

international construction

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COMMENT

The times are changing

In the grand scheme of things humans move very fast. I don't mean fast in an Usain Bolt kind of way (although he is very fast – as well as being very cool), but in the wider sense of the word. There was a time, during the Victorian age, when they thought that everything that would ever be invented had already been invented, such was the rate of progress. Think of the changes in the last 100 years – in the ease of international travel, in medicine, in communication. They are, when you stop and think about them, breathtaking.

The world, and construction, needs to apply some of this speed to the issue of climate change and in reducing carbon emissions and increasing sustainability. To be fair to the construction industry – not a sector exactly known for being light on its feet and quick to pivot – some changes have been made. Whether it is sufficient, or if it is happening quickly enough, is another matter. In this issue we have a special feature on two trends in the industry: sustainability and modular construction.

The two topics are linked – advocates of modular construction point to it being a much 'greener' form of construction with less wastage. Turn to page 20 to have a read and see for yourself if you think the industry is acting quickly enough.

At the back of the magazine we have a fantastic feature on hydrogen power, a potential route for the industry to cut back its emissions on the road to carbon neutral. It is a great accompanying piece to our trends article. The feature looks at the development of hydrogen-powered combustion engines with great access to major OEM JCB's work in this field. It will be fascinating to see how hydrogen develops as an alternative fuel source in the future.

We've also got the equipment itself well covered, with features on the latest new models and product updates for tower cranes and the most popular piece of construction equipment in the world, excavators. The excavator feature is followed by a special two-page review of the global excavator market by Off-Highway Research which sets out sales by different regions, and expectations for the coming years.

I hope you enjoy the issue, and don't forget to check out www.international-construction.com for exclusive video interviews, features you won't see in the magazine and, of course, breaking news.

Andy Brown
Editor



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Generally, in feature articles, although figures may have originally been reported in currencies other than US dollars, *International Construction* will use the conversion rate that is correct at the time of writing and report the figure in US dollars.

Generally, within news stories, the US dollar figure will follow (in parentheses) the originally reported currency figure.



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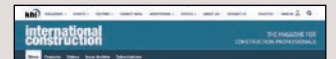
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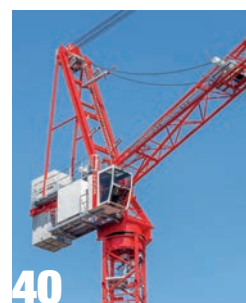
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HIGHLIGHTS

FRANCE French construction and concessions giant Vinci has released its financial results for the first half of 2021, which show a strong increase in revenue and earnings. Revenue for the whole company in the first half of 2021 totalled €22.6 billion (US\$26.8 billion), up 22.3% on an actual basis relative to the first half of 2020.

The upturn was particularly strong in France, where business levels in the previous year were badly affected by the first lockdown that began on 17 March 2020. Of Vinci's total revenue, 55% was generated inside France.

ASIA PACIFIC Global consultancy and construction company Mace has partnered with Tenman Project Management (Tpm) in Asia as the company looks to expand its business around the world. Tpm is a project management company specialising in hospitality, integrated resorts and gaming projects.

Mace recently announced its 2026 business strategy, with a target to grow its revenue by 20% year-on-year in the next five years, lower carbon emissions by 10% year-on-year and increase diversity and inclusivity.

UK Sales of construction equipment in the UK have risen by 73% in the first half of 2021, compared to the same period last year, according to the Construction Equipment Association.

Latest figures from the association's construction equipment statistics exchange, which covers sales in the UK and Northern Ireland, revealed that more than 18,000 units of equipment were sold during the period. This includes roughly 2,400 construction telehandlers, 3,400 crawler excavators and 10,500 mini/midi excavators.

BRAZIL Latin America's largest access rental company, Mills Estruturas e Serviços de Engenharia, said it will invest US\$63.2 million in up to 1,290 aerial platforms to renew and grow its fleet in 2022.

The investment follows continued growth in Mills' business following the worst of the pandemic in 2020. Revenues in the second quarter of 2021 were 75% higher than the same period in 2020. In recent months the company has seen an increase in utilisation rates – up to 57% for the second quarter of the year against 46% in the same quarter last year – as well as improved rental rates.

US

Biden's US\$550 billion infrastructure plan revealed

Deal includes investment of US\$110 billion for roads, bridges and major infrastructure projects – but bill still needs to be approved

The legislative text of US President Joe Biden's US\$550 billion infrastructure bill has been unveiled after months of negotiations.

The deal calls for investment of US\$110 billion for roads, bridges and major infrastructure projects, US\$73 billion in upgrading ageing power infrastructure, US\$65 billion in broadband infrastructure for high-speed internet and US\$66 billion for rail maintenance and modernisation.

Also included is US\$40 billion for bridge repair, replacement and rehabilitation.

The deal also contains US\$17.5 billion for major projects that would be too large or complex for traditional funding programs.

Some Republican senators joined Democrats in a 67-32 vote to proceed with the bill's drafting. Now that the legislative text has been released the bill needs to be finalised and then put to Congress, where it would require at least ten Republican votes.

President Biden said the deal was, "the most significant long-term investment in our infrastructure and competitiveness in nearly a century."



GERMANY

New 'green' vibratory plates

Wacker Neuson has launched a new series of vibratory plates that includes three electric models that offer "100% emission-free work and energy savings of over 70%".

Providing centrifugal forces ranging between 10 and 13kNW, the new APS Series comprises three models – the APS1030e, APS1135e and the APS1340e – with base widths of 30, 35 and 40cm.

The APS vibratory plates are suitable for standard soil and fresh asphalt compaction applications and feature an electric motor and rechargeable lithium-ion battery, which can be changed without tools due to its modular design.

This design also means operators can use the same battery "as a module for all other battery-powered equipment" made by Wacker, including battery-powered rammer and internal vibrator models.



GLOBAL

Construction to grow 5.7%

Despite the ongoing uncertainty over the Covid-19 pandemic, growth in global construction output will reach 5.7% in 2021, according to a report from GlobalData.

This predicted growth would be a robust figure, considering that the industry saw a 2.4% decline in 2020 and that cases of those infected with Covid-19 is still high in certain parts of the world.

Danny Richards, lead economist at GlobalData, said, "The forecast for global construction output is predicated on the assumption that governments and public health authorities will not reintroduce strict lockdown policies and that construction sites will be able to continue to operate with minimal disruption."

Many markets have managed to regain growth momentum and have already returned to pre-Covid-19 levels. Out of 65 markets that have produced data for the first quarter of 2021, 25 had recorded year-on-year (Y-o-Y) growth in that period, including China, France, Italy, India and Saudi Arabia.

From 2022 to 2025, global output growth is predicted to average 3.7% a year.

The report does acknowledge that, apart from Covid-19, the industry has a number of issues including disruptions to supply chains, high prices for construction materials and demand for some materials, such as steel, timber, cement and aggregates, higher than supply.



TURKEY US-based tunnelling equipment specialist Robbins has revealed that one of its Crossover XRE tunnel boring machines (TBM) has set multiple new world records by producing the longest daily, weekly and monthly lengths of excavated tunnel.

The Crossover XRE TBM – model number 451-379 – was deployed by contractor Kolin Construction in March 2021 to bore the new 3km Emse-Salihli Railway Tunnel in Turkey.

It forms part of Turkish State Railways' (TCDD) new 508km long Ankara to Izmir High Speed Railway project. Working on the new Esme-Salihli Railway Tunnel, the 13.7m diameter machine was able to bore tunnel lengths of 25.3m (83ft) in one day, 117m (383.8 ft) in one week, and 345.6m (1,134ft) in one month.

This broke the previous 12m (39ft) daily performance record set by another Robbins TBM in the same diameter class. The Crossover XRE TBM then went on to break its own newly-set records just a month later.

In June of 2021 the TBM achieved new daily, weekly and monthly bored tunnel lengths of 28.5m (93.5ft), 133.2m (437ft), and 455.4m (1,494ft) respectively.

GERMANY

Cat to exhibit through Zeppelin

Caterpillar has confirmed it will not exhibit as a corporate entity at Bauma in Germany next October, with its German dealer Zeppelin Baumaschinen assuming responsibility.

Previously, the two companies had a joint stand at the show, which takes place every three years. Instead, Zeppelin will display a range of Cat construction equipment, services and solutions in Munich from 24-30 October 2022.

Christophe Pelé, Caterpillar vice president with responsibility for Europe, Africa, the Middle East and Eurasia (EAME), said, "Caterpillar is focused on delivering ongoing interactions with customers by expanding its marketing engagements across Europe, Africa, the Middle East and Eurasia, using multiple channels."

The previous Bauma Germany in 2019 saw Caterpillar and Zeppelin Cat jointly taking 13,000 square metres of exhibit space.

Zeppelin Baumaschinen, the largest company in the Zeppelin Group, has been a sales and service partner for Caterpillar Germany since 1954. It had turnover of €1 billion (US\$1.16 billion) in 2020.

In addition to the sale of Cat construction machinery, it offers servicing through 35 nationwide branches, as well as advice and financing. The company is a dealer for Caterpillar in Germany, as well as in 12 other countries in Europe and Eurasia.

CANADA

Acquisition for Ritchie Bros.

Industrial equipment auctioneer Ritchie Bros. has agreed a deal to acquire Euro Auctions for UK£775 million (US\$1.07 billion).

Euro Auctions is a leading heavy machinery auctioneer that was founded in 1998 and operates in EMEA (Europe, Middle East and Africa).

The deal is expected to close in the first quarter of 2022, subject to regulatory clearances and the satisfaction of other customary closing conditions.

In a press release Ritchie Bros. said that it will be retaining Euro Auctions employees and its brand, both of which are highly regarded in the EMEA region.

"Ritchie Bros. and Euro Auctions are an ideal fit with a united goal to make asset insights, service offerings and disposition solutions easier than ever," said Ann Fandozzi, Ritchie Bros. CEO.

"This acquisition significantly accelerates our strategy to drive revenue and earnings growth and add shareholder value by continuing to expand our capabilities in new channels, sectors, regions, and customer segments."

Ritchie Bros. said that the acquisition will expand the company's overall footprint and access to equipment, while also opening up new revenue streams such as inventory management services, data solutions, financing, warranty, insurance, inspections, refurbishing and shipping.

NEW ZEALAND

New Zealand's supply chain

New Zealand has been dropped off the global supply chain by many construction material suppliers due to the Covid-19 pandemic, according to Julien Leys, chief executive of the New Zealand Building Industry Federation.

According to reports Leys said, "Before Covid the supply chain appeared to be fine, but the pandemic exposed the fact it was a lot more fragile than anybody realised. We have to find a way to manufacture things ourselves and fill those supply gaps."

Leys added that, due to Australia's infrastructure push, there was also a worry that skilled construction workers would look to leave New Zealand for their near neighbour for work.

A recent report from independent global construction and property consultancy Rider Levett Bucknall (RLB) also highlighted the challenges being faced by the country's construction market.

RLB's 2nd Quarter 2021 International Report says that, while the New Zealand construction market has navigated the Covid-19 pandemic well, labour shortages coupled with global supply chain disruptions continue to put pressure on construction costs.

Stephen Gracey, managing director of RLB New Zealand said, "... over the last few months there has been significant supply chain issues since the lockdown causing delays, uncertainty, and increased cost."

EVENTS DIARY

2021

Matexpo

8 to 12 September

Kortrijk, Belgium

www.matexpo.com

MinExpo International

13 to 15 September

Las Vegas, US

www.minexpo.com

Construction Days

13 to 16 September

Lyon, France

www.comexposium.com

BICES

14 to 17 September

Beijing, China

www.e-bices.org

Intergeo

21 to 23 September

Hanover, Germany

www.intergeo.de

The Utility Expo

28 to 30 September

Louisville, US

www.theutilityexpo.com

Intermat India

18-20 October

Mumbai, India

www.india.intermatconstruction.com

World Demolition Summit

20 to 21 October

Chicago, US

www.demolitionsummit.com

International Rental Conference

25 October

Shanghai, China

www.khl-irc.com

APEX Asia

26 to 29 October

Shanghai, China

www.apexasiashow.com

AUSTRALIA

Mass vaccinations for construction

Thousands of construction industry workers are believed to have received their first dose of a Covid vaccine at a mass vaccination event in Sydney, Australia, which was expected to attract around 8,000 people.

Health staff and volunteers at the Sydney Olympic Park and the South Western Sydney Vaccination centre delivered vaccines as part of a 'Super Sunday' drive to immunise both students and construction sector personnel.

The New South Wales (NSW) Government is aiming to facilitate the opening up of construction sites across the Greater Sydney area.

Construction sites have been unoccupied since a strict 'stay at home' order was issued following a sharp rise in the number of cases of the Delta variant of Covid-19.

The NSW Government recently announced that building sites in the region would reopen at 50% capacity with, "enhanced Covid safe measures".

NSW Treasurer, Dominic Perrotter, said, "Construction has helped maintain our strong economy throughout the Covid-19 outbreak, but many of our projects and workers are located within the eight affected local government areas.

"For the industry to remain viable, we need to restart those projects."

The Australian Constructors Association welcomed the decision to open up work sites.

CHINA

XCMG launches new 2.7 tonne mini excavator

Chinese manufacturer XCMG has launched a new Tier 4/Stage V compliant mini excavator for



GLOBAL

'Record' construction sales predicted for 2021

Off-Highway Research says construction equipment sales of US\$110 billion to occur this year

Global construction equipment sales are expected to hit a record high of 1.13 million units, with a value of almost US\$110 billion this year, according to updated forecasts from Off-Highway Research.

This figure of 1.13 million units this year would be 2% higher than the previous record of 1.11 million machines, which was achieved in 2018.

This peak in sales was not forecast before the Covid-19 pandemic – the record-high will come about due to the stimulus response to the virus by governments around the world, most significantly in China.

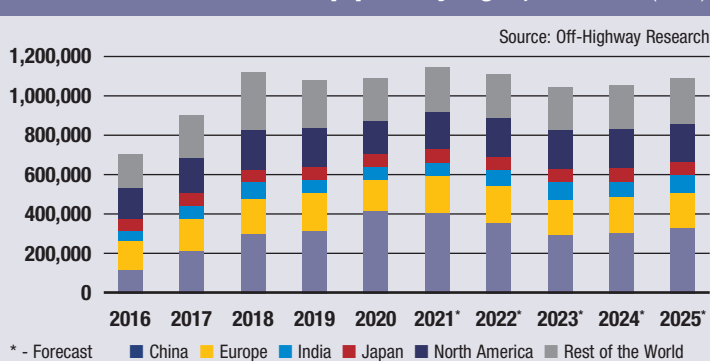
A programme of special bond issues by provincial governments in 2020 to raise funds for infrastructure spending saw the Chinese market rise 30%. Growth has slowed and a 2% decline in sales is expected for the year, but volumes will remain high.

The European market is projected to rise 15% in 2021, and the forecast for North America has been upgraded to a 13% increase.

A modest 1% rise in sales is now forecast for Japan in 2021, as opposed to the previous expectation of a downturn. The forecast for India has been downgraded from a 15% increase to 11% due to the second wave of Covid.

The outlook for the rest of the world remains unchanged, with the expectation of a 6% rise in sales this year.

Global Sales of Construction Equipment by Region, 2016-2025* (Units)



US

Strong Q2 sales for Caterpillar

Caterpillar has announced second quarter 2021 sales and revenues of US\$12.9 billion, a 29% increase compared with sales in the second quarter of 2020.

The OEM's operating profit margin was 13.9% for the second quarter of 2021, compared with 7.8% for the same period in 2020.

The company's Construction Industries' total sales were US\$5.6 billion in the second quarter of 2021, an increase of US\$1.6 billion, or 40%, compared with US\$4.0 billion in the second quarter of 2020.

Construction equipment sales increased in all regions, with Latin America up 103% compared to the same quarter of 2020 with sales of US\$430 million. Sales in North America were up 56% to US\$2.5 billion while Europe, Middle East and Africa saw a 38% rise in sales to US\$1.3 billion for the quarter.

Asia Pacific saw the smallest increase at 8% – although this is from a good level, as the region did perform comparatively strongly in the second quarter of 2020 – with sales of US\$1.3 billion.

INDIA

India to invest in infrastructure

Indian Prime Minister Narendra Modi has renewed a pledge to spend 100 trillion rupee (US\$1.3 trillion) on infrastructure at an event celebrating India's 75th Independence Day in New Delhi.

Modi said that the investment would boost the productivity of industries and the economy and create job opportunities. He added that it would make, "local manufacturers globally competitive," and "reduce the travel time for the common man and the productivity of our industry will increase."

Modi did not give details about a time frame for the plan and critics have noted that the Prime Minister has made similar pledges in the past.

India's economy contracted by 7.3% in its last fiscal year as the country suffered badly due to the Covid-19 pandemic.

