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# international construction

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# COMMENT

## Contractor focus

The time has come once again for our top 200 list, where we rank the world's biggest construction contractors according to their 2017 sales figures. The list – which you can view on page 20 – was something of a labour of love to pull together and I hope that the data that the table provides, as well as additional information such as the revenue for the top 100 companies and how much money each country contributes to the list, makes for interesting reading.

Since I have been in this role, the importance of China regarding the overall health of the construction industry is something which has not been lost on me. While, of course, China is only one of many markets, it is an exceptionally important one and I've enjoyed speaking to representatives of Shantui, Sany and LiuGong (you can read this interview in the next issue) and hope to speak to many more, perhaps at Bauma China later this year, which will also be my first ever visit to China.

Chinese companies continue to dominate the top 200 list, with the top four spots once again being occupied by contractors from what is – according to the latest figures – the world's largest construction equipment market. From talking to those from Chinese companies, and from doing research, it appears that the smart money is on the Chinese construction industry to continue to grow, albeit at a slower rate than it did in 2017.

This is surely a good thing – it is better for the industry in general to have slower, but more sustainable growth, rather than unsustainable growth for a year or two and then another large drop as the industry 'evens out'. It also means that the pressure on supply chains is mitigated, as ramping up production after a lull is not straightforward.

On a personal note, as I write this, my wife is expecting our first child any day now. It has certainly added a frisson of excitement to proceedings, finishing off the issue while frantically checking my phone in case she has got in touch to tell me that we have to dash off to the hospital. If you happen to see me at any shows or company events in the foreseeable future and notice that I am looking tired and devoid of sleep, then you will know why.

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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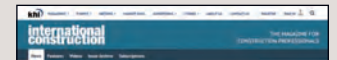
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HIGHLIGHTS

**UK** The organisers of the 2019 Plantworx exhibition have promised a “bigger and better show”. The event will be held between 11 and 13 June, 2019, in England.

The event, which is organised by the Construction Equipment Association (CEA), is being held at a new venue, the East of England showground. The 2019 show is said to have 53% more space than the last time it occurred. Plantworx is being run alongside Railworx for the first time, due to the strong link between rail and construction.

**CHINA** XCMG has announced a comprehensive strategic co-operation framework agreement with Weichai Power, a component supplier of mechanical parts.

Weichai Power and XCMG have worked with each other for more than 20 years in product research and development, manufacturing, supply, and after-sales services. After this contract signing, XCMG and Weichai Power will deepen their strategic co-operation in heavy trucks, cranes, excavators, loaders, roller compactors and other fields.

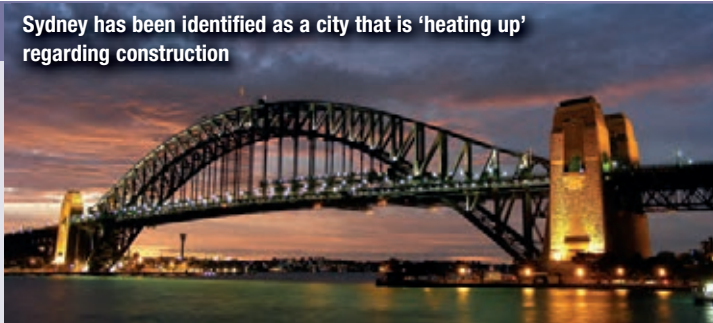
**US-CANADA** The project to build the Gordie Howe International bridge between Detroit, US, and Windsor, Canada, has been awarded by the Windsor-Detroit Bridge Authority (WDBA) to the Bridging North America consortium.

The consortium consists of ACS Infrastructure Canada Inc., Dragados Canada Inc., Fluor Canada Ltd and others. It is estimated the cost of the project will be US\$4 billion, and the scheme is to be delivered through a public-private partnership. Once completed, the 2.5km bridge will be the longest cable-stayed bridge in North America.

**PERU** Vinci Highways, a Vinci Concessions subsidiary and concession holder of Lima’s main expressway until 2049, has opened section two of the project.

The new 9km toll section serves the Peruvian capital’s business districts. The official opening was attended by Lima’s mayor, Luis Castañeda Lossio, Fadi Selwan, chairman of Vinci Highways, and Laurent Cavois, CEO of Lamsac. The new section will help to improve the mobility around South America’s fifth-largest city.

Sydney has been identified as a city that is ‘heating up’ regarding construction



GLOBAL

# Construction markets ‘heating up’

A report on the international construction sector finds most markets are looking positive

**T**here is an expectation of increasing construction activity around the globe, but the lack of skilled workers is a major issue for the industry, according to the Turner and Townsend market survey 2018.

The report identifies markets as ‘cold’, ‘lukewarm’, ‘warm’, ‘hot’ or ‘overheating’. Using this measurement, the survey showed that half of the 46 markets the report investigated are expected to heat up in 2018, while just two are expected to cool.

Five cities were identified as ‘hot’: Dublin, Melbourne, Munich, Sydney and Tokyo. Meanwhile, Amsterdam, San Francisco and Seattle were described as ‘overheating’.

This ‘heating up’ was said to have been felt across the world, with the regions of Africa, Asia and Latin America reportedly picking up pace regarding construction activity.

There was a strong link between those cities said to be ‘cold’ and commodity prices, with cities dependent on commodities dominating the list. The report found Doha, Moscow, Muscat, Perth and São Paulo to be ‘cold’.

The report also identifies growth sectors in construction, with road and rail infrastructure spending coming out on top – with both mature and developing markets investing considerable amounts of money into transport schemes.

The report also identified challenges to the construction sector. According to the report 67% of respondents said that skilled workforce shortages had a major or large impact on the delivery of construction projects, making it the number one problem identified.

Other areas of concern identified were government red tape and the rising costs of construction.



The report was positive for the construction sector in 2019



CHINA

## Excavator sales up for China

It has been reported that sales of China’s major excavator producers grew strongly in May. According to the China Construction Machinery Association (CCMA), the country’s leading 25 excavator producers sold 19,313 machines in May — a 71% increase from the same month last year.

According to the CCMA, over 17,700 excavators were sold in China — an increase of 69%. Exports of excavators jumped by 95% to more than 1,500 machines sold in overseas markets.

In total, 105,935 excavators were sold between January and May 2018, up 60% from the previous year. Sales of excavators are often treated as a barometer to measure the health of the construction industry.

Figures released from market analysts Off-Highway Research showed that 2017 saw a huge rise in crawler excavator sales, which increased 125% between 2016 and 2017 to reach over 98,000 units. This was the first time in China’s history that crawler excavators outsold wheeled loaders. The mini excavator segment also grew rapidly last year, with sales up 88%.

Beijing is targeting economic growth of 6.5% for 2018.



**INDIA** Doosan Bobcat has opened its new backhoe loader plant in India, marking its entrance into one of the world's three largest compact construction equipment markets.

The plant has a site area of 80,000m<sup>2</sup>, a factory floor area of 15,000m<sup>2</sup> and is capable of producing 8,000 machines a year.

Doosan Bobcat has entered the backhoe loader market in a bid to expand its emerging market portfolio with the aim of exploring mid- and long-term growth engines.

India's compact equipment market is the third largest in the world after the US and China, with an estimated worth of KRW1.3 trillion (US\$1.1 billion), where the backhoe loader sales account for more than 80%.

Since 2014, the Indian backhoe loader market has grown at an average annual rate of 9.7%.

## ETHIOPIA

### Doubling of road network

The Ethiopian government has announced ambitious plans to double the length of the country's road network to 200,000km by 2020. This would be double the length that the network was in 2015 — a considerable construction achievement.

The government's Roads Authority revealed the target while reporting on the second five-year Growth and Transformation Plan (GTP-II), which runs from 2015 to 2020.

In 2015, at the end of GTP-I, the road network had reached approximately 100,000km. It is now reported to stand at 121,171km, according to the roads ministry of Ethiopia.

In an interview, Samson Wondimu, a director at the roads ministry, said that the country's annual budget for roads had grown to reach US\$1.7 billion.

Ethiopia is Africa's second most populous country and it is one of the fastest growing economies in the world. Its Gross Domestic Product (GDP) growth has achieved double-digit figures a number of times in the past decade.

In 2017, GDP growth for the country was recorded at 7.5%, but despite this growth, rising government debt is said to be an increasingly serious issue.

## US

### Skills shortage in US 'to worsen'

Over 90% of US construction contractors are concerned about labour shortages, with just under 50% also reporting that they expect this problem to worsen in the next six months, according to data from the USG Corporation and US Chamber of Commerce Commercial Construction Index.

Despite these challenges, contractor confidence is high, with 96% reporting that they expect the demand for commercial construction services to increase in the next 12 months.

Due to President Trump's move to place a tariff on steel and aluminum, it is not surprising that many of the respondents stated that they are concerned about fluctuations in their prices.

Those contractors with concerns about steel prices jumped significantly in the second quarter to 63% — up 33% from a year ago. More than 85% of those surveyed expect US steel tariffs to have some impact on their businesses.

"The commercial construction industry is vital to the growth of the US economy. Steel and aluminum tariffs and continued workforce shortages threaten to slow the industry's growth and job creation," said Thomas J. Donohue, president and CEO of the US Chamber.

## ITALY

### Positive figures for Italy

Exports of Italian construction machinery ended the first two months of 2018 on a high note, with strong growth.

From January to February, Italian manufacturers sold machinery and equipment abroad worth €423.9 million (US\$496.2 million), up by 16.9% compared to the same period in the previous year.

This result was confirmed by SaMoTer, the exhibition dedicated to construction equipment.

The figures analysed by SaMoTer Outlook — developed in collaboration with research company Prometeia and Unacea (the association of Italian construction machinery manufacturers) — show increases in almost all sectors.

Earthmoving saw an increase of +26.6%, road building +62%, concrete +9.8%, aggregates +7.5% and tower cranes +9.5%. Exports of drilling machinery decreased slightly, by -2.7%.

Sales grew across many markets, with an increase in Western Europe of +15%, North America +30.6% and Central-Eastern Europe +35.5%. The Middle East performed especially well at +53.1% and China also saw strong growth of +34.2%. Russia enjoyed a remarkable recovery in orders, with a +267.5% increase.

## EVENTS DIARY

### 2018

#### Intermat ASEAN

Sept 6-8, 2018  
Bangkok, Thailand  
[www.asean.intematconstruction.com](http://www.asean.intematconstruction.com)

#### Concrete Asia

September 6-8, 2018  
Bangkok, Thailand  
[www.concrete-asia.com](http://www.concrete-asia.com)

#### SC&RA

#### Crane & Rigging Workshop

September 26-28, 2018  
Louisville, KY, USA  
[www.scranet.org](http://www.scranet.org)

#### World Demolition Summit

November 7-8, 2018  
Dublin, Ireland  
[www.demolitionsummit.com](http://www.demolitionsummit.com)

#### International Rental Conference (IRC)

November 26, 2018  
Shanghai, China  
[www.khl.com/irc](http://www.khl.com/irc)

#### Bauma China 2018

November 27-30, 2018  
Shanghai, China  
[www.bauma-china.com](http://www.bauma-china.com)

#### Bauma ConExpo India

December 11-14, 2018  
Delhi, India  
[www.bcindia.com](http://www.bcindia.com)

### 2019

#### World of Concrete

January 22-25, 2019  
Las Vegas, US  
[www.worldofconcrete.com](http://www.worldofconcrete.com)

#### Executive Hire Show

February 6-7, 2019  
Coventry, UK  
[www.executivehireshow.com](http://www.executivehireshow.com)

#### World of Asphalt

February 12-14, 2019  
Indianapolis, US  
[www.worldofasphalt.com](http://www.worldofasphalt.com)

#### Bauma (Munich)

April 8-14, 2019  
Munich, Germany  
[www.bauma.de](http://www.bauma.de)

#### European Rental Association

May 15-16, 2019  
Madrid, Spain  
[www.erarental.org/en/convention](http://www.erarental.org/en/convention)



**ECUADOR**

**Ecuador port breaks ground**

Work has begun on a new US\$1.3 billion deepwater port in Posorja, Ecuador, South America, starting with the dredging of what was said to be the deepest channel in the country.

Last year, DP World won a 50-year concession for the 750,000 TEU (twenty-foot equivalent unit) capacity facility, which will be located approximately 65km from Ecuador's main business city of Guayaquil.

To give access to the future port, US\$100 million is being spent on dredging 15 million cubic metres of material using three types of suction to create a 16.5m-deep and 175m-wide channel that stretches for 39km. It has been estimated that this entire process will take about 12 months before it is fully completed to the standard required.

Once this is done, DP World will also build the port terminal, a 20km road between Playas and Posorja, and the infrastructure associated with the port – all of which is expected to cost about US\$1.2 billion.

The port has been designed to accommodate cargo ships with a capacity of between 8,000 and 15,000 TEU. This is very important for a region where maritime trade was said to have been growing strongly in recent years, according to Jorge Velásquez, terminal manager at DP World.

The facility is scheduled to receive its first ships by July 2019 and then gradually increase shipping volume.

**MEXICO**

**Excavation of Mexican rail tunnel completed**

Tunnel boring machines (TBMs) have completed a 9.5km twin rail tunnel that is part of the Mexico City to Toluca Inter-urban Train project in Mexico.

Twin TBMs – called La Mexiquense and La Marquesa – worked together to extract a total of about 570,000m<sup>3</sup> of material, and as they drilled, 6,312 rings of concrete were simultaneously installed.

The full route between Mexico City and the metropolitan area of Toluca will be 58km in length, with

**US**

**Financial close for airport project**

**Consortium responsible for Los Angeles airport automated people mover project secures funding**

**F**inancial close has been reached on the Los Angeles International Airport (LAX) automated people mover project.

Valued at approximately US\$4.9 billion by Los Angeles World Airports (LAWA), the scheme includes the design, construction, commissioning, operation and maintenance of the system over a 30-year period.

The LAX Integrated Express Solutions (LINXS) joint venture responsible for the project comprises Balfour Beatty, Fluor, ACS Infrastructure Development, Hochtief PPP Solutions and Bombardier Transportation at the equity level, and Balfour Beatty, Fluor, Dragados USA and Flatiron at the design-build joint venture level.

Part of LAWA's wider Landside Access Modernisation Programme, the automated people mover will consist of a 3.6km, above-ground rail system connecting LAX passengers with the airline terminals, a new centralised car rental facility, new pickup and drop-off locations with parking facilities, and Metro's regional transit system.

The financing structure includes US\$1.3 billion in private activity bonds, US\$270 million in bank debt and private partner equity. The contract contains milestone payments for design and construction progress, and availability payments for both operations & maintenance and debt service.

Construction is scheduled to begin in the summer of 2018, it will employ an estimated 750 construction workers at its peak, and completion is expected in 2023.



**SWEDEN**

**Volvo Penta goes electric**

Volvo Penta has revealed that by 2021 it will provide electrified power solutions for both its land and sea-based business segments.

“Volvo Penta is embracing the electric transformation and will be at the forefront in delivering compelling business cases to customers using this new technology,” said Björn Ingemanson, president of Volvo Penta.

The company has restructured its organisation to accelerate the switch towards electrified power and has increased commitment to its electrification investment program. An electromobility development-and-test laboratory has also been established at its Swedish headquarters.

While the power outputs and applications of the initial electric systems are being kept confidential for the time being, the company has announced that both hybrid and all-electric solutions will be offered at the outset. Volvo Penta is already field testing early prototypes and system validation is under way.

**SYRIA**

**Lafarge SA investigated**

LafargeHolcim's French unit has been placed under formal investigation over allegations in a case relating to the operation of the Jalabiya cement plant in Syria, which was kept open as the country plunged into civil war.

An internal investigation by the company revealed that Lafarge Cement Syria provided funds to work out arrangements with a number of armed groups, which included sanctioned parties.

French authorities are investigating if Lafarge financed terrorism while sacrificing the safety of its workers by making alleged protection payments to militant groups, including Isis.

Eight former executives have already been charged with financing a terrorist group and/or endangering the lives of others over Lafarge's activities in Syria between 2011 and 2015. Lafarge merged with Holcim in 2015.

two terminals – at Zinacantepec and Observatorio – and four intermediate stations – at Pino Suárez, Tecnológico, Lerma and Santa Fe.

With a design speed of 160kph, it was said that the link will reduce travel times between the two locations to 39 minutes – compared to 55 minutes by car on the highway.

The US\$3.18 billion project is part of the Mexican government's 2014 to 2018 National Plan for Infrastructure. The plan also includes

222 other projects, financed both by the government and also through private-public-partnership (PPP) schemes

It has been estimated that 300,000 passengers will use the tunnel per day, with that number expected to increase to 500,000 by the year 2047.

