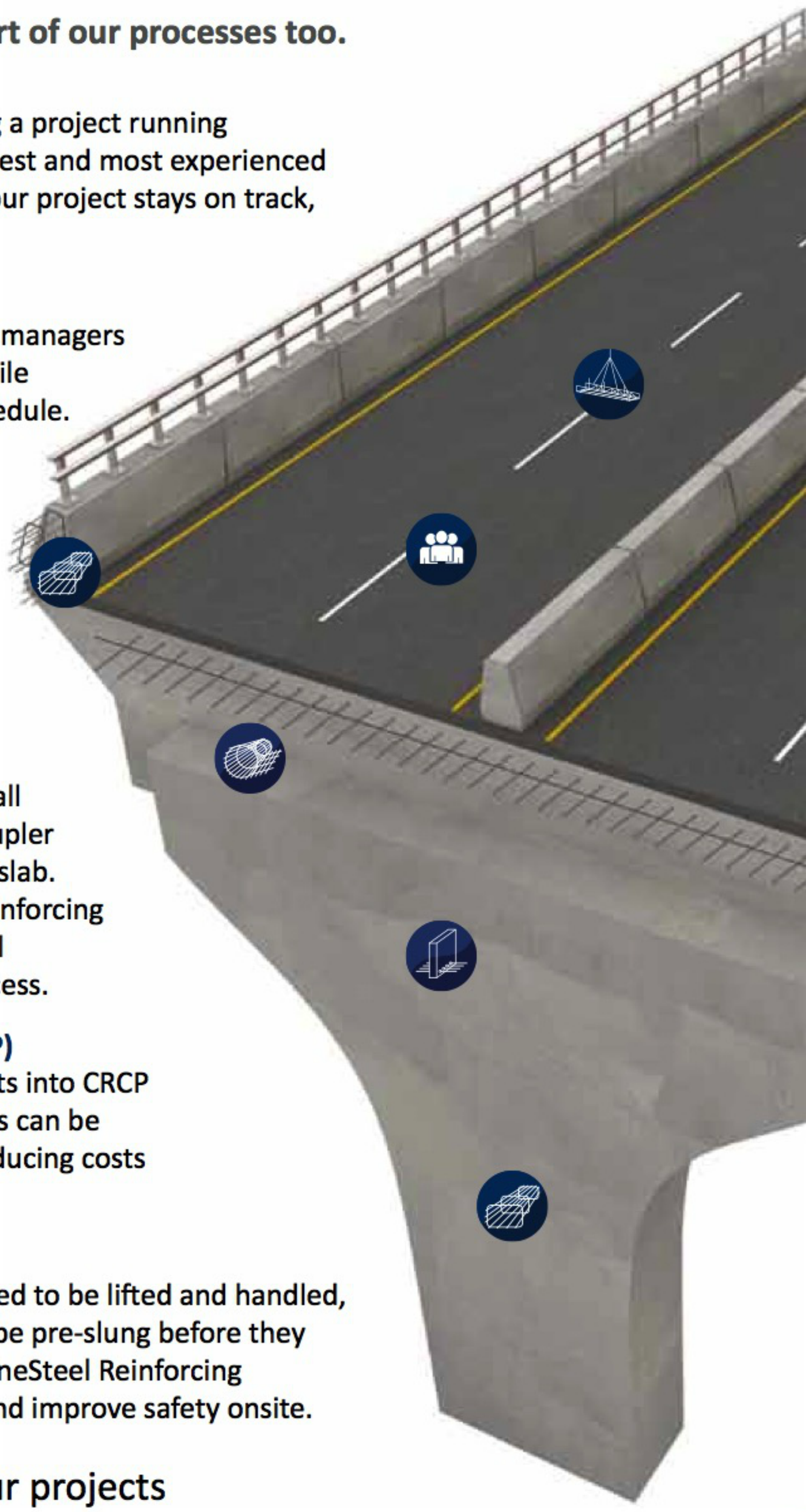
By incorporating 500PLUS® BAMTEC® rollout carpets into CRCP projects such as highway construction, critical paths can be considerably shortened along with substantially reducing costs and excess labour on site.

Logistics Management & Safety

We look at details such as how prefab elements need to be lifted and handled, have lifting points been certified, do loads have to be pre-slung before they leave the yard and, if so, how and where. Liberty OneSteel Reinforcing understand these requirements to save you time and improve safety onsite.



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