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HIGHLIGHTS

SINGAPORE A Vinci and Gammon joint venture is to build the new S\$644 million (US\$471 million) extension to the existing Ang Mo Kio metro station in Singapore. Bachy Soletanche Singapore, a subsidiary of Vinci, and Gammon Construction and Engineering was awarded the contract by the city state's Land Transport Authority.

Described as, "a technological challenge in a very tight urban environment", the expansion of the metro station will join Singapore's existing North-South Line with its new Cross Island Line.

UK An ambitious project to build a road tunnel beneath the historic site of Stonehenge in the UK has been declared unlawful by a British judge. Campaigners against the project said the ruling should be seen as a "wake-up call" for the UK government, which should have considered a longer tunnel, ensuring the World Heritage Site remains undisturbed.

The judge's ruling reverses the development consent for the €2 billion (US\$2.3 billion) 3.3km twin-bore tunnel project, which would have run in sight of the famous stone circle.

AUSTRALIA A Ferrovial and Acciona joint venture company has been awarded the AU\$1.96 billion (US\$1.44 billion) tunnelling works contract for the new Metro West line in Sydney, Australia.

This contract will see the construction subsidiaries of Ferrovial and Acciona construct an 11km long twin tunnel, running from Sydney Olympic Park to The Bays station in New South Wales. The twin tunnel will form the central section of the 24km-long Metro West line, which will connect Greater Parramatta with Sydney's CBD.



GLOBAL

Top performing construction sectors revealed

Survey by Turner & Townsend reveals top three performing sectors for construction industry

The top three performing construction sectors so far in 2021 are data centres, transport, and industrial, manufacturing and distribution, according to consultant Turner & Townsend's International Construction Market Survey 2021.

The top performing sector across all participating markets is data centres, driven by the growth in technology and digitalisation. Many of the large technology giants are investing billions of dollars in new facilities.

This is the first year that data centres have made it into the top five performing sectors, moving up from sixth position in 2020.

The second highest performing sector is transport (roads, rail and ports), which was in the top position in 2020.

Globally, infrastructure investment has been a key focus for government stimulus in the recovery from the Covid-19 downturn, and this is expected to continue over 2021/22 to support economic activity.

Moving from sixth to third on the list is industrial, manufacturing and distribution, which has been driven by the rapid growth in e-commerce that has been fast-tracked by the pandemic. The retail landscape is changing rapidly, and this is driving a surge of investment into new technologies and distribution facilities to meet the changing demands of consumers.

The survey also asked what the biggest challenges are for construction. Unsurprisingly, Covid-19 was listed as number one, with many regions still seeing considerable case numbers and heavy restrictions being enforced.

INDIA Bauer Engineering India, a subsidiary of Bauer Spezialtiefbau, has begun foundation engineering and geotechnical works on the new 500MW Teesta VI Hydro Electric project in northeast India.

A Run of River Scheme, the Teesta VI Hydro Electric project will harvest the potential energy of the Teesta River's natural water flow to generate electrical power.

The project comprises the installation of a barrage, four desilting basins, two head race tunnels and an underground power house along the 300km Teesta River. The river runs from the Pahunri Glacier in the eastern Himalayas and connects with the Jamuna River in Bangladesh.

With Teesta VI currently half complete, Bauer's scope of works will include the construction of an anchored pile wall with five radial gates.

The wall will comprise around 10,000 running metres of 800mm-diameter piles and around 60,000 running metres of anchors. The work is scheduled to complete in 2024.



US

New AEM President

The Association of Equipment Manufacturers (AEM) has announced that Dennis J. Slater will retire as AEM President, effective December 31, 2021, to be replaced by Megan Tanel.

Tanel is currently the AEM's Senior Vice President, Construction & Utility Sector. She will succeed Slater and serve as AEM President effective January 1, 2022.

Slater, 63, joined AEM's predecessor, the Construction Industry Manufacturers Association (CIMA) in 1982, becoming president of CIMA in 1998 and president of the newly formed AEM in 2002.

Slater led the transformation of the association, which has grown by 50% to more than 1,000 member companies, with revenue increasing nearly 700% to US\$60 million.

Tanel, 48, joined AEM in 1995 as an intern and rose through the ranks to her most recent position. For many years Tanel led AEM's exhibitions and events initiatives and helped launch World of Asphalt in 2001 and served as Show Director for The Utility Expo and CONEXPO-CON/AGG.

CHINA

Potain targets China

Manitowoc is to push sales of its Potain range of cranes in China due to the growing demand for medium to high capacity tower cranes.

The Chinese crane market is currently seeing a surge in demand due to the government's urbanisation policy and the growing use of prefabricated buildings.

Brian Wang, Manitowoc senior vice president for the Asia-Pacific region, said, "The market for tower cranes in China is extremely favourable at the moment."

"The shift to prefabricated construction is driving demand for high performance cranes with technology that can boost productivity on jobsites."

Manitowoc achieved net sales of US\$354.3 million in the first quarter of 2021.

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HIGHLIGHTS

HEXAGON has acquired spatial mapping and visual positioning solutions company **IMMERSAL OY**. The company's technology is used to produce augmented reality (AR) applications.

The technology can save time, improve performance and reduce costs. The maps, which are used for visual positioning, are constructed from image data supported by various mapping devices.

The Coalition for Smarter Infrastructure Investments, a collection of digital infrastructure companies including **BENTLEY SYSTEMS** and **MOTT MCDONALD**, lobbied for the inclusion of US\$100 million in the new US infrastructure bill.

In its current form the bill sees an annual US\$20 million dollar investment fund for innovation in construction management over a five year period.

BUILDDOTS has received US\$30 million of investment that it will use to double the size of its global team.

Builddots uses its own AI algorithms to automatically validate images captured by hardhat-mounted 360° cameras, detecting any gaps between the original design, scheduling and the reality on the construction site.

Construction 4.0 webinar

On November 16 at 3pm (UK time), KHL's new Construction Technology brand will be hosting the webinar Defining Construction 4.0.

With a growing recognition that the digital transformation of the industry is both happening and necessary, this webinar will take a close and practical look at what the term Construction 4.0 actually means to construction businesses.

The event will feature industry experts, including speakers from Jacobs Engineering and Trackunit, who will look at how drones, artificial intelligence, virtual reality and robotics – as well as more traditional construction tools – can be brought together, through the use of data, to provide much-needed productivity and efficiency boosts.

A third speaker will be announced at a later date. Register for the event for free on the KHL website.



Digitalisation is 'biggest opportunity'

Digital transformation is the biggest short-term source of opportunity for the construction industry, according to a new global survey from construction project management software company, InEight.

More than 70% of respondents said digital transformation (defined as data analytics, artificial intelligence and machine learning) is the biggest source of opportunity in the next one to three years.

Respondents were largely positive when it came to improvements being made by the sector to deliver projects on time and on budget. Just over 60% of owners and 50% of contractors said that, in the last three years, the number of projects delivered on or ahead of schedule had increased. Similarly, 56% of owners and 51% of contractors say the same for projects on or under budget.

Encouragingly, it is a trend that respondents report as set to continue, with 83% confident of completing future

projects on or ahead of schedule, and 82% confident of doing so on or under budget. The research also revealed that when projects do go over budget, it is by an average of 20% globally.

When comparing geographical differences, there was a noticeable trend of Asia Pacific (APAC) organisations ranking highest for their interest, investment and faith in technology to effect change. For example, a higher percentage of APAC respondents rate digital transformation technologies as critical to their organisation's success in the next one to three years than those in Europe and in the Americas.

Commenting on the results of the survey, Jake Macholtz, CEO, InEight, said that it, "Points longer term to an industry continuing its digital evolution; many respondents report significant investments being made, or planned, to take advantage of the benefits digital transformation has to offer."

3D printed concrete bridge is 'first of its kind'

A 3D printed concrete bridge that holds together through compression with no reinforcements has been unveiled in Venice, Italy, applying computational design and 3D printing for minimal material use and maximum strength.

Designed by Block Research Group and Zaha Hadid Architects, in collaboration with incremental3D and Holcim, the companies say the bridge, named Striatus, is digitally and environmentally advanced.

Striatus is a complex structure made possible by a specific, custom-made ink, from Holcim's TectorPrint range, developed by its 3D concrete

printing research team. It was built using advanced technologies, from computational design to 3D concrete printing.

Shajay Bhooshan from Zaha Hadid Architects' Computation and Design research group, said, "Striatus stands on the shoulders of

giants: it revives ancestral techniques of the past, taking the structural logic of the 1600s into the future with digital computation, engineering and robotic manufacturing technologies."

Jan Jenisch, CEO of Holcim added that the bridge, "demonstrates the infinite possibilities of 3D Concrete Printing to enable more sustainable, faster and effective building structures, without compromise on aesthetics and functionality. Its digital and circular design uses concrete at its best, with minimal material use and blocks that can be repeatedly reassembled."



LiuGong's electric remote controlled wheeled loader

China-based OEM LiuGong has launched the 856E MAX Intelligent Remote Control Electric wheeled loader.

The zero emissions machine has, according to LiuGong, low energy consumption, low noise and excellent performance.

The wheeled loader uses a new lithium iron phosphate battery which can power the machine for up to eight hours. With high energy density of battery, the service life of the cell reaches 4,000 times of charging and discharging, which is said to improve operational stability.

As well as being electric powered, the wheeled loader comes equipped with an intelligent construction management platform based on IoT, intelligent shovel loader, 5G remote control and intelligent management system.

The remote control system adopts SA (Standalone Architecture) independent networking 5G

technology to minimise the network delay.

It is equipped with a global HD wide-angle camera to reduce the monitoring blind area and to intuitively estimate the distance between the loader and the surrounding objects. Dual control units are used for redundancy control, ensuring safe operation in case of unstable signal.



Robotic excavator works 24 hours

A robotic excavator has been tested in real-world construction scenarios, working continuously for more than 24 hours.

The autonomous excavator system (AES) was developed by Baidu Research Robotics, Auto-Driving Lab and the University of Maryland, who say the technology allows the machine to perform on a par with an experienced human operator, working without intervention for long periods.

The AES uses algorithms to perceive its environment, plan actions and control its movements, utilising multiple proprioceptive sensors, LiDAR and camera technology to identify and target material to be excavated.

The developers say the same technology could be used on excavators of all sizes and has the potential to increase productivity across a range of applications.



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No shortage of

Across the world countries have looked to large scale infrastructure projects to provide their economies with a boost out of the economic shadow that the Covid-19 pandemic has cast, and those in the Middle East are no exception. While some projects were given the green light before Covid, many new schemes have been approved or existing ones expanded since the pandemic began.

According to the latest RICS Global Construction Monitor, infrastructure projects are paving the way for construction's recovery. The 2021 Construction Activity Index (CAI) for the Middle East posted a reading of +8 in the second quarter compared to +3 in quarter one, its strongest reading since the second quarter of 2020.

Infrastructure leads the way with respondents reporting a focus on Information and Communication technology, energy and agribusiness as the main areas where workloads have grown. Saudi Arabia, the UAE and Qatar all have positive results, but Bahrain and Oman have slipped into negative territory while Kuwait has remained flat.

Analytics company Global Data agrees with the assessment regarding the importance of infrastructure.

The company states that many governments in the region are looking to step up investment to both support recovery from Covid-19 disruption and as part of ambitious strategic plans to promote the private sector, improve connectivity and enhance competitiveness.

Danny Richards, economist at GlobalData, commented that, "Despite Saudi Arabia's relatively weak fiscal position, the government is committed to major transport projects to stimulate the economy: not least with ongoing investment to improve transport links under metro systems and rapid transport projects."

Construction in the Middle East faces real challenges but there is a strong pipeline – helped by one-off global events such as the football World Cup and the World Expo – and reason for optimism, writes **Andy Brown**

Burj Khalifa in Dubai is the tallest tower in the world – failed contractor Arabtec was involved in its construction



Construction disputes

The average value of construction disputes increased by 76% during 2020, a year that was dominated by Covid-19, according to a report from Arcadis – with the Middle East being the region of the world with the most disputes. The region also had the most disputes in 2019.

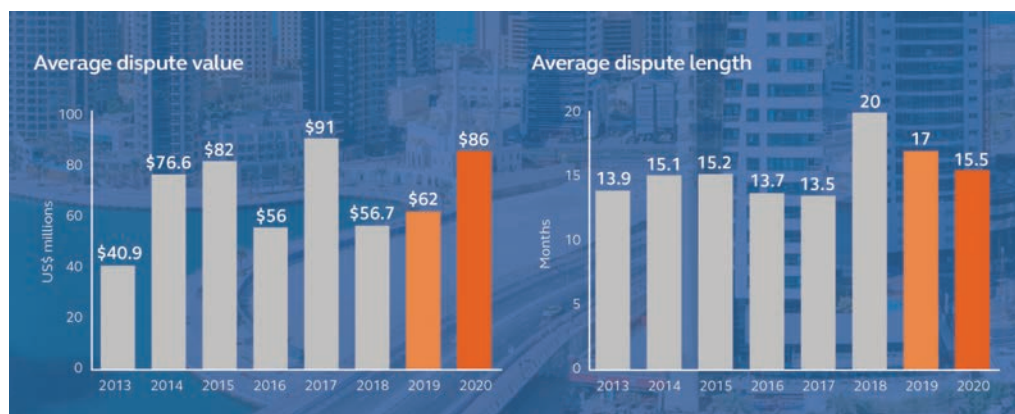
The average value of construction disputes in the Middle East was US\$86 million in 2020, a 38% increase from the previous year, and the number of reported disputes increased. The report revealed that the average value of construction disputes in 2020 – globally – was US\$54.3 million, up from US\$30.7 million in 2019, but that the average length of disputes continued to decline.

Over 60% of survey respondents said their projects were impacted due to Covid-19. The top cause of disputes globally was owners, contractors, or subcontractors failing to understand or comply with their contractual obligations. This was the number three cause in 2019.

Regarding the Middle East, the report did highlight that a major factor that led to an increase in the number of disputes was the collapse of Arabtec, one of the region's largest contractors – Arabtec helped build the world's tallest skyscraper, Dubai's Burj Khalifa, among other major projects in the region.

In October 2020 shareholders voted to pursue liquidation following a loss of AED794 million (US\$213 million) in the first half of 2020. At the time of the liquidation Arabtec Construction had a portfolio of approximately 20 projects under construction worth a combined US\$5.2 billion.

(Below)
Middle East,
average dispute
value and average
dispute length
CREDIT: ARCADIS



Like the rest of the world, construction in Dubai is suffering due to materials shortages



ambition

Riyadh, Saudi Arabia – Covid-19 has disrupted supply chains and led to a shortage of workers



Arabtec, whose shareholders included Abu Dhabi state fund Mubadala, submitted a bankruptcy petition to Dubai Court in March 2021, following the company's former group CEO Wail Farsakh's resignation in February 2021.

The biggest worry for those in the Middle East and Africa (MEA), according to the RICS survey, was financial constraints – a lack of access to financing – with 85% citing this.

Shortages of labour, skills and materials appear less of an issue across MEA relative to the rest of the world. That said, respondents in Saudi Arabia and Qatar both blamed the Covid-19 pandemic for a shortage of both skilled and non-skilled workers.

Covid-19 issues for Saudi Arabia

A recent report from independent global construction and property consultancy Rider Levett Bucknall (RLB) highlights the problems being experienced in Saudi Arabia. The report says that Covid-19 has severely impacted the country's supply chains and limited mobility of labour.



The International Report says that, "Saudi Arabia has a long history of importing goods to be used in the construction of projects. Two of the largest importers have been Italy and China, both at the epicentre of the recent pandemic."

"In addition, the closure of borders has prevented the movement of materials and more worrying is the potential closure of businesses due to Covid-19. Curfew restrictions remain in place, limiting the mobility of the labour force and plant and materials. Construction projects are still ongoing, but evidently at a significantly slower pace."

The report also adds that the Saudi Arabian economy is reliant on oil exports – the significant downturn in oil prices and global demand in 2020, as a result of the pandemic and the OPEC nation's oil price dispute, has impacted the country's finances. As a result, the Saudi Arabian Government is reviewing the 2020 budget for all state funded construction projects, with a view to possibly reducing its construction output.

INTERVIEW:

UrbaCon Trading and Contracting

Moutaz Al-Khayyat

Chairman of UrbaCon Trading and Contracting



UCC was founded as a second-generation company in 1983 and has delivered some of the most high profile projects in Qatar, such as the Mall of Qatar and the Duhail Interchange Expressway project. UCC was recently ranked the number one construction contractor in Qatar by the value of projects under execution. The company's established divisions are: infrastructure and heavy construction, marine works, buildings, and oil and gas.

How would you assess the state of the construction industry in Qatar?