Trains are due to start operating along the line in mid-2019 – around a year later than the original plan, which was for trains to begin running in 2018.

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Watch Topcon Positioning Systems President and CEO Ray O'Connor's Bloomberg "NEXT INFRASTRUCTURE" interview: [www.topconpositioning.com/Infrastructure](http://www.topconpositioning.com/Infrastructure).



HIGHLIGHTS

**US** John Deere has extended its machine warranty on all Commercial Worksite Products to two years. This coverage includes new compact tracked loaders, skid steer loaders, compact wheeled loaders and compact excavators. The standard warranty now promises that Deere will fix any defects in materials or workmanship for two years after delivery or 2,000 hours – whichever comes first. The previous standard warranty was for one year.

**AUSTRALIA** Construction contracts have been awarded for a new airport that is being built in Western Sydney, Australia. A joint venture between Landlease and CPB Contractors will carry out the initial earthworks. A contract has also been awarded to Bechtel as delivery partner and project manager.

The site – which is 1,780 hectares in size – is almost twice the size of Sydney’s current airport, Kingsford Smith. The project is scheduled to be completed by 2026.

**BRAZIL** A new date has been set for M&T Expo following the previous postponement of the show. It will now be held between 26 and 29 November, 2018. Originally due to be held in June, the show was cancelled because of a major truckers’ strike.

The show will take place at the São Paulo Expo Exhibition & Convention Center in Brazil and will be open from 1.00pm to 8.00pm on the first three days and from 9.00am to 4.00pm on last day. The dates for the new show clash with Bauma China, which will be held from 27 to 30 November.

QATAR

# Modular World Cup stadium

Demountable football stadium to be built by China International Marine Container group in Qatar

China International Marine Container group (CIMC) has been chosen to help build the Ras Abu Aboud World Cup Stadium in Qatar, where the major sports event will be held in 2022.

One of 12 venues being constructed for the Qatari World Cup, the new stadium will be built using an unusual method. It was said that the structure would be the world’s first large-scale stadium created using modified shipping containers and the first demountable, transportable and re-usable stadium in the history of the World Cup.

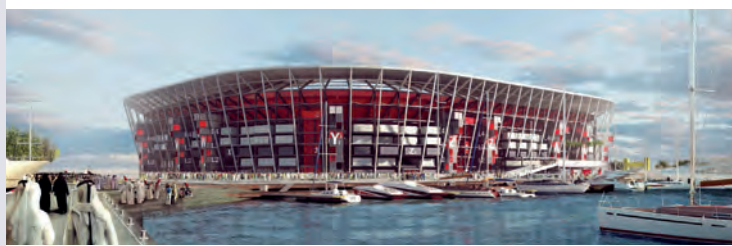
Located on a waterfront site just southeast of the capital Doha, the seven-floor stadium will cover an area of 450,000m<sup>2</sup> and will have the capacity to accommodate up to 40,000 people.

Wang Fei, project manager from CIMC, said, “As long as the construction site is sufficiently and properly flattened, the large-size and modern stadium will be easily erected with modular blocks.”

The modularity of this project is intended as a solution to the common problem that such venues cannot be used efficiently after the major sports event has taken place. The 990 container modules can be disassembled and re-used in other locations or transformed into affordable housing and temporary shelters.

In addition, Wang said, “The use of modified shipping containers as modular building blocks will reduce the construction time by three years, save materials and reduce emissions.”

Fabrication is due to begin shortly, with the modules being shipped in batches from October 2018. The assembly is scheduled to be finished by April 2019, with the entire project slated for completion by June 2020.



ZIMBABWE

# Power station upgrade

International law firm Pinsent Masons has advised on a US\$1.4 billion deal to fund the construction of two expansion units with a total capacity of 690MW at the Hwange thermal power station complex in Zimbabwe.

The Hwange expansion project is a significant milestone in the rehabilitation of the infrastructure critical to increasing Zimbabwe’s economic output, representing one of the largest foreign investments in the country in recent years.

Construction work will take up to three years, and the finished plant will supply an additional 30% to the country’s generation capacity.

Pinsent Masons represented Sinohydro Corporation, which will undertake construction of the power station and the transmission upgrades, in addition to taking a minority equity holding in the project.

UK

# Cummins adds to Stage V range

Cummins revealed its new Stage V power unit range at Hillhead 2018. Delivered as a complete package, Cummins power units comprise a Stage V engine, exhaust aftertreatment system, radiator and cooling system – as well as auxiliaries such as mounting feet, hoses and an air cleaner.

Jeroen van Ginneken, director off-highway engine sales at Cummins, said, “To complement our strong Stage V engine range we are offering a new product to make our customers’ processes easier.

“For key applications such as crushers, screeners, drills, air compressors and concrete pumps, we are providing a drop-in solution, with more than 70% of the content pre-approved for installation. This makes the integration process simpler, reducing the lead-time.”

Cummins Stage V power units are available from 75 to 503kW. The F3.8 power unit ranges from 75 to 129 kW, while the 3.8-litre engine has moved from 97kW at Stage IV to 129kW at Stage V.

## Exchange rates: July 2018

VALUE OF 1:	SYMBOL	AUS\$	BRL	UK£	CNY	€	INR	YEN	MXN	RUB	SAR	ZAR	KRW	CHF	US\$
Australian Dollar	AUS\$		0.36	0.561	4.96	0.630	50.7	83	14.00	46.1	2.78	9.86	839	0.744	0.741
Brazilian Real	BRL	2.81		0.199	1.76	0.224	18.0	29.6	4.97	16.4	0.99	3.50	298	0.264	0.263
British Pound	UK£	1.78	5.01		8.8	1.12	90.4	148	24.9	82.1	4.95	17.6	1494	1.32	1.32
Chinese Yuan	CNY	0.202	0.568	0.113		0.127	10.24	16.8	2.83	9.31	0.561	1.990	169	0.150	0.149
Euro	€	1.59	4.47	0.89	7.87		80.6	132	22.2	73.2	4.41	15.66	1332	1.18	1.18
Indian Rupee	INR	0.020	0.055	0.011	0.098	0.012		1.6	0.276	0.909	0.055	0.194	16.5	0.015	0.015
Japanese Yen	YEN	0.012	0.034	0.007	0.060	0.008	0.609		0.168	0.554	0.033	0.118	10.1	0.009	0.009
Mexican Peso	MXN	0.071	0.201	0.040	0.354	0.045	3.62	5.95		3.29	0.198	0.704	60	0.053	0.053
Russian Ruble	RUR	0.022	0.061	0.012	0.107	0.014	1.10	1.81	0.304		0.060	0.214	18.2	0.016	0.016
Saudi Riyal	SAR	0.360	1.013	0.202	1.784	0.227	18.267	29.973	5.040	16.603		3.55	302	0.268	0.267
South African Rand	ZAR	0.101	0.285	0.057	0.503	0.064	5.147	8.445	1.420	4.678	0.282		85	0.075	0.075
South Korean Won	KRW	0.001	0.003	0.001	0.006	0.001	0.060	0.099	0.017	0.055	0.003	0.012		0.001	0.001
Swiss Franc	CHF	1.34	3.78	0.75	6.66	0.85	68.23	111.95	18.82	62.01	3.74	13.26	1128		0.996
US Dollar	US\$	1.35	3.8	0.758	6.69	0.85	68.5	112.4	18.9	62.26	3.75	13.31	1132.3	1.004	

For example US\$ 1 = AUS 1.35

# A growing economy, but not without challenges

China's economic momentum is healthy but a potential trade war with the US, as well as problems with state bank lending to private companies, means that growth in the future will likely be more moderate than the country has previously experienced, reports **Scott Hazelton** from IHS Global

China's near-term economic momentum has remained healthy over the first half of the year. Output growth in the industrial sector has bounced back, although service sector output growth has slowed. Mining production continues to decline, but output growth in high technology industries has been strong, with year-over-year growth for new-energy vehicles at 82% and industrial robotics at 35%.

The concern is that fixed investment growth continues to decelerate, down to 7.0% year-over-year in April, compared with 7.5% over the first quarter. While government-driven infrastructure spending remains an engine of investment expansion, there are signs that the government is retreating from such policy. Infrastructure investment through April grew 12.4%, down 0.6% from March, the fourth consecutive month of deceleration. Housing sales growth ground to a halt in April, at a mere 0.4%, down from 2.5% through March.

The current trade dispute between the US and China should end with a deal because the US-China relationship is 'too big to fail', although the risk of a trade war should not be overlooked. The White House's different factions have different trade policy objectives, and ambiguous objectives could lead to miscalculations from China. Meanwhile, the Xi Jinping government cannot afford to show weakness to foreign pressure, given rising nationalism in China.

## Tariffs

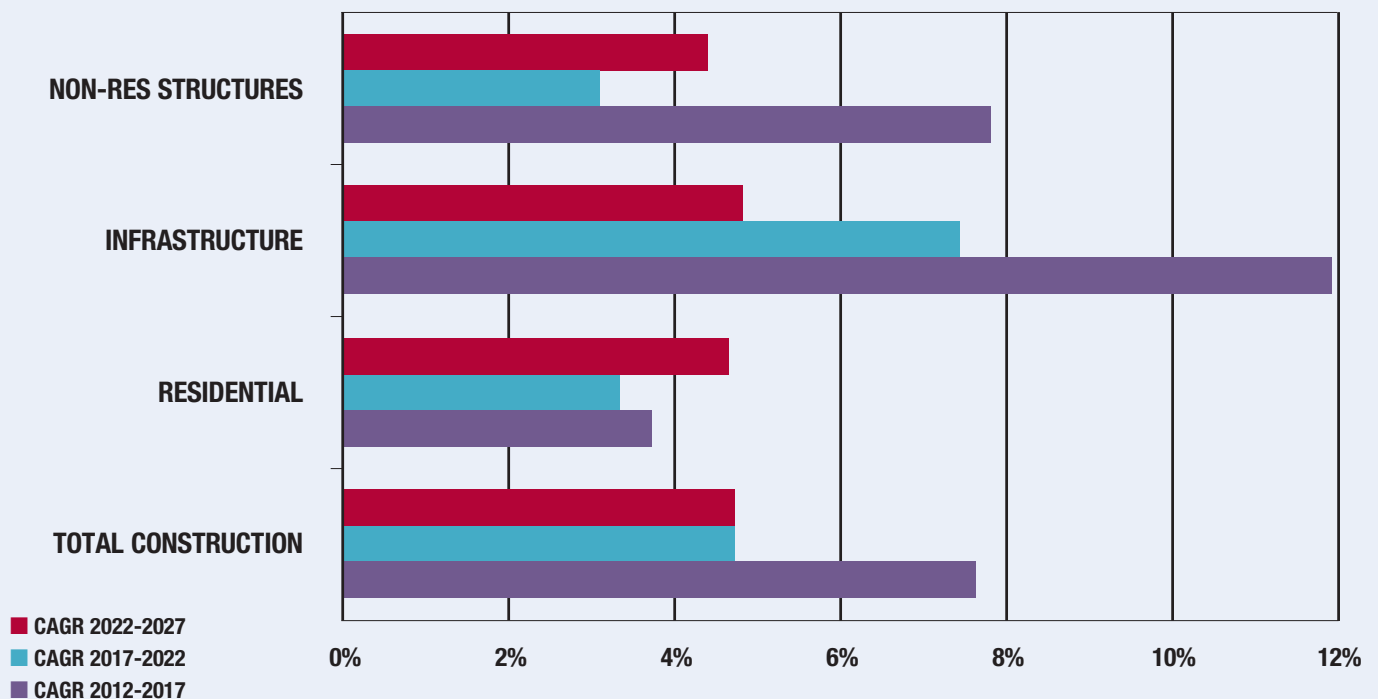
China will most likely impose precise, surgical tariffs targeting specific sectors and voting districts that would ramp up political pressure on President Trump. The Chinese government could also pressure some high-profile US companies by utilising official measures (such as regulatory harassment) and unofficial means (such as inciting a market boycott). China is

also likely to offer market-opening concessions in sectors that fit into the country's structural reform plans.

China's economy in the medium-term faces sizable challenges. Export growth beyond the near-term recovery will likely be subdued, as demand from China's major markets of the US and Western Europe will grow only modestly. While China's consumer demand has long been suppressed and could offset the slack from exports, household demand weakness is structural in nature and unlikely to be corrected quickly. Without strong export or consumer demand, business conditions in China will make it difficult to support robust growth in private investment.

Moreover, should business conditions slump, even the government will find it difficult to sustain rapid state investment expansion, given that fiscal conditions will inevitably deteriorate. Banks rule China's financial system, while the

## Chinese Construction Outlook by Sector



stock and bond markets only account for a minor share.

State banks dominate the banking system, and they have a bias against lending to private firms. As a result, private firms resort to saving, as well as borrowing through unconventional channels at high interest rates. Many private firms are ready to move up the value-added chain, from labor-intensive production requiring low-level investment to capital-intensive activities that require much higher-level investment. The banking sector's bias for state-owned firms is the root of the bad-loan problem, which also constrains China in opening its capital accounts, preventing the country from fully utilising available foreign capital to finance its investment needs. These structural problems endanger China's long-term economic potential.

**Past excesses**

Residential construction remains constrained by the excesses of past years by China's financial condition. Chinese residential construction expanded 2.1% in 2017, and the recent data suggests only a modest improvement to 2.4% growth in 2018, with only another minor acceleration to 2.8% in 2019.

As financial markets stabilise, growth will improve with a 3.3% compound annual growth rate (CAGR) between 2017 and 2022. In the longer run, residential construction spending

will continue to grow at a 4.7% CAGR from 2022 to 2027, as the number of households expands from 460 million in 2018 to 522 million in 2028.

Non-residential construction spending is also weak, growing at 2.4% in 2017, and accelerating as modestly as residential with 2.6% growth in 2018 and 2.5% in 2019. Five-year compound growth will improve to a still weak (by Chinese historical standards) 3.1%. The weakest component of this segment is industrial (1.8%) as excess capacity issues weigh, especially on heavy industries. Even in more growth-oriented industries, such as communications and electronics, cheaper competition elsewhere in Asia has eroded China's market presence.

**Slowing growth**

Real infrastructure construction spending in China yielded healthy, if decelerating, growth of 11.6% in 2017. Spending on water and sewer infrastructure drove this growth, with gains of 23.2%, while the slowest segment was transportation construction, which still advanced 11.9%. Infrastructure construction spending is on track to increase by 9.3% in 2018 and 8.9% in 2019 – strong growth by global standards, but deceleration in the main driver of Chinese construction spending is a concern.

China continues to experience slowing growth in GDP, and this will translate into slowing

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construction growth. Indeed, China has dropped out of the top 15 growth countries in the Global Construction Service for the first time since the product was introduced nearly 15 years ago. However, the country's needs suggest that its growth phase will last a considerable time, albeit at slowing rates. China remains an attractive market with long-term growth potential, but the margin for error has diminished and attention to specific opportunities has become more important than ever before. **IC**



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# A region of rising ambitions

Reporting on construction in Asia Pacific, **Thomas Allen** finds that the scale of some of the projects beggars belief

**W**hile Japan is the land of the rising sun, Asia Pacific is the region of rising ambitions. The Asian Tigers and their Tiger Cubs – as the most dominant and quickly developing economies in the region are known – continue to break records with their mega construction projects.

Perhaps chief among them is China, whose economy picked up pace again in 2017 after dipping to a 26-year low of 6.7% GDP (gross domestic product) in 2016, according to a report by professional services company Turner & Townsend. However, for 2018, the Chinese government has slightly lowered its growth target to 6.5%, as it focuses on deleveraging, containing debt and controlling financial risk.

The outlook for the construction industry in Beijing and Shanghai, in particular, looks bright, with the trend for migration from rural to urban areas expected to fuel the demand for urban development. This, combined with the government's desire to mitigate financial risk, means that infrastructure investment is set to surge this year.

## Record-breaking

One example of the record-breaking scale of development in China is the Shanghai-Nantong Yangtze River Bridge, which is currently under construction in Jiangsu Province, north of Shanghai, and is set to be the world's largest cable-stayed bridge. The south bridge will be a cable-stayed structure that spans the one-kilometer-wide main channel of the Yangtze River, while the north bridge will cross the Tiansheng Port channel.

Measuring a total of 11km in length, the double-decker bridge will have a six-lane highway on its upper level and a four-line railway on the lower.

A cofferdam, said to be one of the largest and deepest ever built, will house the 325m-tall pylons – another world record for any cable-stayed bridge. The enclosed area will be equivalent to 12 basketball courts and it will have a depth of 115m. Meanwhile, each of the pylons will use approximately 147,000m<sup>3</sup> of concrete. Due for completion in 2019, this traffic link is part of an effort to create a new economic zone around Shanghai.