Naturally, the coronavirus pandemic has provided a significant challenge, arriving just as Qatar was experiencing a construction boom in anticipation of the 2022 FIFA World Cup. The pandemic inevitably caused a temporary slowing of some projects while we implemented heightened safety measures to protect our workers, as well as due to delays in certain supplies and a reduced workforce.

However, the Qatari construction sector is extremely resilient. Fortunately, the Qatari government greenlighted many of our projects, such as Elegancia Healthcare's first multi-specialty hospital in Doha. Construction is buoyant and the future is bright. In 2019, just prior to the pandemic, the sector was valued at around US\$43.95 billion. We are confident the economy will rally quickly and significantly, enough for the sector to reach previous estimates of US\$71.65 billion by 2025.

What are the big construction trends in Qatar at the moment?

The most significant construction trends in Qatar are around developing the nation's transport infrastructure, creating a range of world-class sporting venues, and pushing forward with modern residential and hospitality projects to cater for the expected increase in population.

There has been significant investment in the expansion of the country's road and rail network and large-scale infrastructure projects are underway that will deliver not only a fantastic 2022 FIFA World Cup experience, but also long term economic and social benefits for Qatar. Our government has also committed to improving national health and education services, alongside the tourism sector, which of course creates exciting new opportunities where UCC can have a positive impact.

Sustainability is certainly a priority for UCC and for Qatar more widely, forming a core element of the State of Qatar's 2030 Vision.

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Middle East's longest tunnel

Excavation work completed on 1.8km tunnel

Excauation work on the longest tunnel in the Middle East has been completed, according to contractor China Civil Engineering Construction Corporation (CCECC).

The 1.8km long tunnel from Dubai to Fujairah in the Hajar Mountains – the longest tunnel in the Middle East – is part of the Etihad Rail Project.

It is being built in three stages, the first of which became operational in 2016. The second stage is being completed in packages labelled A, B, C, and D.

The packages were integrated as part of a contract to both the CCECC and SK Engineering and Construction, a South Korean company, both of which oversee the design and build of the project.

More than 600km of railway was laid across all four packages of phase two of the project.

CCECC completed the work for Section D of the second stage of the project using blasts to excavate its path, although softer explosions were used due to the terrain. The project was completed in partnership with the Abu Dhabi contractor, National Projects and Construction.

First awarded to CCECC in December 2019 as part of a US\$1.2 billion contract, the Etihad Rail Project is a 145km transport route that links Sharjah, Fujairah, and Dubai. It includes the construction of 15 tunnels through the Hajar Mountains totalling 16km, 35 bridges, and 32 underpasses.

Once the rail tunnel is fully operational, Etihad Rail trains aim to carry up to 30 million tonnes of construction material per year to distribution centres in Abu Dhabi and Dubai. This will reportedly cut transport costs and reduce truck trips by more than 2,000 journeys a day.



Akbar Al Baker, Chairman of Qatar Tourism and Chief Executive and Chairman of Qatar Airways, commented that,

“We are continuing to expand our tourism offer to ensure guests enjoy the best of Qatari hospitality while being able to choose a hotel, resort or serviced apartment that accommodates to their budget and needs.

“These upcoming properties are part of our strategy to diversify our offering and broaden our appeal to visitors. We are pleased to expand our global tourism offer in line with Qatar National Vision 2030.”

Banyan Tree Doha, a five-star luxury property, recently opened while hotel openings on the horizon include the

Pullman Doha West Bay, a five-star Accor property, the JW Marriott West Bay and the Steigenberger Hotel.

It has been estimated that the World Cup will provide a boost to Qatar's economy of approximately US\$20 billion – around 10% of the country's Gross Domestic Product.

The construction industry in the Middle East region is suffering from the same problems as most of the rest of the world: a shortage of skilled workers and materials and higher than average costs.

It is also suffering from the decline in the price and demand for oil, and the pandemic has hit those countries a harder where structures and organisations aren't as developed. However, the region is still investing heavily into infrastructure and one-off events, such as the football World Cup and Dubai Expo, provide additional boosts to construction.

ic

Football fever

Following the successful staging of the Olympic games in Tokyo, Japan, the eyes of the sporting world will be turning to Qatar, which will be hosting the 2022 Football World Cup. Of the eight stadiums to be used, three are reported to still be under construction. One of the most interesting is Ras Abu Aboud stadium – the first built in World Cup history that is designed to be torn down.

The stadium is constructed out of 974 shipping containers, and all the containers are made from recycled steel.

After the tournament is over, many parts of the arena – including all the removable seats, containers and the roof – will be dismantled and repurposed for use in other sporting or non-sporting events, either inside or outside of Qatar.

Construction started in late 2017 and is scheduled for completion by the end of this year, according to the event organisers.

Although stadiums are a very physical – and visual – example of construction related to the FIFA World Cup, they are actually a small part of the government's infrastructure spending for the event, which also includes a metro system, airport expansion, the construction of a new suburb and a large scale plan to build over 100 hotels.

The Qatar Government announced that it will add 105 new hotels and apartment hotels as it gears up to host the FIFA World Cup from November next year.

Ras Abu Aboud stadium in Qatar is being built for the World Cup – then it will be taken apart



Postponed expo to go ahead

Dubai to host World Expo from October

Dubai is getting ready to host the World Expo, a year after it was originally supposed to be held.

Before the Covid-19 pandemic forced the event to be postponed, organisers had expected 25 million visits during the course of the six-month international fair. It will now run from 1 October to 31 March 2022.

When the event takes place it will be the first World Expo to be held in the Middle East, Africa and South Asia region. The event will keep the its original name of 'Expo 2020 Dubai'.

Held every five years, World Expos see hundreds of countries using pavilions to show off the latest in architecture and technology.



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LIEBHERR

Celebrating the beauty and utility of concrete

Paul Adeleke, communications and policy director, GCCA, on the beauty of concrete

As the most used material on earth after water, concrete is all around us. It features so widely because of its many sustainability and performance benefits – providing the roads, pavements, motorways, offices, homes, bridges, dams, and windfarms that keep modern society moving. It plays a crucial part in the global recovery, providing resilient, durable and sustainable infrastructure.

The Global Cement and Concrete Association (GCCA) was founded to show the world the many benefits of concrete as well as highlight and enhance its sustainability, working with policymakers and stakeholders at the international level. However, a big part of our job is also to raise awareness and engagement with our material more widely with communities around the globe.

The Concrete in Life competition is one of the GCCA's public initiatives to shine a spotlight on the material by encouraging people around the world to take photos that highlight the beauty and utility of concrete in our lives.

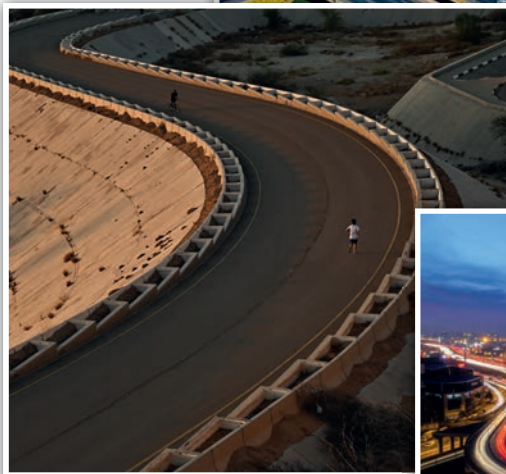
The competition, with a top prize of US\$10,000, asks people to upload their photos of concrete on Instagram or Twitter.

2021 Competition

This year's competition is now open for entry to anyone with a smart phone or digital camera. There are four categories:

- **#UrbanConcrete** – city landscapes and buildings around us, both well-known and hidden away.
- **#ConcreteInfrastructure** – our infrastructure, in our cities and rural, above and below ground.
- **#ConcreteInDailyLife** – the human side of concrete and how it's used and interacted with daily.
- **#SustainableConcrete** – how concrete is used in sustainable construction and infrastructure, for example wind farms, dams, green overpasses, wildlife crossings and green buildings. This category is new to the 2021 competition.

As each category has amateur and professional brackets, the competition has eight categories in total



Each category has amateur and professional brackets, meaning eight prizes in total. The overall winner is selected from the winning category photos. Category winners each receive US\$2,500 and the overall winner receives US\$10,000.

The deadline to enter is the 22 October 2021, and winners will be announced in January 2022.

Last year saw over 10,000 entries to our competition. It was fantastic to see so many people from every corner of the world enter, despite the difficulties we have all faced. We had so many photos that showcased the beauty of concrete – from canals and waterways, to dams, playparks, skyscrapers and cityscapes.

We would love to see even more people enter this year. There is so much to celebrate about our material.

To enter the Concrete in Life 2021 photography competition, you should upload your photograph to Instagram or Twitter and use the hashtag **#ConcreteInLife2021**, and the hashtag of the category you want to enter, either: **#UrbanConcrete**, **#ConcreteInfrastructure**, **#ConcreteInDailyLife** or **#SustainableConcrete**. You can also email your entry to **concreteinlife@gccassociation.org**. It is free to enter.

We will determine whether you are an amateur or professional photographer from your bio – but you can also let us know in your entry caption. **ic**

About the GCCA



The Global Cement and Concrete Association is an international industry association that was established in 2018. Its members – which include some of the largest cement and concrete producers around the world – all commit to improving sustainability throughout their operations, and producing carbon neutral concrete by 2050, in line with global climate targets.

While efforts are underway to make the construction industry more sustainable, data from the Global Alliance of Buildings and Construction's Global Status Report shows just how far we still have to go.

Just two years ago, the Global ABC's Building Climate Tracker unveiled a stark reality – emissions from the buildings and construction industry hit an all-time high. More than 38% of global carbon emissions come from building and construction operations. On top of that, construction uses about 32% of the world's natural resources.

"Construction has an undeniable and vital role to play in limiting global warming," says Nathan Swankie, UK County Director, Environment & Health, Ramboll. "There is great talent in our industry, and we must harness it to address this global challenge. We must focus on skills and innovation and be bold in our pursuit of the needed transformational change."

Actionable steps

At the most basic level, carbon and climate issues must be understood by everyone within an organisation – not just specialists. One way to start the conversation is through education and training.

Jacobs Engineering is one company doing just that. The US-based firm recently announced that it is offering its entire workforce the opportunity to take the Climate Solutions Accelerator course, a 90-minute online program that focuses on need-to-know information while outlining key solutions to respond to climate change.

The course helps to explain how everyone and every organisation can play a role to reduce emissions and informs businesses and organisations on how they can plan better and predict future trends and legislation.

"Effectively responding to the threat of climate change requires all of us to work together – businesses, governments and communities around the world," said Jacobs Chair and CEO Steve Demetriou.

"Our shareholders are becoming increasingly focused on Environmental, Social and Governance (ESG) transparency. Our clients are talking to us every day about how to decarbonise their businesses and move towards meeting national industry targets."

By ensuring there is a baseline level of carbon and climate literacy across the industry, sustainability can become a part of everyday conversations, thus bolstering green practices and initiatives.

Ramboll is also using training to bring awareness to its team members and clients. The company upskills its people through understanding the climate emergency at hand, and Ramboll has also taken on technical training by discipline to ensure climate considerations are embedded into all design and advisory outputs.

Construction is undergoing a transformative shift to adapt more environmentally friendly practices. **Lindsey Anderson** investigates what construction companies can do to ensure they become both greener and cleaner

Constructing

"The industry needs to upskill at speed and close the green skills gap; we must ensure a baseline level of carbon and climate literacy across the industry as well as enabling advanced pioneers," says Swankie.

"We must also be bold in empowering and mobilising sustainability pioneers, giving funding, creating new emerging roles and supporting the challenge to the status quo."

From plans to execution

Victoria Burrows, Director, Advancing Net Zero, World Green Building Council, agrees. "Improving sustainability in construction starts in the design phase long before the first shovel hits the ground," she says. "However, construction companies play a significant role in translating those designs into reality."

Sustainable construction is evolving at a fast, almost break-neck pace. It requires companies to ensure they stay up to date with the latest sustainable practices, materials and technologies. By finding ways to reduce waste, avoiding damage and curbing rework, projects become leaner and more efficient.

Integrated project delivery and lean construction practices encourage efficient processes and outcomes, and also help meet sustainability goals. Construction companies can improve sustainability by developing and implementing policies and documentation practices that explicitly state why, how, when, what and by whom things will be done.

By planning sustainable practices across entire processes – from the construction phase of the project, use phase and end of life phase – 'green' methods become normalised and seamless.



Nathan Swankie,
UK County
Director,
Environment &
Health, Ramboll

More than 38% of global carbon emissions come from building and construction operations

Increasing emission incentives and zero-emission targets have had a marked effect on the increase in greener equipment and jobsites



Swedish green steel venture Hybrit has made the world's first customer delivery of steel produced without using coal

PHOTO CREDIT: REUTERS

the future

"That is why integrated design and involvement of construction companies in the early stages of the project, including their advice on buildability, material selection and construction methods and techniques, is extremely valuable," says Burrows.

For construction to reduce its emissions then all sectors have to work together, but there is no doubt that the OEMs are a vital cog in the wheel. Finnish company Metso Outotec provides technology and services for mining, aggregates, recycling and metal refining industries. The manufacturer says it is relentlessly searching for ways to increase efficiency and reduce waste.

"The crushing and screening segment is constantly looking to be more environmentally efficient and to increase our sustainability in terms of looking to reuse materials wherever possible, which can be seen by the ever-increasing recycling segment," says Adrian Wood, VP, distribution, EMEA at Metso Outotec.

"I believe it is our responsibility as a manufacturer not only to make equipment greener by being more efficient and using energy wiser, but also looking at different processes to limit the use of natural resources."

Metso Outotec's main goal is to reduce waste, find new ways to use waste that has accumulated and reuse what is available today. The company is also looking at limiting transport – making direct point to point deliveries rather than to storage centres.

Ramboll's Swankie says the industry's biggest sustainability 'trend' is designing new, efficient machines that reduce the amount of waste.

He adds that they are now seeing sustainable approaches moving from being an 'add-on' to being the central point of a project.

"With mounting public consciousness, a fast-evolving regulatory landscape, and heightened expectations from financial institutions, we have certainly seen a surge in requests from clients for more substantial sustainability support."

Clients increasingly want to stand out from the crowd by distinguishing themselves through their sustainability approaches. "As more businesses plan for a net zero, climate resilient future, it is encouraging to see the level of

understanding improving and the demand for sound reasoning and clear evidence of sustainable approaches increasing," he notes.

Long-term effects

When thinking about building – and structural lifespans – the construction phase is relatively short. However, the construction sector can have an enormous influence on how buildings are made, where materials are sourced from, and how to reduce emissions and environmental impacts of the construction phase.

Construction also plays a critical role in maximising the quality and positive impact of the finished structure, ensuring the completed building will go on to operate as efficiently as possible.

Buildings are constructed one at a time, but they join an enormous ecosystem with potential to generate and share energy with nearby buildings and respond to the needs of users and the external environment.

Burrows, from the World Green Building Council, points out the scope for buildings to operate as power generation stations, and integrate with other systems like transport.

"Buildings must be flexible and adaptable to future-proof conditions, needs and priorities," she explains. "It must be an easier choice to build a building responsibly – or to renovate an existing building and extend its useful life – than to continue unsustainable levels of resource consumption and emissions."

"The planet's limited resources forces us to reconsider our approach to development, to ensure that by meeting the needs of today we are not causing irreversible damage for the future."

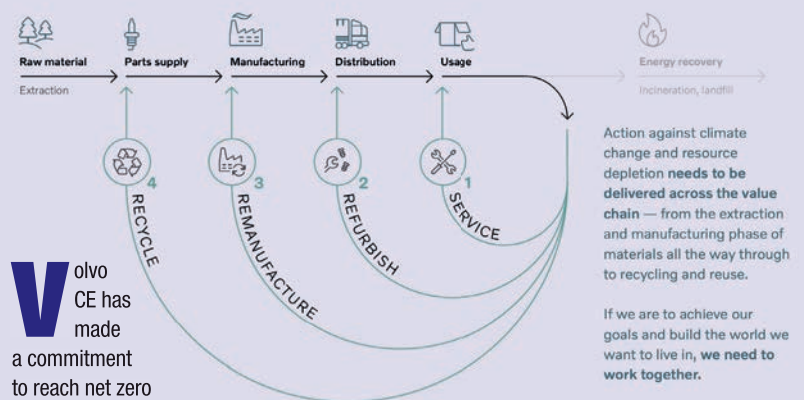
One way to address this is to look at buildings as material banks – with materials being hosted or leased by a building for future re-use. Burrows explains that planning ahead for disassembly seeks to achieve reversible building design with cradle-to-cradle thinking that extends the useful life of



Jacobs has a plan to reduce its carbon footprint

Volvo CE's path to sustainability

Major OEM sets out how construction can become more sustainable



Volvo CE has made a commitment to reach net zero value chain greenhouse

gas emissions by 2040. The OEM says that developing battery electric vehicles and fuel cell electric technology will go a long way to delivering on that ambition, but there is more to do.