The Hong Kong economy also experienced fast economic growth in 2017, with GDP expanding by 3.7%, and



**One of the record-breaking 325m-tall pylons of the Shanghai-Nantong Yangtze River Bridge**

“ **Bright outlook for the construction industry in Beijing and Shanghai** ”

this is expected to be almost matched in 2018 by 3.5% growth.

Last year, the new Hong Kong Special Administration Region (HKSAR) chief executive Carrie Lam put an emphasis on boosting housing and infrastructure. With tourism recovering, construction has begun on an US\$18 billion expansion project to provide a new terminal and third runway at Hong Kong airport by 2024.

For this project, a joint venture led by Leighton Asia – part of Australian construction group Cimic – was chosen to carry out AUS\$390 million (US\$288.6 million) worth of foundation and substructure works for Terminal 2 – after also being previously selected for a contract for Terminal 1.

The contract is for the construction of two annex buildings and associated viaducts, the Terminal 2 basement, south



One of the designs for the new National Stadium to be built in Tokyo for the 2020 Olympic Games

annex building structures, diaphragm walls, utility services and other advance works, which are slated for completion by December 2021.

With the feeling that almost any scheme that the Chinese government gets behind can be achieved, it is inevitable that China's ambitions spill out beyond its borders. The clearest embodiment of this is the One Belt, One Road (OBOR) initiative – a modern iteration of the ancient Silk Road trade route between East and West. However, with China extending its influence, tensions are being created in the Asia Pacific region as countries compete for investment opportunities.

### Competing loans

So, while China has recently approved a \$1 billion loan for a major highway project in Sri Lanka, Japan has green-lighted a loan for an \$88 million highway development in the Philippines.

The loan to Sri Lanka – to be provided through the Export-Import Bank of China – will enable the first section of the long-delayed road between Colombo and Kandy to be build. However, Colombo is recognised as a key hub for Indian cargo and Beijing has been accused of developing facilities around the Indian Ocean to secure its own economic interests and increase its influence in order to counter that of India. Other Sri Lankan megaprojects funded by China include the Colombo Port City and the Hambantota Port and Industrial Park.

Meanwhile, Japan's loan to the Philippines will see the expansion of a road in the country's Bulacan province. It will enable the construction of the third phase of the Arterial Road Bypass Project – a 24km arterial road that will link the North Luzon Expressway in Balagtas with the Philippines-Japan Friendship



Artistic rendering of the new port of Patimban to be built in Java using Japanese funding

### Preparations for the Tokyo Olympics 2020 are boosting construction

Highway in San Rafael. Counterpart funding of \$15 million will be provided by the Philippines' Department of Finance.

Phases one and two of the project were also financed with official development assistance loans from Japan, signed in 2004 and 2012.

The Japanese government has also agreed to provide \$1 billion to Indonesia for the construction of a new port in Java. Located about 120km east of the country's capital Jakarta, in the Subang Regency, West Java, the Port of Patimban is intended to ease the pressure on the Port of Tanjung Priok, which has been experiencing heavy traffic but cannot expand because it is hemmed in by Jakarta.

As well as relieving some of the burden on the Port of Tanjung Priok, the new port will provide the nucleus for a special economic zone, and it will reduce the cost of logistics by bringing infrastructure closer to the manufacturing industry.

Chandra Irawan, Indonesia's director of ports, said that Japanese firms' technical ability would be useful in building the port. Due to the type of soil at the site, double casting will be required to make a strong dock, and Japan was said to have contractors that are capable of such work.

Stage one, phase one of construction is due to be completed by 2019, with the aim to accept the first ships in March of that year. The whole project is scheduled for completion by 2027.

### Japan to welcome the world

The Japanese economy has been expanding, with 1.7% GDP growth expected for 2017 – and that growth is set to continue into 2018.

Preparations for the Tokyo Olympics 2020 are boosting >



Artistic impression of the third runway to be built at Hong Kong airport



**Sumitomo Forestry has developed plans to build the world's tallest timber structure in Tokyo**



## Embracing the digital

Aurecon supports adoption of new technology

**A**lthough Building Information Modelling (BIM) is more than 20 years old, the approach is still in the early stages of adoption in Asia due to a lack of understanding of its benefits, according to Phil Lazarus, digital practice leader at engineering and infrastructure advisory company Aurecon.

With BIM, Lazarus said, "A building's design, services, construction methods and daily operations are represented in a single, dynamic package, bringing closer co-ordination between all parties."

This offers significant benefits, from improved accuracy and quality to better planning, meaning that the cost to a company of enhancing in-house BIM capabilities can easily be recouped, according to Lazarus.

"It is essential that Asia embraces BIM fully if it is serious about reaching its goals in terms of infrastructure development. That is why Aurecon has set up its Regional Centre of Excellence for Digital Engineering in Singapore," Lazarus added.

The new centre is strategically located in Singapore, at the heart of the Association of Southeast Asian Nations (ASEAN) and within striking distance of North Asia.

As an extension of the company's Digital Futures team, it will focus on three key areas over the next three years: Artificial Intelligence (AI) and data analytics; the Internet of Things (IoT); and visualisation and digital collaboration. The overall goal is to accelerate the development of digital engineering capabilities in Singapore and the wider Asian market.



**Phil Lazarus,**  
digital practice  
leader at Aurecon

construction. A large national stadium is underway for completion in 2019, along with six other sports complexes – though the design has had to be altered to make it more affordable. In addition to this, Japan is hosting the 2019 Rugby World Cup and, as a result, is investing in a number of stadium upgrades.

Another significant development connected with the Olympics is the New Shinagawa Railway Station, which is being built to service the Yamanote Loop line and the Keihin-Tohoku line ahead of the major international sporting event.

However, skills shortages and rising costs continue to remain challenges for the Japanese construction industry, and there is the possibility of a small post-Olympic slump, according to the Turner & Townsend report. Yet, the outlook remains positive as Japan continues to promote innovation.

One example of this innovation is the world's tallest wooden building, for which plans have been developed by Sumitomo Forestry in Tokyo, Japan. At 350m in height, the high-rise will have 70 storeys and a total floor space of 455,000m<sup>2</sup> dedicated to a mix of shops, offices, hotels and residential property.

The building will be 90% wooden, using about 185,000m<sup>3</sup> of timber in total, and a braced tube structure will be used, in which steel frame vibration control braces are positioned inside a column-and-beam structure. This helps to prevent deformation of the building in the event of earthquakes and high winds.

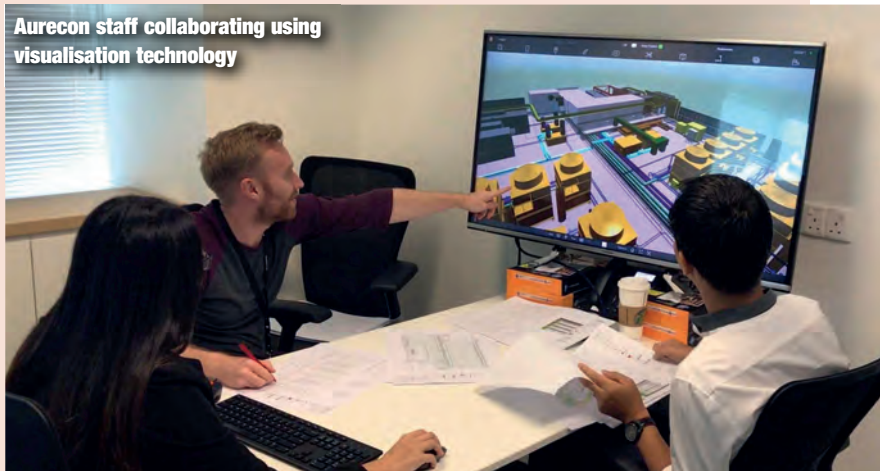
It has been estimated that the project will come to a total cost of JPY600 billion (US\$5.6 billion), which is about double that of a high-rise building constructed using conventional materials and technology. However, it is expected that technological development over time will bring that cost down. The building is expected to be completed in 2041.

### Reach for the sky

What was said to be the tallest building on the Indochina Peninsula – and the 14th tallest building in the world – was recently completed in Ho Chi Minh City, Vietnam.

Standing 461.2m tall, Landmark 81 required some serious foundations. The Vietnam-based construction company Coteccons was involved in what was said to be the country's largest concrete pour. It involved the

**Aurecon staff collaborating using visualisation technology**



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excavation of 25,000m<sup>3</sup> of soil, the installation of 6,500 tonnes of reinforced steel, and the use of 17,000m<sup>3</sup> of concrete to create the 8.5m-thick pile cap for the tower's foundations.

Since safety was such a key concern on this large-scale project, a purpose-built jump form system was used to construct the building's 81 floors. The system, considered the safest option from the perspectives of both constructability and worker safety, allowed a typical floor build cycle time of between just three and four days.

This is one of a number of large construction projects in Vietnam, along with the \$1 billion Thu Thiem Smart City

**Landmark 81 in Ho Chi Minh City, Vietnam, was said to be the tallest building on the Indochina Peninsula**

scheme in Ho Chi Minh City, the \$800 million investment in metro lines in the city, and the planned \$16 billion Long Thanh International Airport project. With the country's rapid population growth, the government is prioritising infrastructure improvement.

There is good momentum in the Vietnamese construction industry, according to the Turner & Townsend report, which is forecast to carry on through to 2021, sustained by strong economic growth – GDP grew by 6.2% in 2017 – and public investment in infrastructure and housing.

### Australian connections

The report also suggested that investment in infrastructure has been a focus in Australia, where road, rail and tunnelling projects have been ramping up.

WestConnex, the country's largest transport infrastructure project at AUD\$16.8 billion (US\$12.4 billion), is currently under construction to improve the transport network in Sydney.

So far, the M4 between Parramatta and Homebush has been widened and the pre-existing road surface smoothed at a total cost of AUS\$497 million (US\$367.4 million), and the on- and off-ramps at the King Georges Road M5 Interchange have been lengthened at a cost of AUS\$131 million (US\$96.8 million)

Sydney Motorway Corporation, which has overall responsibility for the scheme, has yet to extend the M4 in twin underground tunnels between Homebush and Haberfield, which it has been estimated will cost AUS\$3.8 billion (US\$2.81 billion), and to create new M5 underground tunnels running between St Peters and Kingsgrove at a cost of AUS\$4.34 billion (US\$3.21 billion). These tunnels will then be connected via the M4 to M5 Link tunnel.

A bypass will also be built around the city's central business district, and connections will be created to the future Western Harbour Tunnel, BeachesLink and F6 extension. Over the course of the WestConnex project, it was said that approximately 10,000 jobs would be created.

“ Investment in infrastructure has been a focus in Australia ”

## Vinci's presence in Asia

### Vinci Energies acquires Wah Loon Engineering

**V**inci Energies, a subsidiary of Vinci that specialises in energy, and information and communication technology services, has acquired Wah Loon Engineering.

The Singapore-based company specialises in the design, supply, installation, testing, commissioning and maintenance of electrical and mechanical projects.

With nearly 360 employees – 315 in Singapore and 45 in Malaysia – it expects to generate SGD125 million (US\$152 million) in revenue in 2018, mainly in the construction of data centres, as well as industrial, commercial and residential developments.

This acquisition is reflective of Vinci Energies' strategy to deploy more business activities in Asia Pacific, where the group is already operating in New Zealand, Australia, Indonesia and India.

Yves Meignié, chairman and CEO of Vinci Energies, said, “With Wah Loon, we acquire the market leader of data centre construction in Singapore. Thus, Vinci Energies strengthens its activities outside of Europe and will be able to pursue the development of its business in Asia Pacific.”



**Yves Meignié**

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# The global top 200

The league table of the world's biggest construction contractors reflects a positive overall year for the construction industry and sees China-based companies strengthening their position at the top of the list, reports **Andy Brown**

In the latest edition of the *International Construction* top 200 list, there is no change at the very top of the table, with the top six firms all staying in the positions they occupied last year. Chinese firms once again dominate proceedings, occupying all four top spots.

With construction in China experiencing a strong year in 2017 – equipment sales in 2017 increased by an astonishing 82% to take units sold to over 200,000 for the first time since 2014 – their continued presence at the top comes as no surprise. Indeed, it mirrors the results of the Yellow Table (*International Construction's* listing of the top 50 equipment manufacturers by revenue) in which Chinese companies saw the biggest growth. Chinese construction growth is expected to continue for the next few years, albeit at a slower rate than in 2017.

The top players have increased their dominance of the table, with the number one ranked construction contractor by revenue, China State Construction and Engineering, increasing their revenue from \$141.5 billion to \$164 billion. In second position is China Railway group, which has broken into three figures in terms of billions, increasing revenues from \$95.6 billion to \$101.4 billion, a good year in anyone's book.

Three Chinese companies dropped down places, but do not expect the top four on the list to move from their positions any time soon. The combined revenue for the Chinese firms is over \$517 billion, which represents just under a third of the revenues of the whole table.

Chinese firms boasted an average operating profit of \$3.6 billion, which equates to just over 5%. The data shows that China-based contractors on the list, on average, had a head count of over 120,000 employees.

Vinci retains its place at number five and sees decent growth from \$42.6 billion to \$49.8 billion. The French company is followed by two more European firms in the form of ACS from Spain and Bouygues from France (who move from nine last year to seven) before – you've guessed it – we get another China-

	(US\$ million) SALES	COMPANY	COUNTRY	2017 CHANGE	WEBSITE
1	164044	<b>China State Construction &amp; Engineering (CSCEC)*</b>	China	1 ↻	www.cscec.com.cn
2	101425	<b>China Railway Group</b>	China	2 ↻	www.crec.cn
3	99556	<b>China Railway Construction Corporation</b>	China	3 ↻	www.crcc.cn
4	70821	<b>China Communications Construction</b>	China	4 ↻	www.crbc.com
5	49849	<b>Vinci</b>	France	5 ↻	www.vinci.com
6	42559	<b>ACS</b>	Spain	6 ↻	www.grupoacs.com
7	40127	<b>Bouygues' Construction Divisions</b>	France	9 ↻2	www.bouygues.com
8	35622	<b>Metallurgical Corporation of China (MCC)</b>	China	7 ↻1	www.mccchina.com
9	32900	<b>Bechtel*</b>	US	8 ↻1	www.bechtel.com
10	27598	<b>Hochtief</b>	Germany	10 ↻	www.hochtief.de
11	22224	<b>Shanghai Construction Group</b>	China	11 ↻	www.scg.com.cn
12	19884	<b>Sekisui House</b>	Japan	13 ↻1	www.sekisuihouse.co.jp
13	19520	<b>Fluor</b>	US	12 ↻1	www.fluor.com
14	18999	<b>Skanska</b>	Sweden	14 ↻	www.skanska.com
15	18613	<b>Eiffage</b>	France	19 ↻4	www.eiffage.fr
16	17501	<b>Obayashi</b>	Japan	16 ↻	www.obayashi.co.jp
17	16851	<b>Kajima Corporation</b>	Japan	15 ↻2	www.kajima.co.jp
18	16660	<b>Larsen &amp; Toubro E&amp;C</b>	India	38 ↻20	www.larsentoubro.com
19	16653	<b>China Gezhouba</b>	China	18 ↻1	www.cggc.ceec.net.cn
20	16473	<b>Strabag</b>	Austria	22 ↻2	www.strabag.com
21	15723	<b>Hyundai Engineering &amp; Construction</b>	South Korea	17 ↻4	www.hdec.co.kr
22	15085	<b>TechnipFMC</b>	UK	20 ↻2	www.technip.com
23	14888	<b>Ferrovial</b>	Spain	26 ↻3	www.ferrovial.es
24	14599	<b>Taisei Corporation</b>	Japan	23 ↻1	www.taisei.co.jp
25	14091	<b>D R Horton</b>	US	24 ↻1	www.drhorton.com
26	13991	<b>Shimizu Corporation</b>	Japan	21 ↻5	www.shimz.co.jp
27	13523	<b>Doosan Heavy Industries &amp; Construction</b>	South Korea	25 ↻2	www.doosanheavy.com
28	13016	<b>Lendlease Group</b>	Australia	27 ↻1	www.lendlease.com.au
29	12650	<b>Lennar</b>	US	31 ↻2	www.lennar.com
30	11486	<b>Daelim</b>	South Korea	44 ↻14	www.daelim.co.kr
31	11202	<b>Takenaka Corporation</b>	Japan	28 ↻3	www.takenaka.co.jp
32	11200	<b>Cal Atlantic Group</b>	US	48 ↻16	www.calatlantichomes.com
33	10956	<b>Daewoo Engineering &amp; Construction</b>	South Korea	33 ↻	www.dwconst.co.kr
34	10875	<b>GS Engineering &amp; Construction</b>	South Korea	34 ↻	www.gsconstir.co.kr
35	10679	<b>Chicago Bridge &amp; Iron</b>	US	32 ↻3	www.cbi.com
36	10568	<b>Saipem</b>	Italy	29 ↻7	www.saipem.it
37	10445	<b>CIMIC Group</b>	Australia	37 ↻	www.cimic.com.au
38	10022	<b>Jacobs Engineering</b>	US	30 ↻8	www.jacobs.com
39	8845	<b>Acciona</b>	Spain	46 ↻7	www.acciona.es
40	8700	<b>Peter Kiewit</b>	US	36 ↻4	www.kiewit.com
41	8511	<b>Balfour Beatty</b>	UK	35 ↻6	www.balfourbeatty.com
42	8464	<b>PulteGroup</b>	US	42 ↻	www.pultegroupinc.com
43	8052	<b>Bam Group</b>	Netherlands	40 ↻3	www.bam.nl
44	7687	<b>Emcor Group</b>	US	43 ↻1	www.emcorgroup.com
45	7488	<b>Haseko</b>	Japan	45 ↻	www.haseko.co.jp
46	7473	<b>Spie</b>	France	61 ↻15	www.spie.eu
47	7243	<b>Salini Impregilo</b>	Italy	50 ↻3	www.impregilo.it
48	7227	<b>SNC-Lavalin</b>	Canada	52 ↻4	www.snc-lavalin.com
49	7076	<b>FCC</b>	Spain	47 ↻2	www.fcc.es
50	6968	<b>VolkerWessels</b>	Netherlands	53 ↻3	www.volkerwessels.com
51	6657	<b>JGC</b>	Japan	49 ↻2	www.jgc.com
52	6576	<b>NCC Group</b>	Sweden	51 ↻1	www.ncc.se
53	6405	<b>China State Construction International Holding</b>	Hong Kong	56 ↻3	www.csci.com.hk

	(US\$ million)	COMPANY	COUNTRY	2017 CHANGE	WEBSITE
54	6205	<b>NVR</b>	US	59 ↻5	www.nvrinc.com
55	6179	<b>Tecnicas Reunidas</b>	Spain	67 ↻12	www.tecnicasreunidas.es
56	6130	<b>Petrofac</b>	UK	39 ↻17	www.petrofac.com
57	6032	<b>Peab</b>	Sweden	65 ↻8	www.peab.se
58	5815	<b>Toll Brothers</b>	US	68 ↻10	www.tollbrothers.com
59	5741	<b>Barratt Developments</b>	UK	62 ↻3	www.barratthomes.co.uk
60	5522	<b>Whiting-Turner Contracting</b>	US	60 ↻	www.whiting-turner.com
61	5235	<b>Porr</b>	Austria	86 ↻25	www.porr.at
62	5155	<b>Samsung Engineering</b>	South Korea	55 ↻7	www.samsungengineering.co.kr
63	5138	<b>Sinohydro</b>	China	80 ↻17	www.sinohydro.com
64	5075	<b>Kier Group</b>	UK	64 ↻	www.kier.co.uk
65	4932	<b>Bilfinger</b>	Germany	71 ↻6	www.bilfingerberger.de
66	4895	<b>Taylor Wimpey</b>	UK	70 ↻4	www.taylorwimpey.com
67	4852	<b>Penta-Ocean Construction</b>	Japan	72 ↻5	www.penta-ocean.co.jp
68	4831	<b>Gilbane Building</b>	US	85 ↻17	www.gilbaneco.com
69	4817	<b>Ackermans &amp; Van Haaren</b>	Belgium	66 ↻3	www.avh.be
70	4757	<b>Tutor Perini</b>	US	69 ↻1	www.tutorperini.com
71	4704	<b>Chiyoda</b>	Japan	63 ↻8	www.chiyoda-corp.com
72	4670	<b>Kandenko</b>	Japan	75 ↻3	www.kandenko.co.jp
73	4610	<b>Kinden</b>	Japan	73 ↻	www.kinden.co.jp
74	4532	<b>Fayat Group</b>	France	84 ↻10	www.fayat.com
75	4368	<b>KB Home</b>	US	92 ↻17	www.kbhome.com
76	4318	<b>Lotte Engineering &amp; Construction</b>	South Korea	93 ↻17	www.lottecon.co.kr
77	4307	<b>Maeda Corporation</b>	Japan	82 ↻5	www.maeda.co.jp
78	4271	<b>Maire Tecnimont</b>	Italy	124 ↻46	www.mairetecnimont.com
79	4225	<b>Persimmon</b>	UK	79 ↻	www.persimmonhomes.com
80	4171	<b>KBR</b>	US	77 ↻3	www.kbr.com
81	4089	<b>Nexity</b>	France	102 ↻21	www.nexity.fr
82	4037	<b>Implenia</b>	Switzerland	100 ↻18	www.implenia.com
83	3976	<b>Ed Züblin</b>	Germany	87 ↻4	www.zueblin.de
84	3951	<b>Toda</b>	Japan	74 ↻10	www.toda.co.jp
85	3947	<b>Interserve</b>	UK	78 ↻7	www.interserveplc.co.uk
86	3922	<b>Obrascon Huarte Lain</b>	Spain	76 ↻10	www.ohl.es
87	3916	<b>Laing O'Rourke</b>	UK	98 ↻11	www.laingorourke.com
88	3843	<b>Sumitomo Mitsui Construction</b>	Japan	89 ↻1	www.smcon.co.jp
89	3813	<b>Veidekke</b>	Norway	97 ↻8	www.veidekke.no
90	3771	<b>Sacyr Vallehermoso</b>	Spain	105 ↻15	www.sacyr.com
91	3739	<b>Compagnie D'Entreprises CFE SA</b>	Belgium	111 ↻20	www.cfe.be
92	3721	<b>Nippo</b>	Japan	91 ↻1	www.nippohodo.co.jp
93	3600	<b>Walsh Group*</b>	US	95 ↻2	www.walshgroup.com
94	3578	<b>Misawa Homes</b>	Japan	88 ↻6	www.misawa.co.jp
95	3540	<b>Hensel Phelps*</b>	US	107 ↻12	www.henselphelps.com
96	3536	<b>Mostotrest</b>	Russia	126 ↻30	www.mostotrest.ru
97	3522	<b>Astaldi</b>	Italy	106 ↻9	www.astaldi.it
98	3498	<b>Consolidated Contractors Company (CCC)*</b>	Greece	58 ↻40	www.ccc.gr
99	3473	<b>Hazama Ando</b>	Japan	122 ↻23	www.ad-hzm.co.jp
100	3447	<b>Morgan Sindall</b>	UK	96 ↻4	www.morgansindall.co.uk
101	3444	<b>Kumagai Gumi</b>	Japan	108 ↻7	www.kumagaigumi.co.jp
102	3338	<b>Galliford Try</b>	UK	99 ↻3	www.gallifordtry.co.uk
103	3337	<b>Berkeley Group</b>	UK	109 ↻6	www.berkeleygroup.com
104	3311	<b>PanaHome</b>	Japan	103 ↻1	www.panahome.jp
105	3265	<b>McCarthy Building*</b>	US	118 ↻13	www.mccarthy.com
106	3241	<b>Meritage Homes</b>	US	112 ↻6	www.meritagehomes.com
107	3207	<b>Black &amp; Veatch</b>	US	114 ↻7	www.bv.com
108	3167	<b>Mota-Engil</b>	Portugal	130 ↻22	www.mota-engil.pt
109	3158	<b>Bellway</b>	UK	110 ↻1	www.bellway.co.uk
110	3091	<b>Toyo Engineering (TEC)</b>	Japan	83 ↻27	www.toyo-eng.co.jp
111	3026	<b>Clark Construction*</b>	US	81 ↻30	www.clarkconstruction.com
112	3026	<b>Goldbeckbau</b>	Germany	136 ↻24	www.goldbeckbau.de
113	2989	<b>Granite Construction</b>	US	129 ↻16	www.graniteconstruction.com

## Global trends

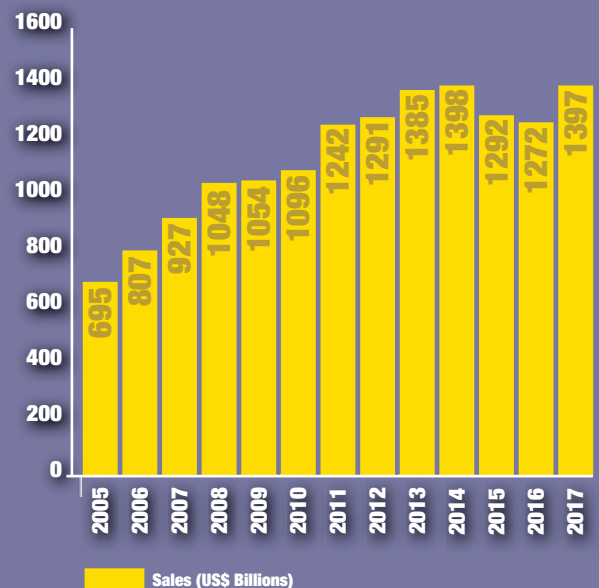
Revenue roundup for the top 100 on the list

The global construction league table is based on revenues achieved in 2017 by the top 200 contractor companies. However, please note that the graph below only looks at the sales and profitability for the top half of the list – so the top 100 companies.

The total sales for the top 100 contractors combined is just under \$1.397 trillion, a decent increase from last year when it was \$1.292 trillion. Since 2005 the high point remains (just) 2014 when the total was \$1.398 trillion. The lowest figure occurred in 2005, when the sales was \$695 billion – roughly half of the total as it stands at today.

In order to ensure that the figures are as accurate as possible, an average estimation has been taken for all of the currencies used before they were converted into dollars. The average trading price of, for example, the Euro, up until 1 June for the year was calculated to try and gain as accurate a picture as possible.

The fact that the US dollar has – aside from a few fluctuations – been relatively strong in 2017 will have an influence on the final figures when converting Euros, Chinese Yuan and other currencies.



based company in the top ten, Metallurgical Corporation. There is one US-based company in the top ten, Bechtel, at number nine, before Germany-based Hochtief round up the top ten.

### Big movers

This year there are seven new companies on the list, the same number as last year. Some of these new entries were expected, due to a merger between two companies on the list last year, and a collapse. The collapse is, of course, UK-based Carillion, which entered compulsory liquidation in January 2018 having failed in its attempt to persuade stakeholders to provide help. In last year's table, Carillion appeared at number 58 with sales of \$5.9 billion, and the company employed approximately 43,000 people.

The merger was between Finish companies YIT Corporation and Lemminkäinen Corporation, which took effect from February 2018. The two companies were 156<sup>th</sup> and 157<sup>th</sup> in last year's table and the merger – Lemminkäinen into YIT – means that the company jumps to 131 on the list. Another merger took place between Cal Atlantic and Lenar Corporation, which helps to explain Cal Atlantic's strong jump from 48<sup>th</sup> to 32<sup>nd</sup>.

\* = estimate

# Analysis by country

Which country's contractors performed the best in 2017?

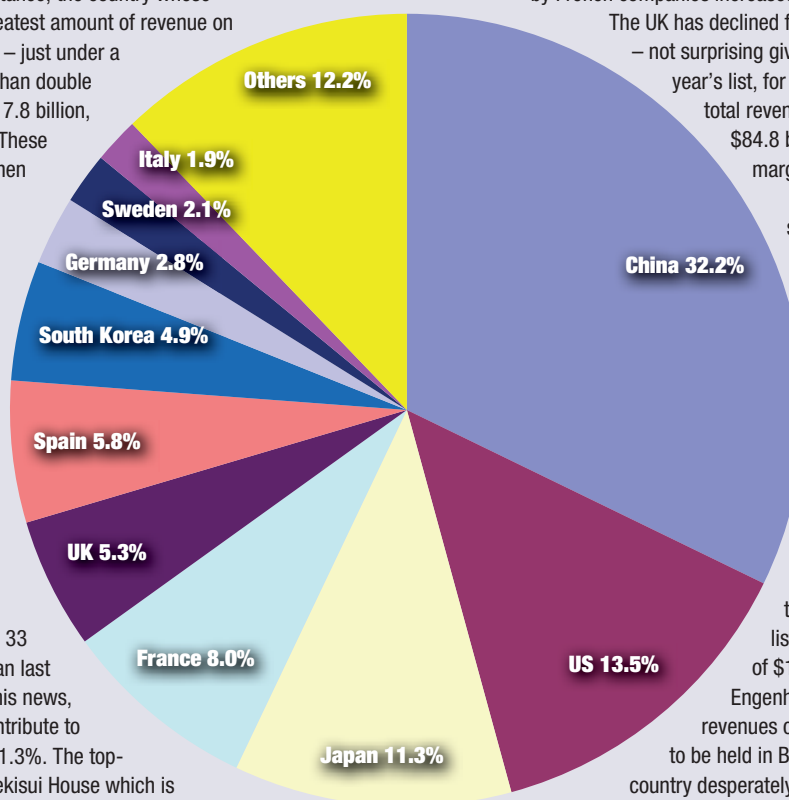
COUNTRY	NO. OF COMPANIES	NEW	UP	DOWN	SAME	TOTAL SALES (US\$ mill.)	% OF TOTAL	AVERAGE SALES (US\$ mill.)	AVERAGE HEADCOUNT	AVERAGE SALES/EMPLOYEE (US\$)
China	9	-	1	3	5	517,988	32.2%	57,554	140,014	\$411,060
US	34	-	17	14	3	217,851	13.5%	6,407	11,972	\$535,192
Japan	33	-	14	14	5	181,930	11.3%	5,513	6,348	\$868,501
France	8	-	7	-	1	128,657	8.0%	16,082	55,941	\$197,821
UK	21	-	8	11	2	85,925	5.3%	4,092	10,254	\$399,033
Spain	10	1	6	2	1	92,955	5.8%	9,295	46,422	\$200,238
South Korea	10	-	4	4	2	78,741	4.9%	7,874	5,495	\$1,432,937
Germany	7	1	5	-	1	45,076	2.8%	6,439	18,178	\$354,243
Sweden	4	-	2	1	1	33,688	2.1%	8,422	18,786	\$448,300
Italy	7	-	6	1	-	29,787	1.9%	4,255	14,274	\$298,104
Netherlands	8	1	3	4	-	27,166	1.7%	3,396	8,574	\$396,033
Australia	3	-	-	2	1	25,739	1.6%	8,580	22,566	\$380,204
Austria	3	-	3	-	-	24,030	1.5%	8,010	32,996	\$380,204
Canada	3	-	2	1	-	11,220	0.7%	3,740	20,073	\$186,310
Belgium	5	-	3	2	-	15,678	1.0%	3,136	8,841	\$354,659
India	3	-	2	1	-	19,374	1.2%	6,458	18,893	\$341,819
Greece	3	-	2	1	-	7,219	0.4%	2,406	39,219	\$61,354
Turkey	3	-	1	2	-	6,654	0.4%	2,218	23,773	\$93,294
Norway	2	-	2	-	-	5,543	0.3%	2,772	5,752	\$481,864
South Africa	3	-	2	1	-	6,333	0.4%	2,111	15,825	\$133,405
Russia	3	-	3	-	-	6,907	0.4%	2,302	17,410	\$132,251
Finland	2	1	1	-	-	3,772	0.2%	1,886	3,271	\$576,663
Brazil	2	2	-	-	-	2,642	0.2%	1,321	12,853	\$102,778
Mexico	1	1	-	-	-	1,218	0.1%	1,218	687	\$1,773,127
Others	13	0	11	2	-	32,094	2.0%	2,469	-	-
<b>ALL</b>	<b>200</b>	<b>7</b>	<b>105</b>	<b>66</b>	<b>22</b>	<b>1,608,187</b>	<b>100.0%</b>	<b>8,041</b>	<b>21,508</b>	

Even though China only has nine companies in the top 200, China is, by a considerable distance, the country whose contractors account for the greatest amount of revenue on the list. China provides \$517.9 billion – just under a third of the total. This figure is more than double that of the US, which comes in at \$217.8 billion, which equates to 13.5% of the total. These figures look even more impressive when they are put into the context of the number of US companies – 34 – compared to China's nine.

The figures are similar to last year's list, where Chinese companies dominated. In 2016, their combined revenues were \$475.2 billion, meaning that Chinese companies have added \$42.7 billion onto their total from last year. To compare again, US firms have added \$8.6 billion, meaning that the gap has got considerably larger.