The company has set out four key strategies: get everyone on the carbon reduction pathway, take action across the supply chain with a circular approach, leverage the power of partnerships and use data to deliver on sustainability goals.

"Climate change is real and one of the greatest challenges of our time. As a world leading manufacturer, we not only have a responsibility to reduce our carbon footprint, we also have the clear vision, determination and talents to drive this transformation that is so urgently needed now," said Melker Jernberg, President of Volvo CE.

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TRENDS: SUSTAINABILITY

Sustainability strategy

A case study example of a construction company that integrated sustainability into their business is global contractor Multiplex's One Decade to Act vision. Multiplex started the program with cultural and behavioral change, performed data collection for their performance and established baselines, analysing the data to set science-based targets.

This extensive plan requires the engagement of all stakeholders including clients, the entire supply chain and consultants. And there's also a large target to hit: net zero carbon building operations and zero transport emissions by 2030.

“Our industry needs to innovate and innovate fast,” says Swankie. “It will take courage and commitment from businesses to innovate, and by clients to try and accept innovative approaches in a safe way. It will take diversity of thought, a willingness to change and think differently, and commitment to prioritise sustainability in business strategy, operations and procurement.”

"Awareness of these issues is helping to mitigate the problem, but action will help overcome them," Burrows concludes. "Whilst in the past years we have seen positive change in the way buildings are designed, constructed and operated; resulting in spectacular examples of high performance new and renovated buildings providing enhanced quality of life, there is still a huge amount to be done."

Metso says reducing its waste is a key priority



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Construction's building blocks

The construction industry has, to some extent, moved with the times in terms of new technology, health and safety rules and new equipment but could it be doing more to exploit modern industrial techniques, such as modular construction?

While there are many more moving parts on a construction site than, for example, a car factory assembly line it is also true that a car assembly plant in 2021 looks nothing like it did a hundred years ago, back in 1921, whereas construction sites haven't changed nearly as much.

According to the Modular Building Institute, modular construction can be defined as a process in which a building is constructed off-site, under controlled plant conditions, using the same materials and designed to the same codes and standards as conventionally built facilities – but in about half the time. Buildings are produced in modules that, when put together on site, reflect the design intent and specifications of the most sophisticated site-built facility.

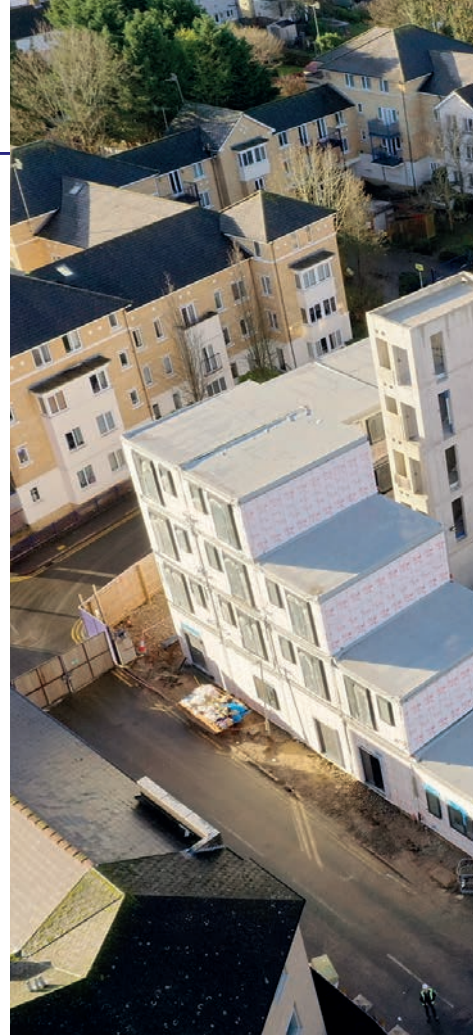
Popularity growing

Modular construction isn't anything new – builders in the US began selling 'kit homes' in the early 1900s and European governments turned to offsite construction after World War II to address housing shortages.

Willem Otter, managing director of BAM Specials, which incorporates various business units, including modular building specialist HSL, says that BAM has been producing modular housing concepts for 25 years. However, he does acknowledge that modular construction is becoming more popular.

"A large part of these concepts is based on modular elements which are produced off site. This applies to both new build and renovation projects," says Otter. "Modular production has become more important, because regulations, requirements and ambitions are becoming ever higher in order to reduce carbon

Modular construction offers many advantages, such as lower costs, increased sustainability and quicker build times. While challenges remain, **Andy Brown** asks if the construction industry is really ready to embrace modular construction?



Certain sectors, such as schools, are more suited to modular construction than others

emissions, particulate matter and nuisance for local residents. To realise these ambitions, BAM has invested to make its production processes increasingly modular. The affordability of housing is also increasingly urgent."

One of the biggest advantages of modular construction is that, because it occurs off site, it can be done under controlled conditions, offering advantages in terms of health and safety and working conditions. It also can have a serious impact on the bottom line for contractors – it can save substantial sums of money.

David Harris, managing director, Premier Modular, agrees that sector is developing quickly, saying, "Modular construction is definitely a growing trend. Demand for our modular solutions is rapidly rising year-on-year and there are a number of drivers."

When it comes to the issue specifically of cost he says, "There is little difference in the cost of off site compared to in-situ construction. However, modular solutions have financial benefits by ensuring earlier occupation for a faster return on investment, earlier revenue generation and greater certainty of delivery on budget."

While modular construction can save costs, it is not necessarily as straightforward as that. The price of raw materials and staff





Transport and crane hire are extra costs associated with modular construction



David Harris,
managing director,
Premier Modular

can reduce the number of employees required on a construction site by up to 70% and cut overall building costs by 20-40%. Furthermore, by 2030, productivity benefits could save the US and Europe US\$22 billion annually.”

Harris from Premier Modular agrees. “The shortage of skilled labour is now even more severe following Brexit and the Covid-19 pandemic, which means more clients and contractors need to turn to offsite solutions to achieve greater certainty of delivery on time and on budget,” he comments.

As well as addressing a shortage of skilled workers (modular construction not only helps by needing fewer staff, but they can be based in one place – avoiding a contractor looking for workers in a remote location) modular can also help improve health and safety. Again, because all work is taking place in one location it can be more of a controlled environment.

The lack of skilled workers is a global trend in lots of industries, but modular construction can help with an even bigger trend: sustainability. Governments around the world have committed to reducing their carbon emissions and building and construction is a key component in whether these targets are met or not.

Modular construction helps to cut down on waste – because everything is made to order, materials waste is minimal. Increasing numbers of those involved in modular construction ➤

will be the same as building on site, but there is the added cost of transportation of the materials when finished, and crane installation.

Gary Buick, director at Pick Everard, a consultancy practice working within the property, infrastructure and construction industry, comments that, “To achieve overall cost benefits, use of standardised modules in volume is required, which will realise improved production rates and buying enhancement on raw materials.”

As is the case with all industrial processes, the more standardised and larger in scale, the higher the cost savings. Otter from BAM agrees, and brings us back to the comparison made at the start of this article, that of the car industry.

“Modular production results in a reduction in cost price. However, the major reduction in the cost price of housing lies in the challenge of whether the construction industry is able to organise the production process with variations and individualisation in the same way as the car industry,” he says.

“When modular factories can robotically produce ‘smart parts’ through standardisation in connections and solutions, the cost of housing can be substantially reduced through scale and elimination of preparation costs.”



Gary Buick,
director at Pick
Everard

Modular construction and mega trends

The shortage of skilled workers is an issue that has dogged construction for years and the use of new technology – such as automated equipment – is viewed as one way of getting around the problem, as is modular construction.

Paul Terry, Managing Director of Roofspace Solutions, says that, “According to the Royal Institute of British Architects, MMC such as modular construction or panellised solutions,

Modular housing

Housing project in Germany makes use of modular housing

Real estate company hanova WOHNEN GmbH has set up a rental housing project in the form of KODAs, a type of modular and moveable house from the company Kodasema, in the heart of Hannover, Germany.

“This is a remarkable example of international private-municipal collaboration whilst addressing the pressing issue of housing shortage in an innovative and sustainable way. We believe this will lead to many even larger scale KODA Community housing projects across European cities,” said Birgit Linnamäe, CEO of Kodasema.

Kodasema was founded in 2013 and the company says that the turnaround is very quick – approximately one year from project initiation to tenants moving in.

Shifting from onsite construction to off-site prefabrication is increasing in certain markets; in Scandinavia 45% of all housing is being built using off-site manufacturing in some capacity, and the permanent modular construction market share of new North American real-estate construction projects grew by 50% from 2015 to 2018. However, says Linnamäe, the future growth of the sector requires government and businesses working in tandem.

“The development of the sector depends on the private and public sector working together. This needs to happen to ensure sufficient housing is provided quickly where people need it most. But also to ensure that, with the development of new areas using modular housing, services such as schools, healthcare, childcare are developed, and redensification does not put a strain on the services available to the existing community,” she says.

“As the housing crisis worldwide has become a significant problem, the only solution to quickly address this issue, is to mobilise factory construction and quick installation of affordable homes.”



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KELLI ROOSIMÄGI

TRENDS: MODULAR CONSTRUCTION

are incorporating recycled materials into the process. Harris from Premier Modular states that, “The drive to net zero presents enormous opportunities for offsite. Modular solutions are a simpler route to achieving low or zero carbon construction and manufacturers need to be leading the way in this area.”

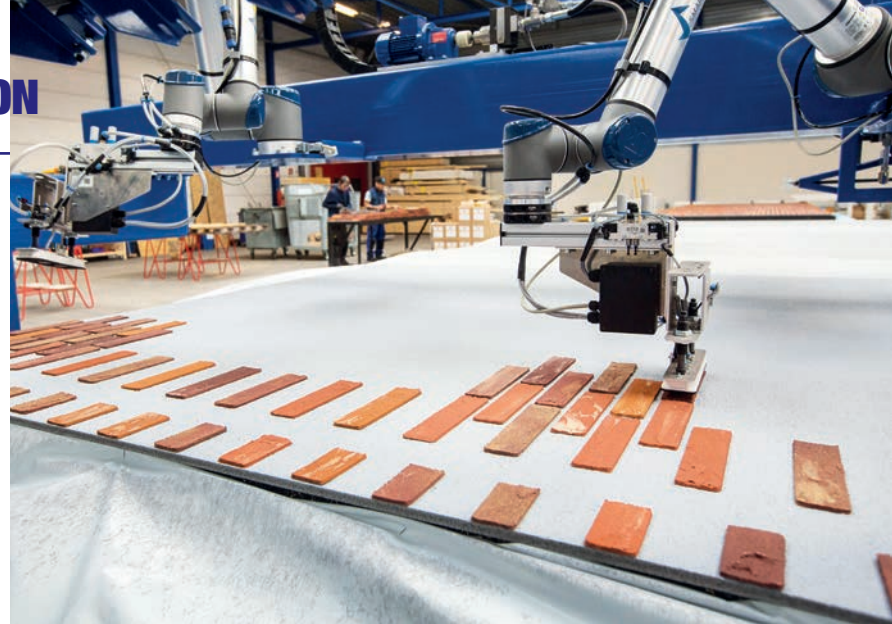
Put simply, less energy and time is required to produce a building away from a site, which makes it more sustainable.

What does the future hold?

There are still challenges with modular construction. It has to be done on a certain scale and size to be profitable and therefore needs substantial investment, there is reduced flexibility as everything is the same size and it can be difficult and expensive to transport the finished products to the site.

It is also worth noting that it is more suited to certain types of projects than others. As Gary Buick, director at Pick Everard, says, “The growth trend in modular construction is sector sensitive, with certain sectors like healthcare, housing and education set to see increased adoption of modular and other modern methods of construction.

“There has been a particular emphasis on offsite manufacturing for residential housing, which is best evidenced with the



The use of robots is increasing in modular construction production

investment from Legal & General's modular housing factory – the largest advanced manufacturing facility for modular homes in Europe. At its peak, this facility will produce around 3,500 new homes per year.”

However, despite challenges, proponents of modular construction point to its green credentials, the potential for financial savings, increased speed of production and it not needing as many workers as easily outweighing the negatives.

The global pandemic has touched all areas of life, including that of the construction of buildings. With working from home looking likely – to some extent – to be a trend that is here to stay, will the same number of office blocks be needed in the future?

Will the same transport links to get people from their homes into city centres be required?

“Looking forward, buildings will need to be more flexible and adaptable to change, presenting tremendous opportunities for modular construction. There are huge lessons to be learned from Covid-19, which highlighted the need to make facilities more interchangeable and futureproof,” says Harris from PremierModular.

“Offices can become hospital wards or buildings may need to be relocated to different sites to meet changing local

needs. This means assets will be considered differently whilst still needing to meet the same standards for build quality and comfort. We believe more buildings will be leased to reduce capital expenditure and, after the leasing period, modular facilities can easily be removed, relocated, reconfigured or refurbished.”

Sustainable construction

Modular building certainly offers a degree of flexibility that conventional construction can't. With governments around the world likely to put increasing pressure on the construction industry in their country to reduce emissions, the usage of modular construction is surely only going to increase. There are simply too many reasons in its favour, as Terry from Roofspace Solutions outlines.

“Looking ahead, factors such as worldwide construction labour shortages, high housing demand, supply chain restrictions, and regulations will likely enable these methods to thrive,” he comments.

“Building technology will increase the labour demand of construction per unit, and more complexity in design will rely more on off-site approaches to ensure quality.”

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CoreHaus' first modular plant

Modular housing company says demand is growing quickly

UK modular housing manufacturer CoreHaus has opened its first manufacturing facility and begun full production of its steel-framed modular homes. One of the newest modular housebuilders in the country, the company is a joint venture made up of Carlton & Co Group and public procurement specialist Fusion21.

Corehaus said its new 1,850m² facility will use modern methods of construction (MMC) to more quickly build houses that offer lower energy bills.

Scott Bibby, CoreHaus managing director, said, “Our light gauge steel-frame system ensures that CoreHaus can be used in both urban and rural locations with elevation treatments tailored to suit each setting, providing almost unlimited design potential. The standardised modular core means the solution can be configured for homes of almost any size.”





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The Doosan DX140W-7
(Inset) The Doosan DX160W-7

Industry roundup

Excatators are – by some distance – the most popular equipment type on the planet. Here, *International Construction* takes a look at some of the new products on the market, shines a light on product updates and new technology, and asks where excavators might develop in the future.

Caterpillar's next gen excavator

With new features, the compact radius Caterpillar 335 Next Gen excavator typifies the ongoing industry drive to introduce new technology into the sector. Randall Crow, global product application specialist, small and medium excavators, Caterpillar, outlines some of the company's leading-edge technological features built into the new generation of its machines.

"Next Gen excavators boast improved machine performance, increased efficiencies and lower owning and operating costs than previous models," comments Crow.

"Offering more power and performance, the Next Gen excavator features multiple standard on-board Cat technologies to boost operating efficiencies by up to 45% as well as focusing on lowering owning and operating costs by up to 25%. These cost reductions can be seen through less fuel consumption and extended life of specific fluids and filters."

According to Cat the new 36.2 tonne 335 delivers the tightest tail swing radius in the industry for enhanced manoeuvrability, making it suitable for

With global sales of excavators over six tonnes in the region of 400,000 units with a retail value US\$55 billion this year, **Ian Cameron** shines a spotlight on the most recent new launches and product updates

working on space-restricted jobsites, such as road projects with lane closures, and excavating next to buildings.

It is powered by a 204 kW Cat C7.1 engine with a no-maintenance aftertreatment system. There are three selectable operating modes – Power, Smart and Eco – with one-touch low idle helping to reduce fuel consumption by up to 10%.

The new 335 features increased stick and bucket cylinder sizes to provide 15% greater digging forces to go through hard ground and asphalt. Hydraulic power is increased by 20% to boost productivity although Cat said that fuel consumption remains similar to the previous model.

The 335 also features optimised weight and dimensions to meet the most common transportation limits. For example, the track gauge is wider to improve side stability, but total machine weight is under 80,000 lb. (36.2 tonnes), with or without a blade. Maximum digging depth is 6.99m; maximum reach at ground level is 10.6m and maximum loading height is 7.96m.

"Three available engine operating modes are available to match performance to the job, resulting in significant fuel savings potential. Smart mode automatically matches engine and hydraulic power to working conditions to improve efficiency, while ECO mode minimises fuel consumption on less demanding applications," says Crow.

"Available for the Next Gen excavator, Power mode constantly provides maximum power and productivity for the most demanding projects. The excavators' responsive hydraulic system balances the need for power and efficiency to deliver precise digging."