The third largest revenue comes from Japanese companies, who have 33 firms on the list, which is one less than last year. Perhaps unsurprisingly, given this news, the share that the Japanese firms contribute to the list has declined from 12.1% to 11.3%. The top-ranked Japanese firm on the list is Sekisui House which is at number 12 with revenues of \$19.8 billion.

The next three countries on the table are all European, with France



at 8%, Spain at 5.8% and the UK at 5.3%. The total revenue generated by French companies increased from \$117.2 billion to \$128.6 billion.

The UK has declined from last year's percentage of 5.7% – not surprising given the omission of Carillion from this year's list, for obvious reasons. Despite this, the total revenue generated actually increased from \$84.8 billion to \$85.9 billion – a relatively marginal gain.

South Korea saw its share increase slightly, from 4.8% last year to 4.9% and saw four firms rise on the list, with four also falling and two staying the same, meaning it is effectively status quo.

A country worth discussing is Brazil, which last year had no countries in the top 200 list – partly due to the fall from grace of the Odebrecht conglomerate and the resulting fallout – following on from the previous year when they had five. In our 2017 list, there are two Brazilian-based firms that make the list – Andrade Gutierrez with revenues of \$1.4 billion at number 184 and MRV Engenharia sneaking in at number 199 with revenues of \$1.1 billion. With a general election to be held in Brazil in October of this year – and the country desperately in need of large-scale infrastructure investment – the results of the election may well determine how many Brazilian companies make the list next year.

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# CONTRACTOR TABLE

One of the sharpest declines on the list is from China Railway Erju, which was at number 41 last year; this year the company is at number 128, representing a drop of an astonishing 87 places. Revenues for the firm shrunk massively in 2017; in 2016 revenues were approximately \$7.6 billion but this has dropped to CNY15.9 billion (US\$2.5 billion). The company has been a subsidiary of China Railway Group (number two on the list) but the firms have since separated on the Chinese stock exchange and the business model of China Railway Erju has changed, which partly explains the eye-wateringly high 75% decline in year-on-year sales figures.

Staying towards the top of the list, and another major mover, is Indian-based Larsen and Toubro – the company jumped from number 38 on last year's list to number 18. Moving further down the list to the other notable upward movers, Austria-based Porr climbed 25 places, Italian-based Maire Tecnimont rose 46 places, Spanish-based Isolux Corsan 44 places, and Shikun & Binui from Israel jumped 27 places.

Aside from the already mentioned China Railway Erju, the biggest fallers on the list are: Greek-based Consolidated Contractors Company, which fell 40 places; Toyo Engineering from Japan, which dropped 27 places; US-based Clark Construction, which fell 30 places to 111 on the list; Enka, which dropped 43 places; and M.A. Mortenson, which fell 56 places to 146<sup>th</sup>. In total, 94 companies rose through the ranks, 64 dropped, 22 stayed the same and seven were new entries.

## European strength

There are four European firms in the top ten, with France-based Vinci the top ranked firm at number five, the same position as last year, although the gap to fourth placed China Communications Construction remains at approximately \$20 billion. The year 2017 saw almost all major markets up for construction, with Europe being no exception – according to FIEC (the European Construction Industry Federation) last year saw total EU construction output increase to \$1.6 billion, up from 2016's figure of \$1.4 billion – an increase of approximately 3.5%.

Backing up these figures, sixth-place ACS has seen revenues rise strongly, with the firm up by over \$7 billion, while an impressive rise in sales of \$12 billion sees Bouygues' Construction Divisions leapfrog two rivals to rise from ninth place last year to seven on the list. Germany-based Hochtief makes up the top ten, as they did in last year's list.

## Looking ahead

The year 2017 was very strong for the construction industry, with almost all markets enjoying an upturn in sales – with China in particular bouncing back strongly from a few challenging years for the industry. The consensus among those in the industry is that this growth will continue, but at a lower and, it could be argued, a more sustainable rate which is better news for the industry in the long-term.

It is expected that the revenue generated by the list next year will see an increase on the \$1.6 trillion for 2017, but not by

“ The combined revenue for the Chinese firms is over \$517 billion, which represents just under a third of the revenues of the whole table ”

	(US\$ million) SALES	COMPANY	COUNTRY	2017 CHANGE	WEBSITE
114	2984	McDermott International	US	125 ↗11	www.mcdermott.com
115	2953	Tokyu Construction	Japan	137 ↗22	www.tokyu-cnst.co.jp
116	2910	J.E. Dunn Group	US	116 ↔	www.jedunn.com
117	2884	DEME	Belgium	140 ↗23	www.deme.be
118	2850	Boskalis Westminster	Netherlands	117 ↗1	www.boskalis.com
119	2850	Besix	Belgium	127 ↗8	www.besix.com
120	2725	Samsung C&T	South Korea	133 ↗13	www.samsungcnt.com
121	2633	WBHO	South Africa	147 ↗26	www.wbho.co.za
122	2619	Nishimatsu Construction	Japan	121 ↗1	www.nishimatsu.co.jp
123	2600	DPR Construction	US	115 ↗8	www.dpr.com
124	2600	Brasfield & Gorrie*	US	134 ↗10	www.brasfieldgorrie.com
125	2595	Isolux Corsan	Spain	169 ↗44	www.isoluxcorsan.com
126	2556	Keller Group	UK	135 ↗9	www.keller.co.uk
127	2513	Renaissance Construction*	Turkey	101 ↗26	www.rencons.com
128	2506	China Railway Erju	China	41 ↘87	www.crec.com.cn
129	2447	Hovnanian Enterprises	US	123 ↗6	www.khov.com
130	2433	CTCI	Taiwan	141 ↗11	www.ctci.com.tw
131	2430	YIT	Finland	156 ↗25	www.yitgroup.com
132	2326	Strukton Groep	Netherlands	128 ↗4	www.strukton.com
133	2322	Swietelsky	Austria	142 ↗9	www.swietelsky.com
134	2279	NGE	France	161 ↗27	www.nge.fr
135	2278	Brookfield Multiplex	Australia	120 ↗15	www.brookfieldmultiplex.com
136	2276	Ellaktor	Greece	144 ↗8	www.ellaktor.com
137	2260	Enka	Turkey	94 ↘43	www.enka.com
138	2257	Takamatsu	Japan	152 ↗14	www.takamatsu-cg.co.jp
139	2252	Arab Contractors*	Egypt	145 ↗6	www.arabcont.com
140	2216	Aecon Group	Canada	131 ↗9	www.aecon.com
141	2192	Hanjin Heavy Industries & Construction	South Korea	132 ↗9	www.hanjinsc.com
142	2191	Sigdo Koppers	Chile	139 ↗3	www.sigdokoppers.cl
143	2158	Maeda Road Construction	Japan	143 ↔	www.maedaroad.co.jp
144	2150	Austin Industries*	US	151 ↗7	www.austin-ind.com
145	2109	ISG	UK	160 ↗15	www.isgplc.com
146	2086	M.A.Mortenson*	US	90 ↘56	www.mortenson.com
147	2080	JM	Sweden	159 ↗12	www.jm.se
148	2079	Costain Group	UK	146 ↗2	www.costain.com
149	2073	Max Boegl	Germany	157 ↗8	www.max-boegl.de
150	2062	Okumura Corporation	Japan	154 ↗4	www.okumuragumi.co.jp
151	2049	Redrow	UK	150 ↗1	www.redrowplc.co.uk
152	2033	Bauer	Germany	175 ↗23	www.bauer.de
153	1958	M/Ihomes	US	163 ↗10	www.mihomes.com
154	1951	TBI Holdings BV*	Netherlands	162 ↗8	www.tbi.nl
155	1935	Aveng	South Africa	149 ↗6	www.aveng.co.za
156	1916	Beazer Homes USA	US	158 ↗2	www.beazer.com
157	1889	Wates Group	UK	148 ↗9	www.wates.co.uk
158	1881	Tekfen Holding	Turkey	172 ↗14	www.tekfen.com.tr
159	1866	Van Oord	Netherlands	153 ↗6	www.vanoord.com
160	1841	Shikun & Binui	Israel	187 ↗27	www.shikunbinui.co.il
161	1833	Per Aarsleff AS	Denmark	176 ↗15	www.aarsleff.dk
162	1804	Abengoa	Spain	166 ↗4	www.abengoa.es
163	1788	Halla	South Korea	171 ↗8	www.halla.co.kr
164	1780	Bloor Holdings	UK	174 ↗10	www.bloorhomes.com
165	1780	Budimex SA	Poland	186 ↗21	www.budimex.com.pl
166	1777	Graham Construction*	Canada	167 ↗1	www.grahambuilds.com
167	1765	Murray & Roberts	South Africa	182 ↗15	www.murrob.com
168	1750	Zachry*	US	165 ↗3	www.zachry.com
169	1744	Italian-Thai Development	Thailand	191 ↗22	www.itd.co.th
170	1730	AF Gruppen	Norway	188 ↗18	www.afgruppen.no
171	1710	Heijmans	Netherlands	179 ↗8	www.heijmans.nl
172	1702	Glavstroy*	Russia	180 ↗8	www.glavstroy.ru
173	1695	Kaufman & Broad	France	189 ↗16	www.kaufmanbroad.fr

\* = estimate

	(US\$ million)	COMPANY	COUNTRY	2017 CHANGE	WEBSITE
174	1669	<b>LSR</b>	Russia	183 ↻9	www.lsrgroup.ru
175	1611	<b>Africa Israel Investments</b>	Israel	164 ↻11	www.africa-israel.com
176	1600	<b>Techint Engineering &amp; Construction*</b>	Italy	177 ↻1	www.techint.it
177	1590	<b>Toyo Construction</b>	Japan	185 ↻8	www.toyo-const.co.jp
178	1552	<b>Tekken Corporation</b>	Japan	178 ↻	www.tekken.co.jp
179	1547	<b>Hindustan Construction Company (HCC)</b>	India	181 ↻2	www.hccindia.com
180	1544	<b>Fukuda</b>	Japan	170 ↻10	www.fkd.co.jp
181	1538	<b>IJM</b>	Malaysia	190 ↻9	www.ijm.com
182	1510	<b>Willmott Dixon</b>	UK	168 ↻14	www.willmottdixon.co.uk
183	1483	<b>Toa</b>	Japan	173 ↻10	www.toa-const.co.jp
184	1479	<b>Andrade Gutierrez*</b>	Brazil	- NEW	www.andradegutierrez.com.br
185	1445	<b>GEK Terna</b>	Greece	195 ↻10	www.terna.gr
186	1443	<b>Dura Vermeer*</b>	Netherlands	- NEW	www.duravermeer.nl
187	1439	<b>Köster*</b>	Germany	- NEW	www.koester-bau.de
188	1388	<b>Jan De Nul</b>	Belgium	138 ↻50	www.jandenul.com
189	1378	<b>Daiho</b>	Japan	194 ↻5	www.daiho.co.jp
190	1341	<b>SRV Group</b>	Finland	- NEW	www.srv.fi
191	1323	<b>CMC Ravenna</b>	Italy	193 ↻2	http://cmcgruppo.com
192	1317	<b>Comsa EMTE</b>	Spain	- NEW	www.comsaemte.com
193	1309	<b>Asanuma</b>	Japan	199 ↻6	www.asanuma.co.jp
194	1295	<b>Nippon Road</b>	Japan	197 ↻3	www.nipponroad.co.jp
195	1262	<b>Teixeira Duarte</b>	Portugal	198 ↻3	www.tduarte.pt
196	1260	<b>Trevi SpA</b>	Italy	200 ↻4	www.trevifin.com
197	1218	<b>OHL Mexico</b>	Mexico	- NEW	www.ohlmexico.com.mx
198	1167	<b>Jaiprakash Associates</b>	India	119 ↻79	www.jalindia.com
199	1163	<b>MRV Engenharia</b>	Brazil	- NEW	www.mrv.com.br
200	1148	<b>Bowmer &amp; Kirkland</b>	UK	196 ↻4	www.bandk.co.uk

\* = estimate

a considerable amount. Such is the gap between fourth placed China Communications Construction and the rest of the list that it is highly unlikely these four will not occupy the top spots in the foreseeable future, although there is only \$1.8 billion between second and third place – so next year's list could have a new number two company. **iC**

## Methodology

How the league table is compiled

The league table is a ranking of the world's largest construction companies, based on their sales revenue for 2017 – either full or financial years, depending on the individual accounting practices of the companies in question.

It is compiled from a range of sources, including audited annual accounts, companies' own statements of revenues and reputable third parties. In some cases *iC* has estimated the revenue – in all of these cases this is clearly highlighted with an asterisk. The ranking is based on sales in US dollars – the exchange rate for all currencies used has been averaged from the start of the year up until 1 June.

While every care is taken to ensure that the information in the *iC* Top 200 league table is accurate, *iC* can not be held responsible for any inaccuracies or errors. If you feel that your company should be included in the league table, or that the information supplied about your firm is not correct, then please contact *iC*'s editor, Andy Brown, at: andy.brown@khl.com

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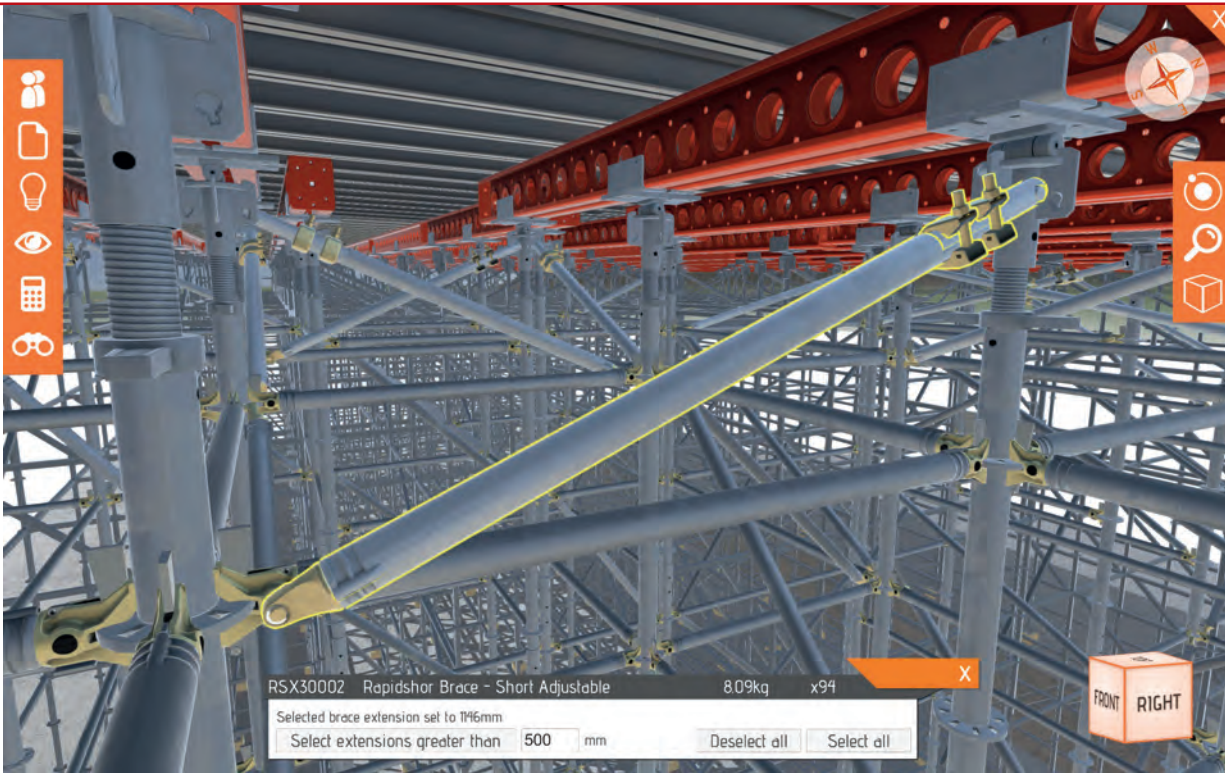
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A Kwikform Rapidshor brace highlighted in the company's visualisation tool, LocusEye

# Digital framework

As the adoption of Building Information Modelling accelerates, **Thomas Allen** discovers how providers of falsework and formwork solutions are responding by collaborating through digital technology

**A**dvances in digital technology have been driving a trend towards total site solutions as data is brought together from all corners of a construction site and beyond. Building Information Modelling (BIM) offers a way of co-ordinating information about a new construction, right through from planning and design to production and even maintenance after completion. This holistic approach is having as much of an effect on providers of falsework and formwork solutions as it is on any other player in the industry.

With clients and contractors demanding greater visibility, UK-based RMD Kwikform said that it now had a greater responsibility to interact more closely with the entire supply chain, right from the point of design. Customers are now demanding IFC (Industry Foundation Classes) BIM-compliant models of the company's temporary solutions.