New models from Doosan Infracore Europe

With a standard operating weight of 16.57 tonnes, Doosan Infracore Europe has launched the new DX140W-7 and ➤



According to Cat the new 36.2 tonnes 335 delivers the tightest tail swing radius in the industry

EXCAVATORS

DX160W-7 Stage 5-compliant wheeled excavators.

The company said the Doosan-powered models offer a number of new features including enhanced fuel efficiency, uptime and return on investment. According to Doosan, the new models provide, “significantly higher performance in every area” than the previous generation Stage 4 machines with a focus on increased power, robustness and agility.

At the heart of the excavators is the new Stage 5 latest generation Doosan DL06 diesel engine, providing 102kW (137HP) at 2000 r/min. According to the company, the DL06 engine offers a new solution to exceed Stage V regulations without exhaust gas recirculation (EGR), which boosts the quantity of air available during combustion, increasing the temperature of the process and greatly reducing the amount of particulates produced.

This is combined with a Diesel Oxidation Catalyst/Diesel Particulate Filter (DPF) and Selective Catalytic Reduction after-treatment technology to ensure minimal emissions. Due to the new technology, maintenance of the DPF has been reduced, with none required until the machine has operated for 8,000 hours.

Offered as standard is the new Auto Digging Brake feature, which automatically holds the service brake in position when the vehicle stops (speed is zero), without the driver having to step on the brake pedal.

The driver can activate or deactivate this by pressing the Auto Digging Brake button on the control panel. When the accelerator pedal is then pressed, the Auto Digging Brake function is released.

Joystick Steering is a new option, enabling the driver to control the machine by using the joystick thumbwheel when working and driving in work mode. The Joystick Steering system only works under 20 km/h when first or second speed gears are engaged.

There is a new Tiltrotator Mode on the control panel in the DX140W-7 and DX160W-7, which can be selected to ensure an optimised hydraulic flow and helps to maximise the accuracy of



The conventional tail swing 60C-2 from JCB

tiltrotator work by eliminating back pressure. This new tiltrotator mode is a special two-way flow mode, but it is managed by the EPOS (Electronic Power Optimising System) like a one-way flow mode, with direct return to the tank in each direction, to avoid back pressure and increase flow and controllability.

The DX140W-7 incorporates a heavier 2.5 tonne counterweight as standard, for both monoboom and articulated boom configurations. It is equipped with a 2.5 tonne counterweight as standard, but can be fitted with an optional three tonne counterweight. This contributes to the higher lifting and digging capacities in both models, compared to the previous generation models. With the optional 20% heavier counterweight, the excavator is particularly suited for working with heavier attachments such as tiltrotators.

Both models have a maximum digging depth of 5025mm, maximum digging reach of 8050mm and maximum digging height of 9150mm.

JCB's stage 5 models

At the lower end of the weight range for new excavators come models from JCB. The company has upgraded its four to six-tonne compact excavator line-up with the launch of three Series 2, Stage 5 models. The zero-tail swing 50Z-2 replaces both the previous 48Z-1 and 51R-1 models, the 56Z-2 takes over from the 55Z-1 and the conventional tail swing 60C-2 replaces the 57C-1.

The new machines are powered by a 1.7L, turbocharged three-cylinder, common-rail Perkins diesel engine, delivering 34 kW (45.6hp).

Equipped with a Diesel Oxidation Catalyst and a Diesel Particulate Filter there is no requirement for a Diesel Exhaust Fluid (DEF) such as AdBlue, said JCB.

The engine now comes with programmable auto stop, programmable auto idle and one-touch idle functions.

Inside the cab, JCB said the layout has been improved, now including the portrait seven inch colour screen seen on the larger 8-10 tonne range.

Operators can programme auxiliary hydraulic flows, in both low and high-flow settings, for up to ten attachments, reducing downtime when swapping between work tools. An integrated rear-view camera can also be routed through the main screen, removing the need for a secondary monitor in the cab.

The excavators have 500-hour service intervals, reducing downtime, while the dozer hydraulic hoses now come in a

First Zaxis-7 medium in Denmark

Contractor in Denmark gets country's first ZX250LC-7

The first Hitachi Zaxis-7 medium excavator in Denmark – a ZX250LC-7 – has been delivered to contractor Hans Ikkær Entreprenørforretning ApS.

Hans Ikkær Entreprenørforretning, based in Hornslyd, carries out a range of projects, primarily in Jutland and its main activities are construction and sewer renovations. It was supplied by local Hitachi dealer H.P. Entreprenørmaskiner. One of the first assignments for the ZX250LC-7 excavator was preparatory work for a construction project in the town of Middelfart.

The new Zaxis-7 excavators are equipped with the Hitachi TRIAS III hydraulic system which is built around a three-pump system. It controls the hydraulic oil flow, allowing operators to excavate quickly and precisely, said Hitachi.

The hydraulic levers are built into the seat, and inside the cab many improvements have been made to the working environment, such as better visibility and reduced noise levels, the company added. The machine features a water-cooled four-cylinder Isuzu 4HK1X engine.

The first Hitachi Zaxis-7 medium excavator in Denmark





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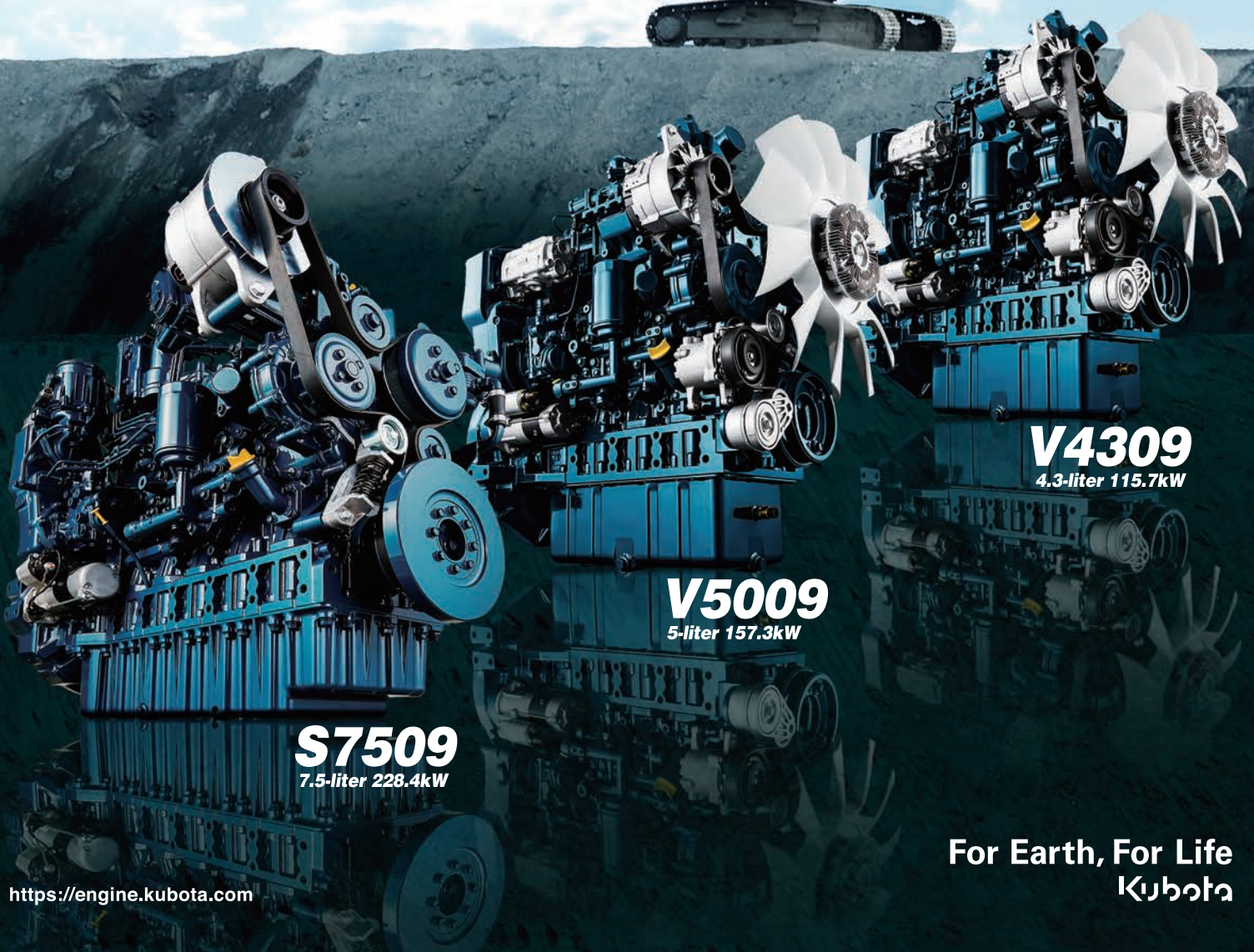
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The XCMG crawler excavator XE155ECR

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XCMG's new crawler

China's XCMG has launched its crawler excavator XE155ECR as part of its new generation of Stage V construction equipment, with an emphasis on offering environmentally friendly equipment.

As the first generation of XCMG short tail mid-excavators, the XE155ECR has an operating weight of 16.6 tonnes providing a maximum digging depth of 5.5m and a maximum digging radius of 8.3m.

Power comes from a Cummins stage V compliant engine equipped with a Diesel Particulate Filter and an associated regeneration system which, the company said, provides less emissions and is more environmentally friendly.

XCMG said the auto-idle function reduces the engine speed when the controls are inactive for a preselected amount of time or when the safety lever is switched off. The engine will immediately return to its original selected speed when the operator touches the controls.

In operation, the machines feature XICS (XCMG Intelligent Control System) – providing a synchronised communication link between the engine's ECU (Electronic Control Unit) and the hydraulic system.

The CAN (Controller Area Network) system enables a constant flow of information between engine and hydraulic system, so that power is delivered exactly as needed.

The non-linear power control technology is introduced into the main pump so that it can reduce the light-load output flow and increase heavy-load system power. Light load energy increases by 4% and heavy load efficiency by 3%.

Two new 50 tonners from Volvo CE

Volvo Construction Equipment (Volvo CE) has launched two new machines that are also a new size class for the company, the EC530E and EC550E. According to Volvo CE they offer a 25% boost in fuel efficiency and a range of advanced features to also deliver a 20% boost in productivity.

The company claims that the excavators feature the highest engine power in the class, providing high tractive force and swing torque. When coupled with large buckets, the EC530E and EC550E are said to be well suited to filling articulated haulers in the 30-40-ton class – requiring fewer passes to load them, thereby reducing cycle times.



Volvo CE's EC550E is said to be very fuel efficient

Liebherr's latest crawler excavator



A super-rigid reinforced undercarriage is supported by equally sturdy lower and upper frames. The EC550E undercarriage has a long and wide lower frame, giving it extra stability when working with heavier loads. The undercarriage on the EC530 shares the same transportation dimensions as Volvo's 48-ton EC480E.

A low emission Volvo D13J engine may be the heart of the EC530E and EC550E, but combined fuel efficiency – of up to 25% – is enabled thanks to these machines' use of the latest electro hydraulics system. It achieves this due to Independent Metering Valve Technology (IMVT) which, due to intelligent electronic control, offers both more precise operation and efficiency than a traditional mechanically coupled hydraulic system.

Further efficiency is gained from engine pump optimisation, which lowers engine speed while maintaining power, and improved hydraulic pipework layout.

The new system offers a range of smart functions, including Creep Mode (useful for precise lift-and-carry work) and optional Comfort Drive Control, which helps to reduce operator fatigue by allowing the excavator to be steered using the joystick rollers, instead of the pedals.

Operators can select several functions depending on the task at hand and their preferences. This includes boom/swing and boom/travel priority, which enables one function to take the lead over another. The boom-down speed can also be adjusted, giving optimum control for tasks that require extra precision.

Komatsu's smallest machine control excavator

The newest entrant to Komatsu's iMC 2.0 line-up is the 123kW PC210LCi-11 excavator. The PC210LCi-11 is Komatsu's smallest machine control excavator. Weighing 23.3 to 24.4 tonnes it is able to dig precise footings, retention ponds and utility work, said Komatsu.

Intended to help close the skill gap between new and experienced operators, and improve the bottom line for contractors, Komatsu's intelligent Machine Control (iMC) is part of the company's suite of Smart Construction products, services and digital solutions, which incorporates proprietary machine technology, according to the company.

Operators can finish grading quickly and accurately with bucket angle hold control that automatically holds the bucket angle to the design surface during arm operation, enabling operators to finish grading using only arm input.

EXCAVATORS

Liebherr's new Generation 8 crawler

The R 928 G8 crawler excavator is a completely new model, developed and produced by Liebherr-France SAS in Colmar. The new model, positioned between the R 926 G8 and the R 930 G8 complements the current Generation 8 series, which already includes seven models with a gross vehicle weight of 22 to 45 tonnes. The modularity of the new Generation 8 facilitated the launch of this new model as its design is based on existing, high-performance components. This new, weight-optimised combination should reduce the transport problems of many customers.

The R 928 G8 crawler excavator rounds off the current range of Generation 8 crawler excavators. It is characterised by high drawbar pull, excellent load-bearing capacity and a large bucket.

Liebherr Generation 8 crawler excavators are the result of constant research and improvement. This new generation has been reworked with the aim of creating optimal ergonomics and performance as well as increased comfort and safety.

Generation 8 develops higher tear and breakout forces compared to the previous generation. The torque of the superstructure has also been increased. This means that the new crawler excavators achieve higher levels of performance under site conditions.

In addition, a new equipment concept enables the load curve to be optimised and the inertia in the rotary drive to be improved, reducing fuel consumption. The new X-form undercarriages ensure greater stability and automatic central lubrication ensures



Three new Wacker Neuson machines

a longer service life of parts and improves productivity.

Tracked excavators from Wacker

A recent addition to the Wacker Neuson portfolio are the new tracked excavators in the four or five metric ton class, ET42 and EZ50 – the Z stands for Zero Tail – and ET58. With these excavators, Wacker Neuson said it has expanded its product offering, which ranges from 800-kilogram to 15-metric ton excavators, to include three machines that it said are suitable for a wide variety of applications.

One of these is the hydraulic system 'Load Sensing Flow Sharing' which, the company said, ensures "precise control and high performance efficiency". The machine adjusts automatically to the load and the joystick movement remains constant for the operator at all times.

This makes working with the excavator comfortable, the company added. Four additional control circuits allow the use of a variety of attachments.

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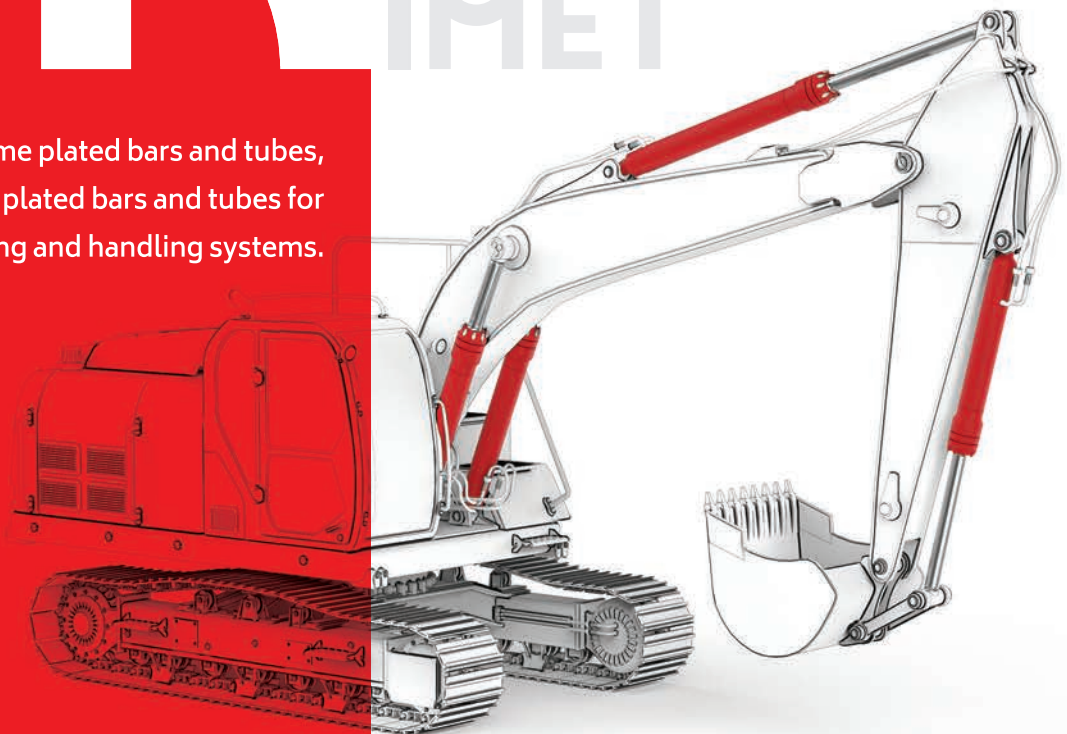


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The excavator attraction

Global sales of crawler and wheeled excavators over six tonnes will be in the region of 400,000 units this year, with a retail value approaching US\$55 billion. The vast majority of those machines – over 95% – will be crawler excavators. The wheeled excavator is something of a niche machine, with pockets of popularity in certain European countries and South Korea, among other territories.

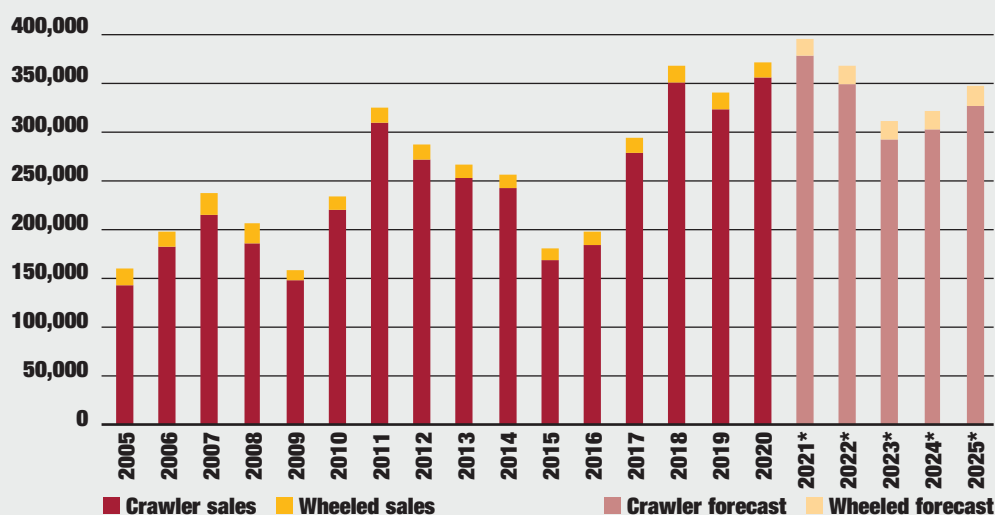
The key reason for the spike this year and last is the huge sales surge in China. Enormous bond issues by provincial governments have taken place since April 2020 as the main tool to combat the economic impact of the Covid-19 pandemic. Among the sectors to benefit from this funding are transport infrastructure, urban utilities and affordable housing.

The stimulus effort is still in progress and is likely to exceed the US\$585 billion that the Chinese government spent in the wake of the global financial crisis. Accordingly, equipment sales in China, including excavators, will likely hit a new high in 2021 – although, at the time of writing, there are strong signs of the excavator market cooling.

A record number of excavators will be sold around the world this year. While the market will fall from this cyclical high in the coming years, there is no doubting the popularity of these machines, writes the team at **Off-Highway Research**

Global excavator sales, units

Source: Off-Highway Research, * are forecast sales



Rest of the world

While the Chinese excavator market slows down, it is picking up elsewhere. A combination of factors have contributed to this, including stimulus spending plans such as the Recovery Plan for Europe and the various measures in the US supporting the economy through the pandemic, as well as the proposed Infrastructure Investment and Jobs Act.

In addition to specific measures to aid the economic recovery from the pandemic, there are other factors stimulating demand for excavators, particularly in the residential building segment.

In many parts of the world this section of the industry is benefitting from low interest rates and the shift towards home working for many so called white collar workers, who are moving to new properties or expanding their homes to add office space. This is all helpful to demand for excavator sizes used in small to medium scale construction, as well as mini excavators – machines under six tonnes.

Although the growth in excavator sales in other parts of the world will cushion the falling Chinese market in 2022 and beyond, overall global sales will fall. This is purely a reflection of the sheer size of the Chinese market at the moment: some 205,000 excavators will be sold there this year. This equates to more than half of the entire global demand.

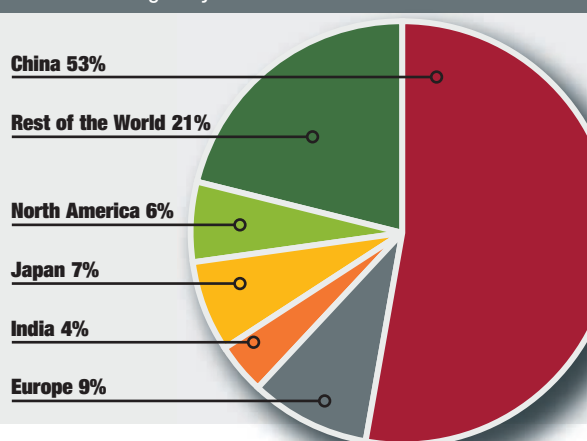
As the chart illustrates, excavator sales should remain above 300,000 units per year over the medium term, a figure that had only been achieved three times prior to 2020 and the Covid-19 pandemic.

This underlines the broad appeal of excavators across different markets applications and operating environments.

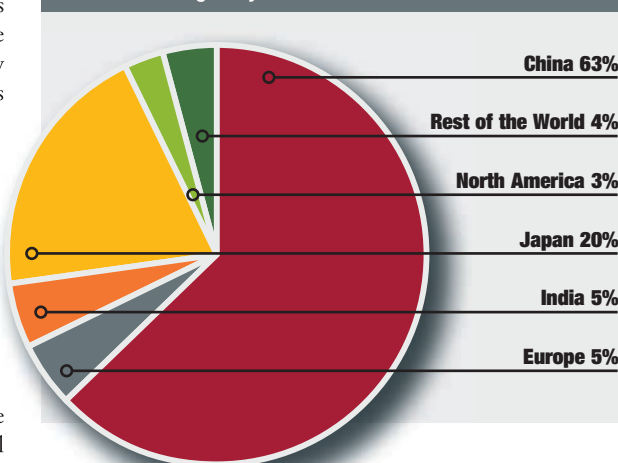
As previously mentioned, most of the excavators sold around the world are crawler machines, favoured for their off-road capabilities. However, in several key markets including France, Germany and South Korea, wheeled excavators are popular in various sizes up to about 20 tonnes (the practical limit for this type of equipment).

In the applications where these machines are used, off-road capabilities are not the highest priority. More important is on-road mobility for moving around large sites or moving between sites on public roads. Needless to say, wheeled excavators only

Sales of excavators by region, 2020 (Unit terms)
Source: Off-Highway Research



Production of excavators, 2020 (Unit terms)
Source: Off-Highway Research



flourish in countries where there is not only a tradition of using them, but where regulations allow them to be driven on public roads.

Excavator producers

The majority of excavators sold around the world today are manufactured in Asia. Japan is arguably the spiritual home of the hydraulic excavator, but in 2017 it was overtaken by China, which became by far the world's largest producer of these machines.

Although in the region of 85% of the excavators manufactured in China are sold in the country, the remainder represent useful export business, with most of these machines destined for other emerging markets.

Japan may have lost its position as the world's largest excavator manufacturer, but its foreign trade balance is, and always has been, much more favourable. The country regularly exports 70% of the excavators it manufactures.

The other major excavator producing countries include India and the US (both mostly for domestic sales) and South Korea.

There are pockets of excavator production around Southeast Asia, predominantly Indonesia and Thailand, serving the local markets. The other main region is Europe and the companies that

manufacture excavators in this area are now predominantly native to the region following a spate of factory closures which began in the 2010s.

Supply issues

Demand for all types of construction equipment is such that the industry is facing delays and long lead times. These problems extend far beyond the equipment world. For example, as has been widely reported, the automotive industry is facing the same challenges.

Several factors continue to contribute to the supply-side problems. In 2020, as the pandemic struck, many industries moved to convert inventory to cash to see them through what lay ahead. Supply chains for machines, components and raw materials were empty when the unexpectedly strong demand for equipment arrived and this was a barrier to lifting production to the levels which were required.

In addition, although the world is emerging from the pandemic, many industries remain below capacity due to illness and self-isolation among workers and social distancing requirements in the workplace.

These constraints and limitations also apply to the global logistics industry, with reduced shipping capacity (and high shipping costs) being a barrier to getting components to construction equipment factories and then finished machines to dealers and on to customers.

For these reasons, many excavator producers report that their order books stretch well into 2022. This also implies that, as high as excavator sales will be this year, they could have been higher still if the supply chain and shipping constraints had not been a factor.

IC

About Off-Highway Research

Off-Highway Research is the world's leading provider of market intelligence and forecasts for the global construction equipment industry. With offices in the UK, China, India, the US and Japan, it offers unrivalled market insights, helping its clients to set

their global strategies, and plan and invest for profitable growth.

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Talking tower cranes

Not only do they play a key role constructing the high-rise buildings that decorate horizons around the globe, tower cranes are also the backbone of many construction sites. With an impressive lifting capacity and compact footprint, these heavy-duty machines are tasked with building upwards, and tackling heavy lifting at sky-high levels.

As the world continues to adapt to both short and long-term effects of a global pandemic, urban construction projects are beginning to see a return. And with that, tower cranes are once again in demand as fleet utilisation begins to revive in most areas.

Boasting the largest tower crane market in the world, China has potential to thrive when it comes to a market recovery if conditions evolve and stay favourable.

Shanghai Pangyuan Machinery Rental Co. is the largest rental company in China and has maintained a top spot in the *International Cranes & Specialized Transport* IC Tower Crane Index for years. With a finger on the pulse of the Chinese market, the company is competing with the issue of a surplus in unused machinery as projects return.

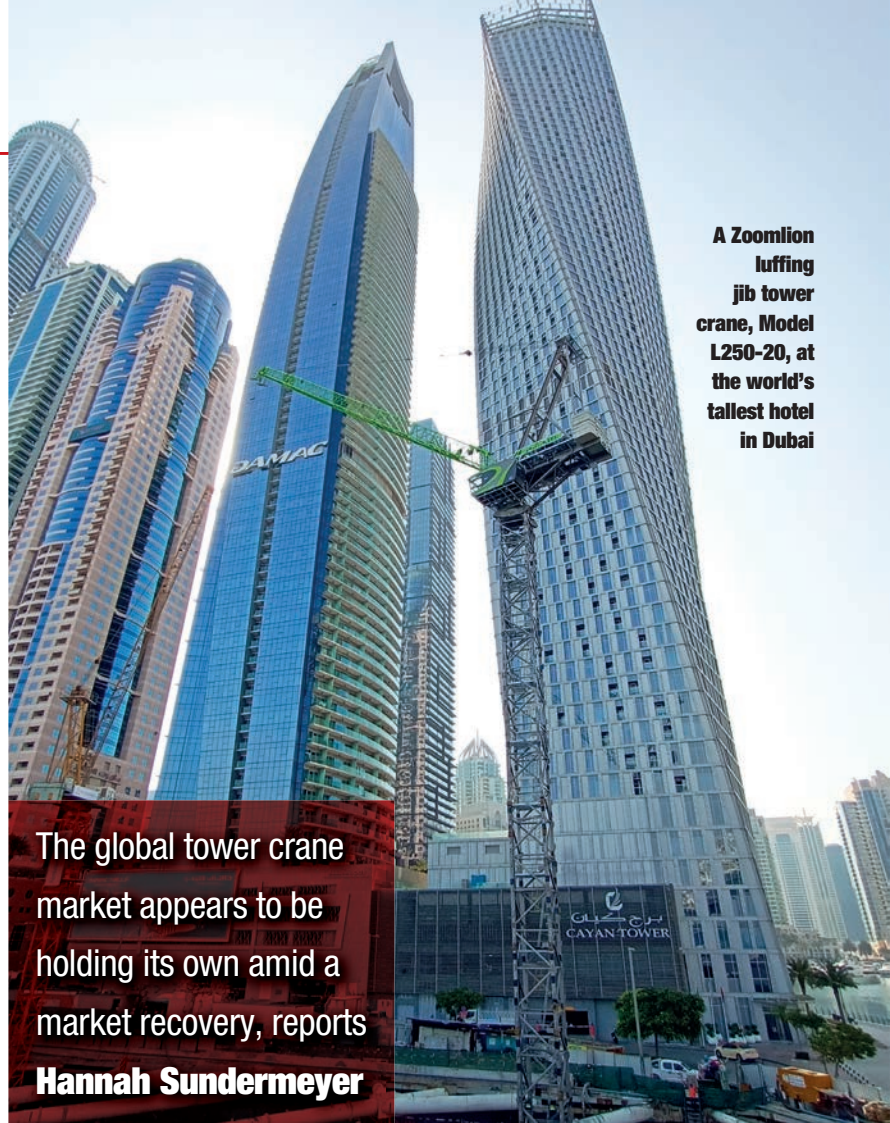
“Product surplus is very serious when it comes to both the current production capacity and product population. Manufacturers are keen on taking the market shares: i.e. to dump their surplus. The zero down payment policy has also made the situation even worse,” said Chai Zhao Yi, managing director, Panghuan.

“In the coming two or three years, the contradiction between the demand and supply will be still there, and the market will keep dropping. It will be a long and painful time, and over 60% of the manufactures and rental companies will be out of the game [market], and that will be the necessary step for the Chinese market.”

While Off-Highway Research forecasts a downturn in Chinese construction equipment sales for 2021 to 2023, it is not expected to be as steep as the one from 2012 to 2016.

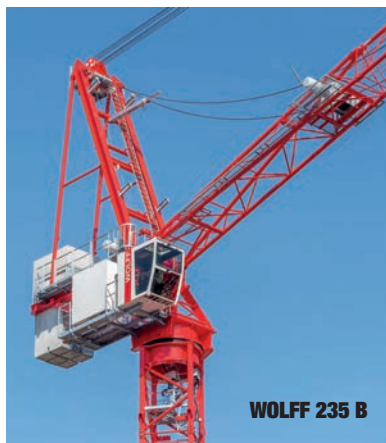
Shifting the focus to North America, Brian Ralston, president of PJ Arcomet (A Uperio Group Company) says he has begun to see the market improving each month, in all areas of business, sales, rental, parts and service, despite a slow start to 2021.

“The overall economy is strong, and our customer sentiment is up,” added Ralston. “That said, the start of 2021 was unusually low because of concerns arising from the pandemic, but for the most part, those concerns are giving way to optimism.”



A Zoomlion luffing jib tower crane, Model L250-20, at the world's tallest hotel in Dubai

The global tower crane market appears to be holding its own amid a market recovery, reports **Hannah Sundermeyer**



WOLFF 235 B

The US Senate has also recently passed a US\$1 trillion infrastructure bill set to repair roads, bridges, airports and waterways. This spike in funding for the construction industry has left the industry optimistic. While some parts of the world are seeing a more rapid recovery than others, the industry is generally hopeful as projects begin to see revival.

International Construction has compiled the leading tower crane models from some of the most prominent companies.

Wolffkran

The new Wolff 235 B replaces the Wolff 224 B and ranks between the hydraulic Wolff 166 B and the larger Wolff 275 B in the lower load moment range, thus fulfilling the demands of construction sites with a high volume of concreting work on high-rise buildings.



Favelle Favco M900F-ST H32

“The Wolff 235 B was developed in close collaboration with Wolffkran customers from the UK, who have decades of experience in handling luffing cranes on inner-city construction sites,” said Wouter van Loon, product manager, Wolffkran. “The result is a Wolff with a proven duty chart that is unrivalled when it comes to assembly and versatility.”

The hoisting gear of the new Wolff 235 B is positioned on the jib rather than the counter jib as is typical. The Wolff 235 B offers a maximum load capacity of 8 tonnes in single-fall and 16 tonnes in 2-fall operation and jib lengths from 30 to 60m. Designed to deliver its best performance with a 50m jib, it is said to outperform its competition with a tip

load capacity of 4.1 tonnes. Its 60kW hoisting winch allows for working speeds of up to 130 m/min and a rope storage capacity of 620m.

Favelle Favco

Tower crane manufacturer Favelle Favco has a new luffing jib model for the US market, the 64-tonne capacity M900F-ST H32 with reduced tail swing. It is one model in the new M900F series of luffers. With a 36.6m boom the M900F-ST will lift 64 tonnes on two falls of rope at a 15m radius or 32 tonnes at a 33.5m radius on a single fall of rope.

With the maximum 73m boom it will lift 39 tonnes at 12m and 7.5 tonnes at a radius of 71.5m on two falls. This crane can also be rigged to lift 96 tonnes with a three-fall block.

The main hydraulic hoist winch is a 400hp unit giving maximum line speeds of 111m a minute on one fall and 55m a minute on two falls. The 220hp luffing winch will raise the boom in 2.5 minutes.