Simon Dowd, major project manager at RMD Kwikform, said, "We recognised some years back that the industry would move away from 2D drawings. It has been a slow trend, but as we work closer with customers – particularly on larger infrastructure projects – it's clear that 3D drawings should now be standard practice."

### 3D capabilities

RMD Kwikform has since developed its 3D capabilities and created a visualisation tool called LocusEye that automatically renders 3D models. A given model can be changed in real time and viewed on a PC, tablet or smartphone, making it accessible to disparate parties involved in a project.

Dowd added, "Through this system, on-site clashes can be

detected, plus data can be captured to better manage equipment and plan construction phasing."

LocusEye was recently used to provide a quick response constructing the Astmoor Approach Viaduct as part of the Mersey Gateway Crossing in the UK.

The main contractor responsible for the project, Mersey Link CIV, commissioned RMD Kwikform to provide a solution to support the 115-tonne pre-cast concrete beams. However, the contractor needed to build a 40m span each week, meaning that RMD Kwikform only had seven days from initial contact to produce the design and begin delivering equipment to the site, so LocusEye played an important role by speeding up the process.

Megashor and Rapidshor propping systems were used to support the pre-cast beams situated at each 40m span. Since the site was

**V-shaped columns being created for the new terminal at Gazenica Passenger Port near Zadar, Croatia**





on an exposed riverside, the solution had to make the most out of the permanent structure in order to withstand high wind loads.

The company's engineering director Ian Fryer said, "On the outside of the composite assembly, the pre-cast beams are landed directly onto Megashor supports, which subsequently also support the bulk of the deck construction. The Megashor is laterally supported in one axis by Megashor yokes that clamp around the piers.

"Between the piers, Rapidshor falsework supports the Megashor yokes and the cast in-situ crosshead, as well as providing a boarded access from which the pre-assembled Megashor falsework could be safely erected and attached."

Due to the sheer scale of the project and the volume of equipment required at such short notice, RMD Kwikform called on its national branch network to supply materials and equipment, which was sourced from across the UK.

## Digital transformation

In recognition of the increasingly important role of digital technology in the construction industry, German-based Peri founded a Digital Transformation Office in 2017. The company's digitalisation-related strategic activities and initiatives are grouped together and co-ordinated at the site, and Peri's BIM Competence Centre has been integrated into it.

Daniel Stadel, head of the new office, said, "With the organisational change, we are taking account of the strategic importance BIM already has for the entire Peri Group and our customers today, as well as in the upcoming years."

Peri currently offers a range of digital applications, from product-related apps for simple calculations and formwork & falsework systems to its online customer portal myPERI, which is an information

## Aerial view of the Astmoor Approach Viaduct on the Mersey Gateway project

and formwork solution for was the new two-storey terminal building at Gazenica Passenger Port near Zadar, Croatia.

The challenge posed by the design's complex geometry and the need for support at large heights was made greater by the stringent demand for occupational safety and high quality of the finished surfaces.

The most technically difficult design element was said to be the V-shaped, 10.3m-high circular columns. They required a customised Peri SRS Circular Column Formwork, and in order to support the first 6m-high concreting section, SRU Steel Walers and Heavy-Duty Spindles had to be adapted from the Variokit Engineering Construction Kit.

For concreting the second section, the team installed a working platform supported by Peri Up Flex Shoring that could be adapted to accommodate the diagonal circular columns. Peri Up Flex Stairs served as a safe and secure access solution, according to the company.

The building will cover an area of 25,000m<sup>2</sup> in total, and after completion ships with a length of more than 400m will be able to dock at the port.

## Nuances of modelling

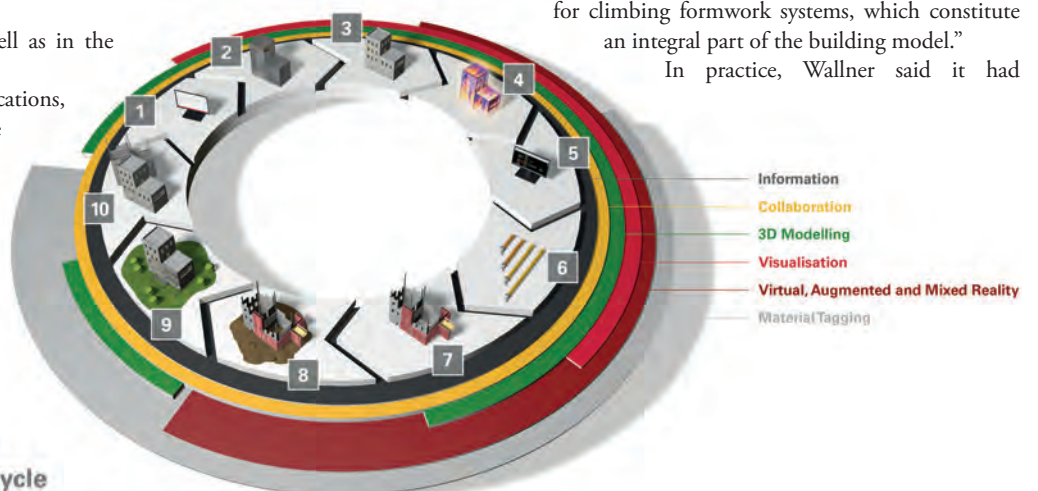
Talking about the nuances of creating BIM models for falsework and formwork projects, Tobias Wallner, head of IT engineering services at Germany-based Meva, said, "We differentiate between temporary and build-in parts. As the temporary components are only required for the production process of a building, these do not have to be archived in BIM in the long-term. The situation is different, however, for build-in parts such as anchor plates for climbing formwork systems, which constitute an integral part of the building model."

In practice, Wallner said it had

**BIM is part of a change process and requires a new way of thinking**

— TOBIAS WALLNER, MEVA

## Visualisation of the BIM lifecycle, according to Peri



### BIM life cycle

- |   |                   |   |                        |    |                           |
|---|-------------------|---|------------------------|----|---------------------------|
| 1 | Programming       | 5 | Documentation          | 9  | Operation and Maintenance |
| 2 | Conceptual Design | 6 | Fabrication            | 10 | Renovation, Demolition    |
| 3 | Detailed Design   | 7 | Construction 4D, 5D    |    |                           |
| 4 | Analyses          | 8 | Construction Logistics |    |                           |



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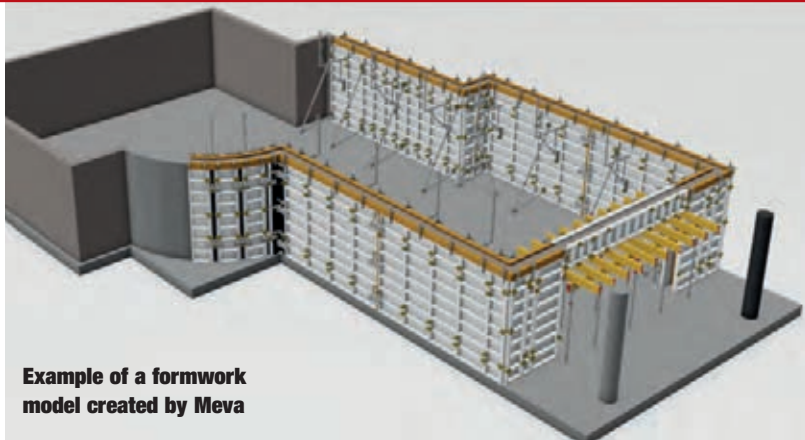
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**Example of a formwork model created by Meva**

proved advantageous to think in terms of discipline-specific models, so the company develops formwork models that consist solely of formwork objects with formwork- and manufacturer-specific information.

Wallner said, “To ensure that model-based formwork planning works sensibly, the information in the building model must be complete – and it must be specified.”

This means that all in-situ concrete and steel-reinforced concrete parts, as well as installation surfaces and build-in parts, must be specified and classified in terms of building stages, storeys and building cycles.

Time is taken into account indirectly in the cycle definition and the manufacturing sequence in what is referred to as the shell construction model.

One significant benefit highlighted by Wallner was, “The planning processes become significantly more efficient due to the fact that the formwork supplier no longer needs to gather information.”

Since the model is available to everyone involved, suppliers can synchronise their schedule with everyone else’s without having to develop a separate model.

However, Wallner went on to say, “Digitalisation in the construction industry is far more than just the introduction of a new tool. On the contrary, BIM is part of a change process and requires a new way of thinking.”

In the constantly changing world of BIM, Meva needs to continually adapt its formwork object library. To this end, the

“ All persons involved in the planning process can access the latest data from anywhere in the world ”

**Ulma’s solution for the restoration of the Ágora building of the Palace of Sciences and Arts in Valencia, Spain**

## Formwork of the future

Doka helps to develop ultra-thin concrete roof

Scientists at Eidgenössische Technische Hochschule – the university for science and technology in Zurich, Switzerland – have developed a new method of construction for ultra-light roofs in collaboration with specialists from Austria-based Doka.

The team created a prototype self-supporting, ultra-thin, scoop-curve structure that comprised 18 tonnes of wet concrete supported by 0.7 tonnes of fabric. The completed prototype measured 7.5m at its highest point and had a surface area of 162m<sup>2</sup>.

To construct it, a flexible wire-rope net was stretched over scaffolding and a tailored polymer membrane was then laid on top of the net, acting as the formwork that gave the roof its shape. Concrete was then sprayed onto the structure.

Doka was called on to help make the formwork system work. Using 3D planning software, the research group came up with a construction consisting of a wooden edge-beam frame for tensioning the net’s steel cables, vertical and inclined props, and tailor-built components. Doka’s AutoCAD software was adapted to specially programmed custom applications so that a collision check was run automatically for every single change made.



**Prototype wave-shaped concrete roof**

company works with cloud-based solutions so that it can react quickly and comprehensively to any changes.

“This ensures that all persons involved in the planning process can not only access the latest data on the spot but also from anywhere in the world,” said Wallner.

## Tricky geometry

Ulma recently used BIM for the restoration of the Ágora building of the Palace of Sciences and Arts in Valencia, Spain, which has an unusual elliptical geometry.

The entire building was covered with multidirectional BRIO scaffolding to refurbish more than 4,247m<sup>2</sup> of space, both externally and internally.

BIM technology was used to help the various collaborators involved in the project to interact effectively. It allowed Ulma to plan each section and register them all in a single place that was accessible to all parties.

For the north and south ends of the building, BRIO Perimeter scaffolding with one-metre cantilevered extensions





## Lessons learnt

Insights into the use of BIM

In order for the full potential of BIM to be realised in falsework and formwork solutions, it demands collaboration and comprehensive planning – and this takes experience to get right. It is necessary to clarify the goals of a project and to make sure all parties are properly trained to use the technology correctly.

Roland Hassert, head of construction applications engineering at Layher, said that although BIM is not a particularly new concept – 3D models have been used in the planning phase for many years – it has started to become more common for customers to provide 3D models. This was said to save Layher time and resources otherwise spent building a new model from scratch.

For Ulma, based in Spain, BIM has enhanced the information flow between the departments within the company, as well as with external collaborators and clients. Detailed and easily-viewable simulations help to provide clients with more information, and real-time tracking of changes and validations can be undertaken by both parties.

The improved information flow facilitated by BIM also applies to foremen on the construction site, according to another Germany-based firm, Paschal.

Ralf Schmider, an architect at the company, said, “By introducing sturdy tablets and the BIM-capable PPL 11.0, formwork plans and 3D models can be sent directly to the foremen on the construction site and can be used there in practice too.”

The use of BIM does come with challenges though. Since BIM requires close collaboration, Paschal emphasised the importance of ensuring all participants are familiar with the technology and the appropriate standards to be adhered to. This requires training.

Another key issue is keeping the models up-to-date, according to Layher. The company said it was important to make sure customers inform the planners of any changes made to the 3D model as and when they occur.

Also, Layher said it had to adapt its approach to data management since such large quantities of data were now being produced. Unnecessary information must be filtered out and cloud-based computing is becoming increasingly relevant.

In terms of BIM software, Layher has developed LayPLAN CAD, the central feature of which is a comprehensive component library that contains a 3D rendering of all of the company’s scaffolding components. The library also contains pre-fabricated assemblies to speed up the design process.

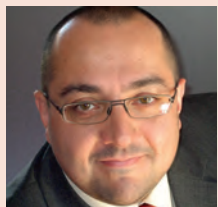
The finished model can then be exported as a 3D PDF, which can be viewed on mobile devices or transferred to animation software to simulate the construction sequence.

As base tools, Ulma uses Revit, Navisworks and Autodesk 360, but the company is preparing a variety of specific automation systems for its products to facilitate the work of its engineers.

Meanwhile, Paschal has IT-specialist Planitec as a member of its group and it has developed the formwork planning software Paschal-Plan light (PPL). Its IFC interface allows all relevant information about geometry and formwork to be exchanged with other BIM-compatible programmes.



**Roland Hassert,**  
head of construction  
applications  
engineering at Layher



**Ralf Schmider,** architect at Paschal



### Layher’s falsework being used to help construct a sugar silo in Sweden

was used to reach a maximum height of 33m and cover a total surface area of 1,000m<sup>2</sup>.

For the four central phases of the building, which stretch to a height of 48m and have a surface area of 2,600m<sup>2</sup>, the same BRIO Perimeter scaffolding was used but with cantilevers that extended up to 3m and push-pull props that were adjusted to adapt the scaffolding precisely to the building’s varied curvature.

### Sweet spot

Another project was carried out recently by Layher at a sugar factory in Sweden. A concrete silo with a height of 69m and a capacity of up to 80,000 tonnes of sugar was built by German contractor Heitkamp Bauservice using the slip-form method.

The silo wall grew at a rate of 2.5m per day, but a particularly challenging part was the roof structure, which consisted of roof rafters and a steel compression ring as the top closure element at a height of 63m. When the individual components were not forming a closed structure, the 45-tonne mass required high-strength support.

Applications engineers from Layher helped to plan a solution using the company’s software LayPLAN, which includes a CAD module. This plug-in for Autodesk AutoCAD can be used to create 3D designs of all types of scaffolding structures.

The solution in this scenario included three of Layher’s systems – Allround Scaffolding Lightweight, Allround Shoring Frames TG 60 and pre-assembled Allround Shoring Towers TG 50. **iC**



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The construction industry has embraced the use of drone technology to make their processes quicker and easier. Here are five helpful tips to consider when picking the right drone for the right project, as the team from Microdrones explains.

**M**ike Dziok, marketing director for Microdrones was interviewed by Sean Heath from the MarketScale Electronics and Software podcast. They discussed the role of drone technology in geomatics and construction and how Microdrones has established a strong partnership for distribution.

**Sean Heath (SH): Your company has taken a toy and repurposed it to be one of the most important advancements in the industry. Tell me a little bit about some of the things that you do with drones?**

**Mike Dziok (MD):** The work that's being done with drones in terms of photogrammetry, geomatics and surveying has been done for the past thirty years. It just wasn't done with drones but rather manned aircraft, and by foot on the ground. Drones fill the space where ground work can be done more efficiently with an unmanned aerial vehicle.

When you mention toy, we cringe at that. We are not in the toy segment. We have commercial grade aircraft that stand up to wind, rain, and weather. From the very beginning these systems are professional grade and they withstand the rigors and abuse of daily field use.

As you might imagine, a manned aircraft that's mapping a large section of land costs a lot of money to fly, insure, and fuel. An unmanned aerial vehicle is much more cost-efficient. We are not in competition with traditional aircraft that are doing mapping and photogrammetry. We're really complementary. If a piece of land is smaller, it makes sense to use an unmanned aerial vehicle.



# Drones: tools,

**SH: You've expanded the base of customers that can now utilise this technology. You've given them the ability to become really granular in the way they go about getting information that's needed for a project.**

**MD:** Yes. Sometimes we hear, "Wow. You're taking away jobs from surveyors." That's not the case at all. We still need professionals from the geomatics and aviation trades involved in these projects. It's just that more work can be done more efficiently and to a greater degree of accuracy and safety.

**SH: Tell me more about the complete solutions that you've come up with.**

**MD:** We have three main product offerings. We have our mdMapper lineup which is best suited for aerial photogrammetry. We have our mdTector series – the first system is called mdTector1000CH4. Then our newest release is mdLiDAR1000. We're really selling a whole package: the drone, the sensors, the software and the workflow, plus the training and the support that goes into making this a fully integrated package for professional users out in the field.

We break that down in all our materials as: plan, fly, process and visualise. So the planning is done via our tablet software called mdcockpit tablet. Then you fly the mission, collect the information, land, and download the data via Bluetooth. Once processed, you have a visual. That visual is different depending on what the application is.