Terex Cranes

Terex Cranes has launched its first luffing jib tower crane with hydraulic luffing technology, the CTLH 192-12. Specifically designed for inner-city construction sites, this new model reaches the lowest in service and out of service radius, of only 3m and 8m respectively.

“We focused our R&D efforts to develop a model tailor-made on the high demanding markets where space issues are of primary importance and is required to work on constrained areas, even with multiple cranes,” said Lee Maynard, global sales director towers and rough terrain cranes, Terex Cranes.

The CTLH 192-12, with a jib length from 25 to 55m, can deliver a maximum 12 tonne and up to a 2.35 tonne load at the maximum 55m jib length. Terex Cranes’ Terex Power Plus function will temporarily allow for an increase of the lifting capacity by approximately 10%, giving the operator extra lifting capacity at the touch of a button.

Jaso

Spanish manufacturer Jaso has added flat top tower cranes to its model lineup for the first time. First to join the range are the J200.12 and J200.10 with 12 and 10 tonnes capacity, respectively.

Booms on the two new models start at 30m and can be increased in 2.5m increments. Swing radius with the full boom is 14.9m while, for booms of 52.5m and lower, the swing radius can be reduced to 12.9m. Counterweight slabs are the lay flat type, the same as the weights of the base ballast, Jaso said. The 12-tonne model comes as standard with a 60 hp hoist, giving a maximum speed of 152m a minute.

New with the crane is the Eco mode system. In normal mode the



Jaso J200.12



Terex CTLH 192-12

Comansa

Comansa has added two new models to its 21LC series, as an evolution of the 21LC550 model, with two options: 20 and 25 tonne maximum load, which can be assembled with ranges of between 30 and 80m with configurations every 5m.

Both models incorporate an optional boom configuration that allows the total range to be extended to 85m at the tip. Compared with the 21LC550 model, load capacities are on average 16% higher for the 21LC600 and 23% higher for the 21LC650.

The first of the new features in these models is that they have ➤

Comansa 21LC650



Tower cranes down under

Work in Australia's busiest railway station

As Australia's busiest railway station, Central Station supports an estimated 270,000 passengers every day, with daily capacity demands expected to grow to more than 450,000 passengers over the next 20 years. The redevelopment of Central Station is pivotal to the new Sydney Metro network.

After working with Marr's team on the delivery of the Sydney Yard Access Bridge to facilitate heavy vehicle access to Central Station, Laing O'Rourke was keen to explore how a similar heavy lift craneage solution could be adopted on construction for the Central Station Metro.

Laing O'Rourke needed a solution that allowed their team to adopt a new method of modularised construction – which required lifting large architectural columns and heavy pre-assembled structural steelwork – in a confined, live rail environment.

Marr's solution involves a M1680D heavy lift luffers with a 71m radius boom installed on a purpose-built steel grillage to complete the heavy lift requirements of the project – including lifting 60-tonne prefabricated roof trusses and skylight modules.

Marr's engagement on the project was completed in January 2021. Central Walk and the new escalators from Platforms 12 to 23 will open in late 2022.



Marr's M1680D HLL is installed at Central Station to complete heavy lift and general construction requirements

CRANES

a shorter, modular counter-jib, ranging from 24.4 to 16.4m and having up to five possible configurations. The height, which is self-supporting with a built-in base, can reach up to 85.8m. Also, the tower sections are 2.5 square metres for both models.

The cranes can be used for the construction of residential and commercial buildings, as well as power plants, mining, bridges and other high-commitment infrastructure.

Liebherr

Liebherr's 125 K features a radius of 180 feet and a maximum hook height of 215 feet. The crane has an initial hook height of 97 feet. Five tower sections can be inserted to reach a total hook height of 136 feet. The 30-degree luffed jib position enables a 215-foot hook height. The crane has a 17,600-pound maximum load capacity and with a 180-foot radius at the jib head, it is able to lift 2,800 pounds due to its Load-Plus function.

Liebherr also presented its 340 EC-B flat top series at ConExpo in 2020. Three of the eight units are equipped with fibre rope, which the company said has four times longer service life than steel rope and enables cranes to work with a significantly higher load capacity.

BKL

A brand-new product in the self-erecting crane sector is soon to be available from German-based BKL. The crane specialists teamed up with the design engineers of the Italian manufacturer Cattaneo S.p.A. to improve the CM 74S4 quick-assembly crane. Its successor, the BKL System Cattaneo CM 300, features an increased maximum load capacity of three tonnes, or an extra

**BKL System
Cattaneo CM 74S4**



Liebherr 340 EC-B



500 kilos, a 30m radius and a maximum hook height of 23m.

Another fast-erecting crane in the BKL System Cattaneo range was unveiled at Bauma 2019. Without the need for additional climbing tower sections, the fast-erecting crane CM 415 offers three hook heights of 23.8m, 28.5m and 31.5m. The crane series BKL System Cattaneo currently consists of eight types

of crane and ranges from a mobile roofing crane with inbound axle to a stationary 63 tonne crane. The self-erectors meet any challenge, with radii ranging from 22 to 41m, hook heights of 17.3 to 31.5m and 1.8 to 5 tonnes of load.

BKL has expanded its rental fleet, which comprises more than 500 tower cranes, more than 100 mobile cranes and ten mobile construction

cranes for construction sites in Germany and throughout Europe.



Potain MDT 489

Potain

The newly released Potain MDT 489 topless crane from Manitowoc fills the gap between the MDT 389 and new MDT 569 models. It is said to be ideal for large-scale construction and infrastructure projects, especially the installation of large, prefabricated components, as well as for shipyards and mines with heavy loads to handle. The Potain MDT 489 can lift a maximum of 20 or 25 tonnes within an 80m maximum radius.

The MDT 489 can be placed on a 5.95 or 7.95m cross base platform and assembled in various configurations to best use the space and equipment available on the jobsite. The jib has been designed for easy and efficient erection with built-in slinging points. The jib sections can be assembled in different configurations to offer jobsite flexibility according to the assist crane size and ground space available.

Zoomlion

One of Zoomlion's most popular machines, the luffing jib tower crane Model L250-20 is hard at work on the Ceil Hotel in Dubai. The hotel is the tallest in the world and has been utilising the L250-20's special feature of a single rope lifting 10 tonnes at 100 meters/minute. Faster lifting work provides better efficiency, the company said.

The luffing jib tower crane features a maximum jib length of 60m, and the jib length under different assembling modes can decrease progressively by 5m. The minimum jib length is 30m. With a maximum lifting capacity of 20 tonnes, the crane boasts multiple operation modes and wide applications.

ic

Industry event going ahead

Leading tower crane event taking place in France in December

The International Tower Cranes (ITC) conference has been rescheduled to 2 December this year. The event, which was originally planned for 29 June, will be held in the same venue in Nice, France.

The date has been changed to give the opportunity of an in-person event, there being no guarantee that travel would be possible on the original June dates.

The conference – organised by *International Cranes and specialized Transport* and KHL Group – will be preceded by a networking reception on 1 December, with the full-day conference on 2 December.

All the speakers have been confirmed for the new date, including: Christophe Simoncelli, SVP Europe, Manitowoc & SVP Tower Crane Operations, Marc Lambert, founder/CEO, Lextan, and Eduardo Estelles, Managing director, Windcrane.

Other topics with speakers to be confirmed soon include: Project case study, Using fibre ropes: experience from construction sites and Tower cranes and Prefabricated Prefinished Volumetric Construction building techniques.

The networking reception and conference will be held at the Le Meridien Nice hotel, which has a promenade location in Nice. It is located around 6km from the Nice Côte d'Azur Airport.



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Building the future,



The Electricity Generating Authority of Thailand rolled out a series of electrical power system substation and transmission projects with the help of Black & Veatch

After months of wrangling, the US Congress finally agreed to a massive, US\$1.2 trillion new infrastructure bill. In it are provisions for a US\$7.5 billion national network of electric car charging stations, US\$73 billion for 'smart grid' projects such as wind, solar and battery powered electrification, and US\$8 billion to develop clean hydrogen fuels.

For US-based Black & Veatch, a US\$3.0 billion engineering, construction, and asset management company, the timing couldn't be better. For decades the Kansas City company's engineers have been designing and building new technology-enhanced infrastructure projects, from simple solar installations and electric vehicle charging stations to an intelligent highway backbone along the entire 220 mile (354km) length of the Pennsylvania Turnpike.

The company's global reach also includes projects in the UK, Europe, Central and South America, Canada, Africa and the Asia-Pacific region. But in the US conditions are favourable for taking the next big leap into intelligent transportation systems, or what Randal Kaufman, sales director for Black & Veatch's Transformative Technologies business, calls the 'killer' app.

"My first impression of the Biden plan is that it helps to have a policy directive, regardless of the details," says Kaufman. "It makes it easier for businesses, institutions and individuals to plan and the confidence to make investments in technology, resources and support far into the future."

The emphasis on smarter infrastructure is not just the fad of the day but a realistic appraisal of where the country needs to be 50 years from now, says Kaufman.

"We can't just build back what we have today," he says. "That's already obsolete. We need to design for resiliency, greater sustainability and social equity."

Since its founding 106 years ago, Black & Veatch has defined its mission as "building human critical infrastructure." Today that includes everything from smart highways to alternative energy, decarbonisation and even the gas station of the future, writes **Tom Jackson**



Randal Kaufman has more than 15 years in the electrical power industry

Private and government financing

While infrastructure generally means large public works projects to many in the US, Kaufman believes private financing and corporate involvement will play a prominent role in many aspects of our future (and greener) infrastructure. Government will assist, he says, with providing tax credits and regulatory guidance.

In the past, government incentives helped green infrastructure builders and technology reach economies of scale on manufacturing, production and deployment. As a result, prices for solar, wind and battery power have come down dramatically in the last ten years, giving green infrastructure forward momentum.

However, the social aspects of a new generation of infrastructure can't be ignored, says Kaufman. An example: rooftop solar panels are great for people who own single family homes. But people who live in apartments see fewer benefits. "That's where the government can help, by steering investments to the right place. Ultimately it has to be the private markets that are incentivised to build these," he says.

And those market implications are huge. "There are tremendous job opportunities at every level: for contractors, civil construction, electrical construction, mechanical construction, software and the engineering to support it," Kaufman says. "And of course, you've got the whole OEM supply chain for technology."

Emerging hubs

Kaufman says intelligent and decarbonised transportation systems will emerge in areas with logistical advantages that meet a number of important criteria. These hubs will start with existing transportation infrastructure but will be able to step up to the next level with affordable housing, favourable government, and

Black & Veatch crews work to expand Florida Power & Light's solar photovoltaic capacity at the Babcock Ranch, the first solar powered city in the US



today

corporations with a willingness to invest in alternative energy sources such as solar and battery storage for electric vehicle charging, natural gas and eventually hydrogen fuel capabilities.

The central valley of California is one such area. "It's already a big aviation technology hub, as well as a ground transportation hub and it's one of the few places left in California with affordable housing," Kaufman says.

"If you follow the trends, there has been tremendous growth in these secondary and tertiary housing markets. There is potential for a whole new zero carbon national transportation logistics network with new regional hubs emerging that accelerate service and alleviate stresses on the existing hubs."

One of Black & Veatch's proprietary engineering concepts is what it calls 'ZEV Multi-Energy Hubs.' ZEV stands for Zero Emission Vehicles. These are vehicle fuelling stations that include electric vehicle (EV) charging, natural gas, low carbon fuels and, eventually, hydrogen fuels. All these can be packaged in a single location that creates its own power supply, sells EV charging and low-carbon fuels, and exports electricity.

What makes the ZEV Multi-Energy Hub a game-changer is the ability to generate its own fuel onsite – electricity from solar and battery power or hydrogen. Derived from natural gas or electrolysis, hydrogen can be used to power electricity generators, but also as a transportation fuel for vehicles with hydrogen fuel cells.

The company has several projects underway that include EV charging, battery energy storage and solar and is working on plans for hubs that also include natural gas and hydrogen fuel cell charging.

"Truck stops are already starting to deploy EV charging, so there is no reason why they couldn't put in hydrogen or solar panels and battery storage in the future," says Kaufman.

Black & Veatch served as the engineer of record for the marine works and desalination components of the Escondido Water Supply project



Black & Veatch provided the Orange County Sanitation District (California) with services for a project that developed a 60 million gallons per day activated sludge treatment train



Black & Veatch projects

Notable recent projects for the 'human infrastructure' company

CARDINAL POINT WIND

Completed in March 2020, the Cardinal Point wind project included the installation of 60 wind turbines generating 150 megawatts of power. This US\$246 million project used many locally sourced parts and materials in McDonough and Warren Counties in western Illinois. It generated US\$2 million in tax revenues with the local school districts as the primary beneficiaries.



LONG RIDGE ENERGY TERMINAL

Ohio's Long Ridge Energy Generation plant hired Black & Veatch to retrofit its 485-megawatt (MW) combined-cycle power plant to run on a blend of natural gas and carbon-free hydrogen. This will make it the first large gas turbine plant in the US to transition to hydrogen fuel after it begins commercial operation this year.



PASO ROBLES INTEGRATED WATER REUSE SOLUTION

Prolonged drought conditions prompted the city of Paso Robles, California, to hire Black & Veatch to add tertiary treatment facilities to the 4.9-mgd (million gallons per day) plant to reduce reliance on the Paso Robles groundwater basin, where levels had fallen, and produce recycled water for irrigation of parks, golf courses and vineyards.

Hydrogen is still an expensive option. Making it onsite requires a larger footprint than a traditional filling station, but it has a lot of upsides as well. Truck and automotive OEMs are continuing to pursue hydrogen fuel cells as a power option, and hydrogen, a true zero emissions fuel, is easily created by electrolysis. Plus it's easy to store. "It's a great complement to any utility," says Kaufman.

Black & Veatch has already constructed 19 of the first 39 hydrogen filling stations built in California and is also doing feasibility studies for hydrogen generation and fuelling of mining equipment and

hydrogen coal-plant conversions in the western US.

Future focus

One of the unique aspects of Black & Veatch is how much the company and its 8,000-plus employees focus on the future of infrastructure. The company does not just bid on jobs when bids are let. It is aggressively designing whole systems and logistics plans for a newer, more equitable and greener infrastructure to come. They are, to use the Wayne Gretzky ice hockey analogy, "skating to where the puck is going to be."

For the last 50 years, the US has been failing in this regard. The American Society of Civil Engineers routinely gives the country a grade of C-minus or D for the condition of its infrastructure.

The US cannot afford to make that same mistake again, says Kaufman. "You really do have to think years into the future," he says. "If you are building infrastructure now you have to ask, will this serve our purposes in 25 years?"

IC

New ADT from

Liebherr has introduced the first in a new line of articulated haulers, again called the TA230, like their previous version. **Dan Gilkes** puts it through its paces

Demand for articulated dump trucks (ADT) has grown rapidly over the last decade and shows little sign of slowing going forwards. As ADTs have become larger and more sophisticated they have found new customers, across the construction and civil engineering sectors, in bulk earthmoving and in the quarrying market.

It's a machinery sector that has attracted plenty of players over the years, though the majority of global sales are split between a handful of leading manufacturers. Liebherr has tried to break into the ADT sector before, launching the TA230 in the early 2000s. Now the company is back, with the first in a new line of articulated haulers, again called the TA230.

Clean-sheet design

Liebherr might have opted for a different naming structure for the new truck, such is the step-change from the previous model. The chassis is totally new, with much of the design and engineering work aimed at increasing ground clearance, for improved performance on tougher terrain. The main articulation joint is now built from heavy-duty castings, rather than fabrications, adding strength and durability at the centre of the truck.

The transmission is mounted above the front axle, while all of the engine exhaust after-treatment is packaged high up behind the cab. The front axle rides on four-point hydro-pneumatic suspension, while the rear A-frames are redesigned to also sit on four-point suspension, providing a smoother ride at higher speeds, while allowing plenty of axle articulation for rough ground.

The TA230 has permanent six-wheel drive and there are both inter-axle and



Access to the ADT cab



cross axle differential locks, for maximum traction. All three axles use wet multi-plate disc brakes to bring things to a halt, though the truck also has an effective engine exhaust brake and a multi-position hydrodynamic transmission retarder, to control speeds when hauling downhill.

Construction and mining equipment usually gets bigger with each generation, but Liebherr has reduced the size of the dump body from 19m³ to a class-competitive 18m³. The payload is set at 28 tonnes and the machine will come with Liebherr's load weighing system, with lights outside the cab to tell the loading operator when the truck is up to weight. This early demonstration model was built before that system was available however, so is equipped with an after-market RDS Loadmaster system.

Productive power

The truck features a more streamlined bonnet than the rather bull-nosed original, though the engine has increased in size, from 10.5 to 12 litres. The Liebherr D956 is an EU Stage V compliant six-cylinder motor, delivering 265kW (360hp) at just 2,100rpm, with a hefty 2,520Nm of torque.

To achieve that steeply sloping bonnet line, greatly improving forward visibility from the cab, the engine is tilted forwards by 7°, while all of the cooler cores and radiators are mounted to either side. Reversible cooling fans will be offered as an option for dustier site conditions.

The ZF powershift transmission is also repositioned, now sitting almost above the front axle line. The box offers eight forward and four reverse gears, for a top forward speed of 57km/h and a reverse speed of up to 16km/h. This will reduce time positioning the truck beneath a loader, or backing up to the tipping site.



The inside of the cab – the TA230 has a clear dash with a large, 9" tablet-like display screen mounted to the right of the steering wheel

established OEM



Demand for articulated dump trucks has grown rapidly over the last decade

The exhaust after-treatment has also been moved, from beside the cab to sit in a single unit behind the cab. The after-treatment consists of a Diesel Oxidation Catalyst (DOC), Diesel Particulate Filter (DPF) and a Selective Catalytic Reduction (SCR) system with exhaust fluid additive. The DPF has passive regeneration, so there is no need to stop the truck while burning off soot and it should last up to 5,000 hours before the need for a refurbishment or replacement.

Unlike the earlier model, which used heated fluid to heat the dump body, the new TA230 pushes its exhaust gases through the body, to reduce the chance of material sticking in colder weather.

The engine drives three hydraulic pumps. The larger of the three delivers up to 345 litres/min of hydraulic flow, to power the steering and the dump body lift cylinders. Tipping time is just 12 seconds to raise the body and eight seconds to lower. The other two smaller hydraulic pumps drive the cooling systems, with the radiators mounted remotely from the engine, ensuring optimum operating temperatures can be maintained.

Operator comfort

As with the rest of the truck, the cab is all new. There is more space inside and the front windscreen now has a glass-to-glass join with the front quarter windows. This, in combination with the lower bonnet line and much smaller mirror supports, results in a panoramic view to the front and sides of the truck.

Those mirrors are electrically adjusted and heated, for maximum visibility in all weather conditions. A reversing camera is standard, with the image displayed in a corner of the main dash monitor and there are LED lights to the front and the rear of the machine for maximum working area visibility.

Access to the cab is easy, with sturdy steps to either side and well placed hand rails. You can also specify optional LED lighting for the steps, providing timed illumination to let you get in or out in safety. There is a choice of operator seats available, with air suspension, heating and lumbar support. A secondary training seat sits to the left of the operator.

The TA230 has a clear dash with a large, 9" tablet-like display screen mounted to the right of the steering wheel. This provides

all of the necessary operating data, in a series of menus. As mentioned, the demonstration truck was equipped with an RDS weighing system, which is the second screen in the photographs. Automatic air conditioning ensures a comfortable working environment and internal noise levels are just 72dB(A). There is plenty of storage space for the operator, including a cooled storage compartment capable of holding two large bottles.

Service and maintenance

The TA230 has a daily check function built in, which runs through a series of tests on initial start-up each day. Should you need to raise the bonnet, it can be lifted at the touch of a button and there is a fold-down ladder at the front of the machine to provide access to the top of the engine and the cooling packs.

Those radiators can also be released and folded out, to improve engine access, and all of the filters are easily accessible. Fuel and AdBlue tanks can also be reached from ground level and a centralised lubrication system is standard. To the right of the nose of the machine there is a small compartment with a tool box and spare grease cartridges, which slides out for easy access.

The truck is also supplied with Liebherr's LiDAT data transfer system, allowing fleet managers to monitor and control the machine's operation remotely. All main machine data can be viewed through a web portal, including maintenance reports and other operational information.

Performance and productivity

Liebherr has certainly not rushed into this second-generation truck, but has listened to customers and designed the new TA230 to better meet their needs. Taking on the most popular 30-tonne class, the TA230 is certainly not without competition, but the combination of truck and loader, or excavator, from the same supplier will no doubt open plenty of doors for the company. There will almost certainly be additional models to come too, in the 40 or 45-tonne class.

The ADT rides well, has plenty of pulling power and the traction to put that power to good use. The new cab is a comfortable place to spend the day and the truck promises the productivity to justify that badge. In a rapidly growing sector, Liebherr's new TA230 should do well.

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The TA230 is considerably different from Liebherr's last entry into the ADT market



Can hydrogen help turn construction green?

“We were thinking of the electric job site; now we are thinking of the hydrogen job site.” The words of Tim Burnhope, chief innovation and growth officer at JCB, underline just how quickly strategies are changing as construction battles to minimise its environmental impact.

He was speaking about JCB’s work on a zero CO₂ emissions hydrogen combustion engine, a development he believes will play a key role in construction’s more sustainable future.

The UK-based OEM has built, and is currently testing, a prototype backhoe loader with a new hydrogen motor. JCB is using and adapting established engine technology with readily available components: once the hydrogen is ignited the power is delivered in exactly the same way as in a diesel engine.

The result is a backhoe loader than can do everything its traditional diesel powered relative can do and behaves in the same way – with fuel costs that are expected to be very similar to diesel. Boringly normal, you might say.

That normality is something that excites its JCB developers. After all, if its customers do not adopt the technology, then we will not make progress.

“Our customers say only two things – don’t make it too complicated and don’t make it too expensive for the market they serve,” said Burnhope.

JCB’s hydrogen combustion engine has roughly the same size, weight and usability of its diesel equivalent which means the

Hydrogen combustion engines move to centre stage as construction aims for zero emissions, reports

Graham Anderson

existing equipment does not have to be significantly redesigned and the operator training required is negligible. However, there is still a lot of work to be done, as Burnhope acknowledges.

“Our starting point was: how do we leverage our expertise into hydrogen? There is a way to go to get it into production, but so far nothing that scares us,” he comments.

“The next step is to get to the market with some experimental products. We are looking to have products out there with some customers so that they can use them experimentally, for feedback and analysis. We reckon at the moment that we will be using these engines across our range, from mid-range backhoe loaders and telehandlers – about three or four tonnes upwards.”

Hydrogen power journey

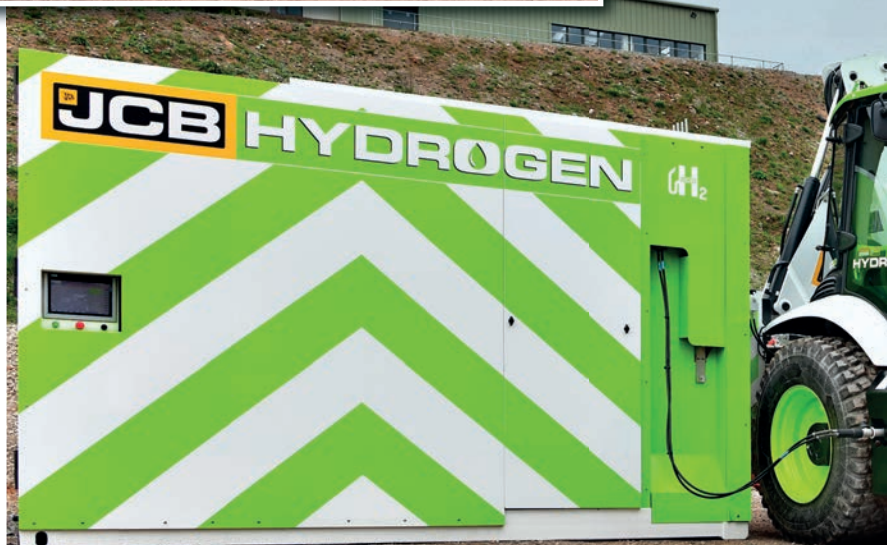
The company’s path towards the hydrogen combustion engine started with a challenge from chairman Lord Bamford, which resulted in the creation of a specialist development team at its



JCB says that the performance of the hydrogen backhoe loader is at least as good as that of its diesel counterpart



Tim Burnhope, chief innovation and growth officer at JCB



Power Systems factory in Derbyshire, UK.

JCB had long been working on clean diesel engines – according to the OEM, the diesel engines it makes today produce 50% less CO₂ compared with machines manufactured in 2010. There are even more dramatic reductions in particulates and nitrogen oxides compared with 1999 levels.

The OEM has already launched an electric mini excavator and now has 14 different models in its compact equipment range powered by lithium-ion batteries, including telescopic handlers, scissor lifts and dumpers. Then, in 2020, it developed a 20 tonne tracked excavator powered by a hydrogen fuel cell.

In a fuel cell, hydrogen and oxygen are combined to generate electricity, heat, and water.

Fuel cells that use pure hydrogen fuel are carbon-free, with their only by-products being electricity, heat, and water. This is fantastic for sustainability, but both batteries and fuel cells have their limitations.

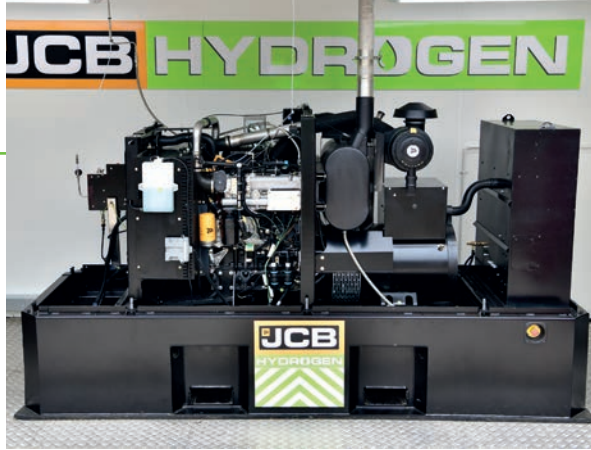
JCB says that batteries are not practical for equipment with an operating weight of over six tonnes. The batteries would weigh too much, cost too much and result in a loss of machine performance.

At the same time, fuel cell technology has unresolved technical and cost issues, combined with concerns about security of supply.

“To be clear, we are not saying that fuel cells will never take off, but there is a long way to go. We have to be so careful that we do not go through iterations of design that mean the final products are not available until, say, 2050. We have to start reducing CO₂ much, much quicker,” says Burnhope.

“The future is going to be about using the right solution for the right equipment. Low hours, low usage, it will probably be a battery. Bigger machines working in more remote locations where recharging is more difficult – the industry will probably be looking at other solutions. Then we think hydrogen will come into its own.

“It looks to us like there will be a fragmented market for batteries, fuel cells, hydrogen combustion – with a market for each,



Hydrogen power may be key in the construction industry cutting emissions

same as its diesel equivalent.

The JCB developers have been liaising with academic engineers and metallurgists on aspects of the engine development while trying to perfect the fuel mix. The result is a turbo-charged internal combustion engine with a fuel-to-air ratio of one part hydrogen to 100 parts air, a solution that is delivering zero emissions and exciting early results.

So far, the capacity of the hydrogen tanks on the current prototype backhoe are, in the words of one of the engineers, probably not quite enough to do a full day's work. It is worth pointing out, though, that it is a first prototype machine and there is a lot of development and learning still to do.

Obviously, one option to consider is increasing the capacity of the fuel tanks, but further improving machine efficiency through design changes could reduce the amount of fuel required.

Supply chain issues

Perhaps the biggest obstacle to the successful commercial development of the hydrogen combustion engine will not be the engineering challenges, but political and regulatory support and the need to establish relationships with new suppliers.

Certainly, JCB is keen to see the development of a hydrogen sector that will spur the growth of the necessary supply chains. According to Burnhope, “We are not looking at this as a sales opportunity to other manufacturers; we are doing this in the hope that others will look at what we are doing and will get involved.”

Hydrogen's potential to help combat climate change has only been fully recognised in recent years. For a long time it was mostly ignored by regulators and politicians alike.

Yet the potential of hydrogen combustion engines was first recognised over 200 years ago. In 1806, French inventor Francois Isaac de Rivaz designed the first internal combustion engine which ran on a hydrogen/oxygen mixture.

Today, JCB's enthusiasm for the technology is matched by some of the biggest names in construction and beyond. Those working on hydrogen combustion engines include Liebherr, engine manufacturer Cummins, German engine development specialist FEV, UK engineering consultants Ricardo and aerospace giant Airbus. Even Formula 1 is looking at it.

All hope that their innovation and commitment means a global market can be successfully developed. Liebherr has said little about its work to date, but Cummins announced in July that it has begun testing a hydrogen-fuelled internal combustion engine.

“We are thrilled about the potential of the hydrogen engine to reduce emissions and provide power and performance for customers,” said Srikanth Padmanabhan, president of the engine business at Cummins.

“We are using all new engine platforms equipped with the latest technologies to improve power density, reduce friction and improve thermal efficiency, allowing us to avoid the typical performance limitations and efficiency compromises associated with converting diesel or natural gas engines over to hydrogen fuel.

“We have made significant technological advancements and will continue moving forward. We are optimistic about bringing this solution to market.”

JCB's hydrogen powered backhoe loader charging



HYDROGEN POWER

As a next step, the company plans to evaluate the engine in a variety of on- and off-highway applications and said that hydrogen engines offer OEMs and end-users the benefit of adaptability by continuing to use familiar mechanical drivelines with vehicle and equipment integration mirroring that of current powertrains.

Government incentives

German-based FEV, an international vehicle and powertrain developer, is another company heading in the same direction. This is partly as a response to the European Union initiating the European Clean Hydrogen Alliance in 2020 with the aim of creating an integrated hydrogen market by 2030.

The EU's move revived the debate on what would be the most appropriate way to use hydrogen; FEV has reached a similar conclusion to JCB. "The hydrogen internal combustion engine is a robust, cost-efficient option for zero CO₂ transport. It can be implemented into the current production infrastructure relatively simply and offers potential for existing vehicles," said Professor Stefan Pischinger, President and CEO, FEV Group.

Because hydrogen is a carbon-neutral fuel, only minimal amounts of carbon monoxide, carbon dioxide, and soot are produced from burnt lubricant. The main exhaust gas component is nitrogen oxide (NOx), but its low exhaust gas temperatures mean that – even without exhaust gas aftertreatment – the level of nitrogen oxide is already below the current limits.

FEV says that further research is needed, for example into the ignition system, crankcase ventilation, the fuel mixture and exhaust gas treatment. All companies involved want to see the engines tested long-term in working conditions onsite to flush out any concerns that have so far not come to light.

The possibility of hydrogen embrittlement – when metals can become brittle as a result of the introduction and diffusion of hydrogen into the material – is one subject of concern, although there have been no problems reported to date. Green groups also point out that the environmental benefits of developing hydrogen combustion engines depend on how the hydrogen is produced.

Blue hydrogen is derived from natural gas and its manufacture produces CO₂ as a by-product, which has to be captured and stored. As a result, opponents argue that the uncertainty surrounding the storage technology means blue hydrogen is not a zero-emission fuel and should not be promoted as such.

Green hydrogen

On the other hand, green hydrogen is the production of hydrogen from renewable energy through electrolysis, a process that splits water into its basic elements – hydrogen and oxygen – using an electric current. The electricity used in the process can come from renewables such as wind, hydropower and solar energy.

Apart from the availability of green hydrogen, bigger obstacles are likely the need for political support, effective regulation and the establishment of crucial supply chains with new commercial partners. As one of JCB's development engineers observed, "we are making a lot of new friends".

The OEM is optimistic that supply chains will develop and that hydrogen production can be ramped up sufficiently to meet future demand, encouraged by reports of the many major corporations looking to enter the market.

But governments and regulators will need to agree



A Cummins PEM electrolyzer

US-based engine manufacturer Cummins is one of the companies investing in hydrogen power



“We are thrilled about the potential of the hydrogen engine to reduce emissions and provide power and performance for customers.”

SRIKANTH PADMANABHAN, president of the engine business at Cummins

international standards and rapidly develop policies for hydrogen production, distribution and storage. JCB Chairman Lord Bamford has stressed that opposition to fossil fuels should not lead to a blanket rejection of the internal combustion engine.

He said, "We believe that there should be continued use and development of internal combustion engine (ICE) technology; the use of fossil fuels in machinery may be phased out in the future but that shouldn't mean that ICEs don't have an important on-going role in helping to reach zero carbon dioxide emissions."

One of the many organisations watching developments closely is ESTA, the European association of abnormal road transport and mobile cranes. Its members work on major construction, energy and industrial projects.

ESTA director Ton Klijn said, "The development of hydrogen combustion engines is very exciting. We can only hope that our political leaders in Brussels and EU member states keep up with the pace of change."

"If industry is to develop the new supply chains that will be required, we will need our politicians to show clear thinking and leadership – and that means agreeing the necessary regulatory frameworks and harmonised standards."

"We know from bitter experience that such aims are far easier to debate than deliver. We can only hope that the climate emergency will induce a much greater sense of urgency."

Without such agreements, the huge strides that have been made by JCB and others in the construction and off-highway sector could well be in vain.

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**ESTA director
Ton Klijn**





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