For our mdMapper, the output is typically an orthomosaic, a collection of hundreds of photos, taken with a very high resolution sensor, to create one giant image.

For our mdTector, our methane gas detection system, the output is essentially a map showing your methane hotspots. That shows where problems are along a pipeline or gas infrastructure.

Last, but not least, is our new LIDAR lineup of products, where the output is a pointcloud. This enables someone who is developing a piece of land to figure out where they need to level or raise it. If it's irrigation, they can detect where they may have water problems and where they need to address that.

**SH: You mentioned earlier that these drone based solutions are an addition to the tools**



**Alex Lowry, Drone Operator for Brent Scarbrough & Company flies an mdMapper1000DG system from Microdrones 2-3 times each week, to efficiently capture data from construction sites and generate tops.**



Paul Shepard, UAS support specialist at Sitech South, helps customers implement new technology from Microdrones throughout the southeast United States.

Interested in how fully integrated drone packages might be helpful for your business? Visit [lp.microdrones.com/ic](http://lp.microdrones.com/ic) to talk with an expert

# not toys

that surveyors already use, and that the mdLiDAR1000, the mdMapper1000DG actually have a Trimble-powered component. Where do you see that partnership helping the industry move to the future?

**MD:** I'm glad that you bring that up, because some of our products have Applanix components inside. Applanix is a Trimble company and their APX-15 is actually a critical component within our mdMapper1000DG and our mdLiDAR1000 systems. Direct georeferencing is very important, because it allows for more efficient mapping of an area with a high degree of accuracy. You don't have to set as many ground control points or, in some cases, you don't have to set any ground control points at all. You save time post processing.

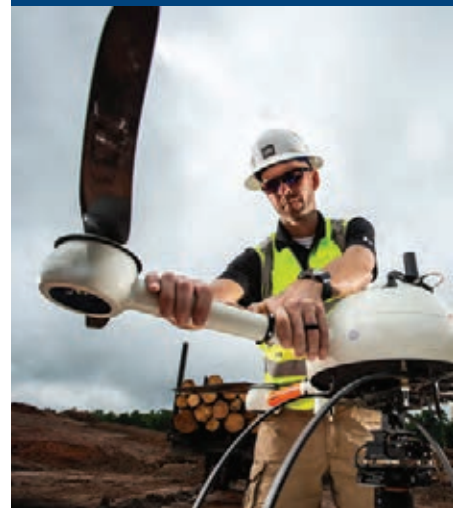
**SH:** I now understand why you call the product lineup mdSolutions. I ignorantly said, "You guys do drones!" But that's just a small fraction, you are actually a solutions company.

**MD:** The name of our company is Microdrones and for obvious reasons people talk about drones, drones, drones. We are anything but just a drone company. Instead, we're solving very niche problems for established professionals.

Where we see Microdrones long-term, is that before heavy equipment starts moving dirt, our systems have flown to help collect data that is then used to make decisions about where that dirt should be moved, where structures should be placed and how projects should be tracked. That's really where we see our company and how we've aligned ourselves with the absolute best in the industry.



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# A job for the specialists

Utility construction requires a combination of specialist equipment and operator skills, and the equipment designed for this sector is becoming increasingly intelligent and bespoke, reports **Andy Brown**

**W**hile it is still common for excavators to be used for digging trenches, there is also an increasing amount of specialist equipment being developed and used for a sector which is being pushed to both economise and innovate.

One of these innovations is in the form of a new AMT Pipe Trailer attachment for the Articulating Multi-Purpose Truck (AMT) from Ardco. Designed for safe and efficient handling of pipe, the AMT Pipe Trailer offers adjustable lengths and a good load capacity, making it ideal for utility construction applications.

Built specifically for the Ardco AMT 600, the pipe trailer attaches to the truck using a supplied hitch mount with conventional fifth wheel connection. The trailer features a flexible-load rear frame with 45° swivel capabilities, trailer axles with available braking system, and various tire options.

To protect against damage to pipes or other products, the load surface is constructed of oak timbers and the side pole surface is Teflon-coated. The trailer offers a load capacity of 22.68 tonnes. Trailer length can be adjusted from a maximum of 10.6m to a minimum of 6.7m.



The Cat PL61 pipelayer

“Market feedback indicated that utility contractors who are operating compact-size drills are demanding more performance”

**Built specifically for the Ardco AMT 600, the pipe trailer attaches to the truck**

The pipe trailer is one of many Ardco attachments compatible with the modular back-end platform of the AMT 600. The AMT 600 has a two person, fully enclosed, all-weather ROPS (roll-over protection structure) cab that is sound rated to 68dB. A seven inch display in the steering column provides digital gauges with onboard diagnostics, digital manual access and an optional backup camera display.

## Compact equipment

A new horizontal directional drill (HDD) specifically designed for the utility installation market has been launched by Vermeer. The compact D10x15 S3 Navigator is designed to provide more power and carriage speed, and lower sound levels than its D9x13 S3 Navigator HDD predecessor.

“Market feedback indicated that utility contractors who are operating compact size drills are demanding more performance,” said Tod Michael, product manager at Vermeer. “We listened and responded by optimising the horsepower, thrust, rotation and carriage speed of the new D10x15 S3 to help utility contractors install more feet per day.”

The D10x15 S3 features a 44.7kW Deutz TD2.9 Tier 4 Final engine — said to provide a 36% power boost compared to its D9x13 S3 predecessor. Vermeer also increased the thrust/pullback to 44.5kN, the maximum torque to 2,033.7Nm and the maximum spindle speed to 220rpm.



**The A330 and A650 from Terex Utilities have radio remote controls**

With sound an increasingly important consideration for contractors, the company said that the drill's reduced sound levels help reduce disturbance on residential jobsites, and enables easier communication among the crew members.

"Measuring just 3.8m long, the D10x15 S3 has one of the smallest footprints in its class," added Michael. "When a crew is working in a residential area with limited space, they may have to set up in the street. The compact design of the D10x15 S3 helps minimise traffic disruptions in a neighborhood."

## New equipment

A new drill was recently debuted by Terex Utilities at the International Foundations Congress and Equipment Expo (IFCEE) in Orlando, US. The redesigned A650-30 auger drill features enhanced control systems and a hydrostatic drive transmission, which was said to lead to easier operation. The A650-30 offers a drill depth of 9m and drill diameter of up to 1.83m.

The A330 and A650 have radio remote controls — said to be a first in auger drill operation — and the new control system

**70%**

The percentage of global compact equipment demand made up by mini excavators

SOURCE: OFF-HIGHWAY RESEARCH



**The Bobcat T770 compact tracked loader with a wheel saw attachment**

allows the truck, unit controller and unit engine to talk to each other, which supports the application of radio remote controls. The advantage for the operator is improved productivity, comfort and visual reference.

The enhanced auger drills have many features that are automated, including auto brake release, inner-Kelly retract stop, inner-Kelly slack stop, home position, return to center and dig depth. The return to center allows the operator to return the auger to the drill position used previously.

"This keeps the hole at the proper diameter and the proper vertical position throughout the dig, regardless of how many times the operator needs to clean the dirt from the auger tool," said Gary Rice, Terex South regional sales manager.

Transports i Excavacions Jocar, based near Barcelona, Spain, is a family business with more than 25 years of experience in earthmoving, demolition, compaction, grading and the supply of aggregates. Company owner Joan Carles Mora recently added the new Bobcat T770 compact track loader to the fleet.

Powered by the Bobcat D34 diesel engine, providing 68.7kW of power at 2,400rpm, the Bobcat T770 loader has a rated operating capacity of 1.61 tonnes and a tipping load of 4.6 tonnes. The T770 has a height of 2.07m, a length with bucket of 3.6m, a bucket hinge pin height of 3.4m and a width over the tracks of 1.98m.

## Attachments

The T770 model is equipped with the quick-change Bob-Tach attachment mounting system, allowing it to be combined quickly and safely with over 70 different types of Bobcat attachment, meaning that it is suitable for construction utility work.

Joan Carlos Moda said, "By owning so many Bobcat attachments, we have continuous work for the Bobcat T770 loader, which completes more than 1,000 hours of work all year round thanks to all the combinations with the attachments."

Another piece of construction equipment helping those who work on utility job sites is the updated PL61, part of a full line of purpose-built Caterpillar pipe layers, which delivers 18.15tonnes of maximum load capacity. The new PL61 was said by the company to offer a faster steering response than its predecessor for superior maneuverability



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## View from the trenches

Insight from Peter Stuijt, KCME product manager

### REGARDING UTILITY WORK, WHAT ARE KOBELCO'S MOST POPULAR MINI EXCAVATORS?

Currently, Kobelco's most popular mini excavator segments are the one- to two-ton (0.9- to 1.8-tonne) class with the SK17SR-3 and SK10SR-2 being the most popular models. This is followed by the two- to three-ton (1.8- to 2.7-tonne) class with the SK28SR-6 being the most popular model.

### REGARDING UTILITY WORK, WHAT ARE THE MAIN BENEFITS OF USING MINI EXCAVATORS?

The main benefits of choosing a mini excavator are for their compact size coupled with excellent productivity – while still promoting very modest fuel consumption. For example, the SK17SR-3 is a compact but very sophisticated machine – its hydraulic system is smooth and it is available with either canopy or cabin. Excellent operator comfort is also a key benefit, as operators can be in the machines for many hours.

### WHAT ADVANCEMENTS HAVE BEEN MADE TO MINI-EXCAVATORS TO MAKE THEM MORE SUITED TO UTILITY WORK?

Kobelco's mini excavators, from SK28SR-6, are equipped with iNDR (Innovative Noise and Dust Reduction) technology, which makes them very suited to work in urban areas where we need to be more careful of noise.

Other improvements include fine-tuning the hydraulic system for lower fuel consumption, one-touch deceleration was introduced to reduce fuel consumption and noise, and, depending on the model, Kobelco offers extended auxiliary hydraulic piping so that our end users can use their attachments, such as rotating grapples. Finally, an accumulator has become part of the configuration, allowing the end user to easily connect and disconnect attachments.

Exhaust emissions will become increasingly important as mini excavators will also have to comply with Stage V of the NRMM (Non-Road Mobile Machinery) regulations from 2019 onwards.

on the pipeline, as well as a more robust fuel system.

Powered by a Cat diesel engine, the PL61 meets US EPA Tier 4 Final, EU Stage IV and Korea Tier 4 emissions standards with emissions reduction technology that is transparent to the operator. A configuration is also available to meet China Non-road Stage III, India Bharat III, Eurasian Economic Union Stage IIIA and UN ECE R96 Stage IIIA emission standards, equivalent to Tier 3 and Stage IIIA.

**Volvo CE's ECR18E has an ultra-short tail design – the shortest radius in the company's range**

### Excavators

The ECR18E 1.8 tonne compact excavator, with an ultra-short tail design – the shortest radius in the Volvo range – was launched by Volvo Construction Equipment (Volvo CE) at Intermat, Paris. The machine, which will be available worldwide from the end of 2018, can retract to less than 1m wide to enter confined areas – or expand to 1.35m.

The cab environment of the ECR18E has fingertip operation, simple layout controls and large travel pedals.

Safety is helped by a standard orange seatbelt and optional sensors that lock the controls, preventing movement if the operator is not sitting firmly on the seat.

Transportation is secure, helped by four tie-down points on the upper frame. Thanks to its light weight, it can be safely



The Kobelco SK55SRX-6 is powered by a water cooled, four-cylce, four-cylinder, direct injection diesel engine by Yanmar

“ The new PL61 was said by the company to offer a faster steering response than its predecessor ”



**The 1.5-tonne 15C-1 is the fourteenth model since the first of the next generation machines was introduced**



## Touchdown for Ditch Witch

Working at the home of the Detroit Lions provided unique challenges

**W**hen Underground Contractors Inc. (UCI) won the contract to work at Ford Field, home of the Detroit Lions football team, they knew their operators would be up against a unique set of obstacles.

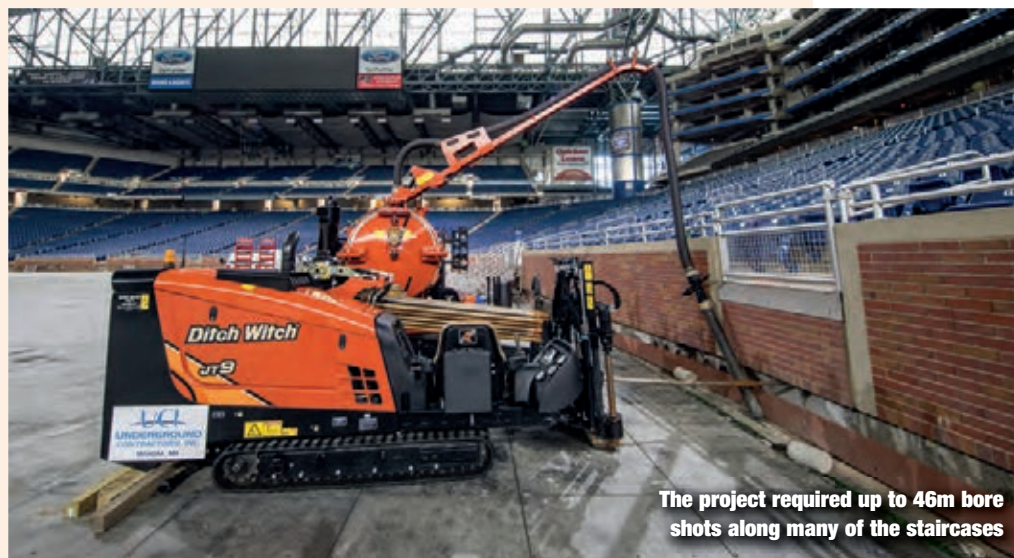
The job was to upgrade the Wi-Fi system, and the plan called for Wi-Fi antennas to be mounted on handrail locations in the stands surrounding Ford Field. First, holes would be drilled down from three access points along each handrail, then cable deployed underground beneath the stands.

In total, the project required up to 46m bore shots along many of the staircases. Operators stopped three times where a hole had been drilled from above. But before shooting out under the staircase, HDD crews first bored a 15 to 18cm hole into the bulkhead. Once through, they steered the drill bit straight up to run along the staircase.

When shooting out from the bulkhead, another obstacle was encountered – the conditions beneath the ground were unknown. Crews primarily expected clay, but the conditions varied and occasionally gravel was encountered.

Originally expecting to drill through sand and clay, UCI sent two horizontal directional drill (HDD) and two support crews. When encountering clay, they can get up to five bores done each day. However, when running into gravel, a single bore can take as long as three days. The unpredictable underground terrain required UCI to add more crews to the project. They were running Ditch Witch HDD rigs, including the JT2020 and JT9.

Del Mecum Jr, vice president, UCI, said, “On this project, we used the powerful JT2020 for the tough rock conditions and relied on the compact JT9 to get in the bulkhead and make tight, quick turns. Easy-to-use controls and overall machine versatility were a must-have on such a complicated jobsite.”



**The project required up to 46m bore shots along many of the staircases**

transported with up to three buckets and a hydraulic breaker on a compact trailer.

A Hitachi ZX19-5 mini excavator was selected to complete a utilities project in Poland by the contractor FHU Elkop when the company was commissioned to remove old meters and install a new network of electric cables at a holiday camp.

The mini excavator has been designed to provide operator comfort and optimise performance in confined spaces. Safety is also upheld by the redesigned cab, which offers greater all-round visibility. On site, communication between the operator and his co-workers has been made easier due to the design of the front window, which can be fully opened when required.

### New model

Elsewhere in the mini excavator segment, JCB has added to its mini excavator range, with the launch of the 1.5 tonne 15C-1, the fourteenth model since the first of the next generation machines was introduced in 2014.

The conventional-tailswing mini excavator shares a similar design to previous models, with the same choice of digging equipment as the 16C-1. Both machines are powered by an 11.7kW diesel engine, though the 15C-1 uses a gear pump, while the hydraulic system on the 16C-1 has a variable displacement piston pump.

The 15C-1 uses a shorter fixed undercarriage, with single speed tracking, long pitch tracks and mechanical track tensioners. The higher specification 16C-1 is a plant hire model, with a variable width undercarriage for additional stability when both digging and lifting.

The machine was said to benefit from short pitch tracks for smoother travel, with grease track tensioners and twin-speed tracking motors. The 15C-1 has 100% steel bodywork and, where the full ROPS-compliant cab is specified, it has flat glazing all round, for easy replacement.

Despite its compact dimensions, the mini excavator was said to benefit from the next-generation cab already seen on larger models, meaning it has greater internal space than previous machines.

All JCB next-generation mini excavators come with ten tie-down points, positioned on the undercarriage and upperstructure, making it easier to transport the machine without risk of damage to rubber tracks.

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# Achieving more with less

Advances in mixing technology are paving the way for significant productivity gains, reports **Neil Ford**



**F**lexibility seems to be the biggest trend in the development of new mixing technology. Customers require ever higher technical standards as well as the ability to move equipment on and around construction sites as quickly as possible. At the same time, as with other elements of the construction industry, environmental standards have to be tightened — both through lower emissions and by recycling an increasing proportion of used materials.

Flexibility obviously favours mobile plants, but the main challenge for mobile equipment is producing the large quantities of concrete required for big building projects such as airports, tunnels or highway construction. Nevertheless,

**The project at Erzberg, Austria, is called ZaB – Centre on the Mountain**

“ As with cooking, you need not only the right ‘pot’ but also the right recipes and ingredients in adequate quality if you want to produce excellent concrete ”

Klaus Eckert, head of sales promotion at Liebherr-Mischtechnik, said, “The trend towards mobile concrete mixing plants has been apparent for several years. The relocation of the plants is getting faster and easier to manage.”

The Liebherr Mobilmix 3.5 has a production capacity of up to 300m<sup>3</sup> per hour when operating as a double plant. The plants are always based close to the construction project in question. They can be relocated during the construction process, with the support of Liebherr service staff usually only required for the first occasion — something that is particularly attractive for those working on road projects. The Mobilmix 3.5 double plant is currently being used on a road building project in Poland.

Gerhard Gschwandtner, head of SBM Concrete Mixing Technology, agrees that mobile concrete mixing plants are extremely efficient, providing just-in-time concrete.

His company’s super-mobile wheeled concrete mixing plants can be erected within eight hours on any site that is accessible by lorries and does not require any foundations. Gschwandtner said that they can reduce carbon emissions by up to 25% by producing concrete directly on site, with reduced construction site transport and lower lorry traffic.

## Mobile benefits

SBM is promoting its mobile plants for the production of ultra high-performance concrete (UHPC), which needs precise and high quality mixing technology. UHPC needs to be produced according to each customer’s specific needs. SBM’s Euromix 500 SM Compact has a lorry trailer with

**The Mobilmix 3.5 double plant is currently being used on a road building project in Poland**





**Ausa believes that there is a trend away from self-load mixers towards dumpers**

“ Some firms are developing mixers with portable and non-portable options ”

Astec chief engineer Mike Varner, said, “In contrast to RAP dryers that heat and dry RAP directly with hot oxygen-rich gases that can cause oxidation and emissions, the DBXHR heats RAP indirectly by contact with virgin aggregate.” The proportion of heat lost is low, so more of the heat in the fuel is put into the mix, leading to a reduction in emissions.

The company recognises that there can be problems with any new product, even if it is a derivative of an existing proven product line. It therefore devised a program of analysis, simulation, review and consultation with customers to overcome potential problems.

The prototype provided Astec with more information about welding and material selection, resulting in the production of the first commercial model, which was deployed in Florida, US. Much of the new technology developed for the Double Barrel

XHR is now provided as standard on its other plants because of the advantages in terms of greater reliability, increased longevity and lower life-cycle costs.

integrated water and power supply, making it suitable for off-road operation without supporting infrastructure.

It can also supply several sites at the same time if the material is carried by separate supply vehicles. It has particular applications on wind farms, as, according to the firm, “the integrated concrete pump presses the special concrete directly into the annular gap of wind power plants”.

With production capacity of 1,500m<sup>3</sup>, SBM’s Specimix UHPC is currently being used to renovate bridges at the Viaduct de Chillon on the Swiss A9 motorway near Villeneuve. The plant was delivered in three main containers. Aggregates and cement are delivered by a tank lorry directly into working silos, with steel fibre added by crane, to produce a 50mm-thick base course, including reinforcement.

SBM was involved in the development of the Alpha Concrete System to provide high-quality concrete. The system includes hardware and software, with liquefying and stabilising components added to the admixture, taking into account concrete temperature, transport and processing times, and the density of recycled water. Temperature, humidity and density probes are used to manage the production process.

SBM’s Gschwandner said, “As with cooking you need not only the right ‘pot’ but also the right recipes and ingredients in adequate quality if you want to produce excellent concrete. If only one part is not right, the result will not be satisfying.”

## New versions

Some firms are developing mixers with portable and non-portable options. For instance, Astec recently introduced a new configuration for its Double Barrel XHR, with increased capacity on the larger models. The external mixer can be either a twin-shaft timed coater or a rotary mixer. It has been used to produce up to 70% recycled asphalt pavement (RAP) while still maintaining the capability of producing mixes at lower RAP levels.

**The Liebherr Mobilmix 3.5 has a production capacity of up to 300m<sup>3</sup>/h when operating as a double plant**



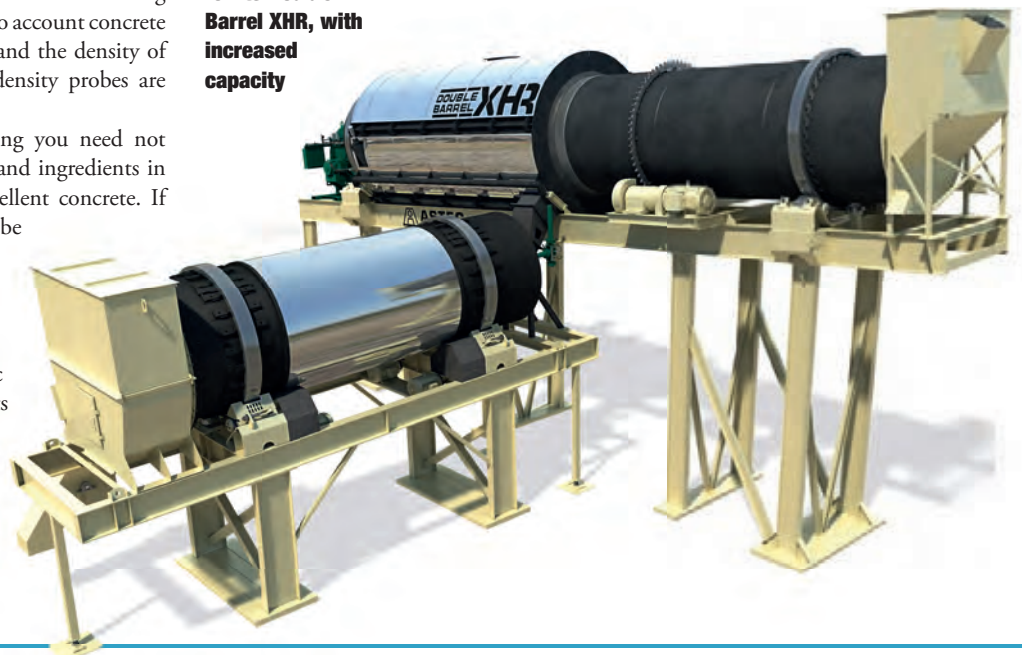
## Dumpers

Ausa believes that there is a trend away from self-load mixers towards dumpers because of their ability on rough terrain and higher load capacities. They also reduce costs by avoiding pump, truck and generator set rental. Albert Vicens, Ausa marketing manager, said, “Dumpers are also more productive, safer and faster, and therefore more efficient. Particularly in the US, this application is getting stronger and we are selling our dumpers with concrete chutes as an attachment.” Ausa stopped

producing self-load mixers last year.

The Spanish company has seen a rise in demand for its dumpers to work in golf course construction and improvement over the past few years. Vicens said, “Apart from the gradients >

**Astec recently introduced a new configuration for its Double Barrel XHR, with increased capacity**





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## MIXING TECHNOLOGY

“ Increasingly stringent environmental regulations have increased the emphasis placed on recycling ”

and the different course surfaces, one of the main jobs has been to do the paths with concrete, including machines with concrete chutes attached at the end of the skip.”

The big challenge has been to avoid grass damage. Previously, skid-steer loaders were used but they scarred the surfaces, so AUSA switched to low-degradation tyres on its first golf project in Maryland and now uses them as a matter of routine.

Increasingly stringent environmental regulations have increased the emphasis placed on recycling. This reduces transport time and energy, while minimising the amount of new materials needed. Wirtgen used its KMA 220 mobile cold recycling mixing



**At the Ndabeni Roads and Stormwater Depot, Wirtgen's cold recycling mixing plant KMA 200 produced the BSM mix**

plant to produce about 11,000 tonnes of materials, using feed materials reclaimed locally, to produce a hydraulically-bound base layer for flight operations at Cologne/Bonn Airport at the end of 2017.

The plant has been deployed on various projects. Alexander Weber of SAT Straßensanierung, which coordinated the deployment of the mobile KMA 220, commented, “We use the cold mixing plant in projects across the country. In the last three months, for instance, it has been in Munich, before going on to the Rhineland and then to two different locations in the Hunsrück region. This works outstandingly well because the plant is very easy to transport and the setup times are very short.” Crucially, it stays within international rules for road transport.

## Asphalt vs. concrete

Both materials have strengths and weaknesses

As ever, there is considerable debate over the relative merits of asphalt and concrete as road building materials. Companies specialising in one or the other obviously favour their own products, so it is difficult to canvas objective opinion. Eckert from Liebherr-Mischtechnik said, “The advantage of concrete roads is their high longevity and high capability. Heavy freight haulage or high temperatures during the summer are no problem for concrete roads.”

Wirtgen offers hardware to produce both materials and also promotes hybrid construction. For example, old asphalt subgrade can be milled off with new concrete pavement and black topping. It also considers horizontal combinations to be viable, with the hard shoulder and the truck lane built with concrete, while asphalt is used for the remaining lanes.

The German company cited the other main advantages of asphalt to be its pliability and plasticity, eliminating the requirements for expansion and relief joints. Due to the absence of joints for mitigating cracking, asphalt roads tend to be smoother. Smoother roads also reduce driver fatigue and cut the stress on vehicle drive train components. Asphalt roads are generally quieter and pervious asphalt can be used on highways to reduce spray, enhancing safety and decreasing noise by absorbing sound energy instead of reflecting it.

By contrast, concrete road surfaces offer longer lifespans, often of 40 years, and lower maintenance costs given the reduced need for repair. They are not affected by extreme heat in the same way, although they are more prone to cracking in frost. Leaking oil has less of an effect than on asphalt and concrete can be laid on subgrade.

**A hybrid surface of asphalt and concrete is available**



## Recycling for resurfacing

To take another example, Wirtgen's 3800 CR recycler and a Vögele VISION 5200-2i tracked paver were used last year to resurface 160km of main traffic arteries in San José, US. The 3800 CR travelled in reverse, removing the damaged asphalt layers in a down-cut process and transferred the material to the paver for recycling.

In a statement, Wirtgen revealed, “In the down-cut process developed by Wirtgen, the milling drum rotates in the direction of travel, not against it as in the up-cut process. As a result, particle size can be precisely controlled when processing the material, especially on very brittle, thin, old asphalt roads.”

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**The milling and mixing rotor of the Wirtgen 3800 CR granulates the damaged asphalt layers to a depth of 18cm**

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# Industry disruptors

The team from KHL sat down with **Stephen Roy**, President Volvo Construction Equipment, Americas, to discuss the state of the US market, disruptors for the industry and the health of the global construction market

**S**tephen Roy is a true Volvo stalwart – he has been with the company for over 20 years and worked in both the group’s financial services business and trucks segment before taking up his current role in September, 2016.

Volvo Construction Equipment (Volvo CE) is an enormous organisation, even bigger if you factor in SDLG, the China-based construction manufacturer, of which Volvo CE has 75% ownership. The firm is a global brand in the truest sense of the word, but Roy said that, internally, North America is viewed as one of the bigger opportunities. In the US, Roy commented that Volvo CE had seen a real growth in excavator sales, with this sector up over 10%, and that the strong conditions in North America are actually being reflected around the world.

## Strong growth

“We have seen industry growth of around 10 to 20% in 2018 already and we think that the demand is going to continue. When we talk to our customers, there are a lot of jobs pending, and they aren’t just six-month jobs, they are two-year jobs. Used equipment prices are going up, which is a sign that there are equipment availability issues,” comments Roy.

“The crazy thing is that almost everywhere in the world is going through this growth – you talk to people around the world and they have never seen this much growth at one time that is



**Roy has been with Volvo CE for over 20 years**

**Volvo CE presented the HX2 autonomous, battery-electric, load carrier at CONEXPO/CON-AGG 2017**



everywhere. Even Brazil and Latin America are coming back. This demand can put a strain on the supply chains, but that is a good problem to have.”

Roy comments that there will be big changes to come in the shape of ‘disruptors’ – new technology which will change how the construction sector operates. He lists these as electro mobility, connectivity and automation. Of course, electro mobility is nothing new; back in 2008 Volvo CE showcased a hybrid wheeled loader, but this is a sector which is only going to expand. The firm’s advanced technology group – internally referred to as X labs – is working on new solutions and, while acknowledging that some larger machines may never get away from diesel power, this will certainly be a disruptor. Roy commented that in the future the industry will need people with different skill sets to be able to work with new battery technology and new models that use hybrid power.

In terms of connectivity, there has been a new wave of data available through increasingly sophisticated telematics but, as ever, the real trick is being able to interpret and use this data in a smart way. Volvo CE believes that it can use this information to solve problems before they happen – for example, bringing in a machine for service if the data suggests that it might fail in the future – and to also solve problems quick.

## Monitoring data

In its US office, the company has a ‘war’ room which was said to be crammed full of staff constantly monitoring equipment via screens on the walls. According to Roy, this approach has already reaped rewards.

“In one year, we have reduced the number of days a machine is down by 20% and we have a target for 2018 of another 20% – that is all machines, so we have a real culture of up-time. We want to create a sense of urgency about it.”

Last, but by no means least, is automation. A hot topic for the industry, Roy is keen to stress that automation does not mean the end of operators, but rather them operating the machine in a

“ In one year, we have reduced the number of days a machine is down by 20% and we aim for another 20% in 2018 ”



**Volvo CE's LX1  
prototype electric  
hybrid wheeled  
loader being  
tested at the  
Redwood Landfill  
and Recycling  
Center in the US**

different way that is also safer.

"When you explain that someone isn't actually in a cab with 60 tonnes of material on the machine going down a 30% grade, but are controlling it from a safe place outside, the interest is there," he comments.

The process of automation will be a gradual one – perhaps beginning with a co-pilot, then a semi-autonomous machine – and even in the future when the technology is available, it is about picking the right machine for the right project. While a semi-autonomous machine may be suitable for work in a large quarry,

it probably would not be used on a project taking place on a busy street in a city centre.

Looking towards the future, Volvo CE plans to launch its range of rigid haulers, which are currently for emerging markets, into developed markets within the next few years and it will also be launching a number of new wheeled excavators in the third quarter of the year.

Summing-up the influence of the disruptors previously mentioned, Roy said, "We see a lot of change over the next ten to 15 years for the industry, but good change." **IC**

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# Compact growth

Global compact equipment sales are expected to set new record highs over this year or next, with growth forecast to continue for at least the next four years

The global market for compact equipment is a diverse one, with many different types of equipment fitting into this broad market. In terms of mainstream machines with global appeal, Off-highway Research tracks the compact wheeled loader, skid-steer loader and mini excavator markets, which amounted to some 275,000 machine sales last year with a retail value of \$12.8 billion.

The increasing popularity of these machines is such that this year sales are forecast to reach more than 293,000 units, which is close to the pre-crisis high set back in 2007. Growth is expected to continue over the coming years, with a new high of more than 335,000 units expected to be sold in 2022, taking the value of the segment to an impressive \$16.3 billion at today's prices.

With sales of 209,000 units globally last year and a value of \$9.4 billion, the mini excavator segment is by far the most

significant sub-set of the compact equipment world. Worldwide sales of these machines have already eclipsed the remarkable highs of a decade ago, and the market could reach a quarter of a million machines in the next few years.

## Rental to the fore

The various drivers of this include the continued rise of the equipment rental sector around the world, but particularly in mature markets. Mini excavators have proved a popular rental

proposition, and sales of new equipment are helped by the fact that rental companies tend to renew their fleets with more regularity than contractors.

Another important driver for the segment has been the rise in popularity of mini excavators in emerging markets, where rising labour costs tend to make machines like mini excavators more economically viable. This has seen the emergence of the Chinese mini excavator market over the last 15 years or so, which in 2017 amounted to 36,640 machines. Further behind the curve is the Indian mini excavator market which exceeded 1,000 units for the first time last year – not a huge number of machines, but a remarkable change for a market which essentially didn't exist as recently as 2010.

## Declining markets

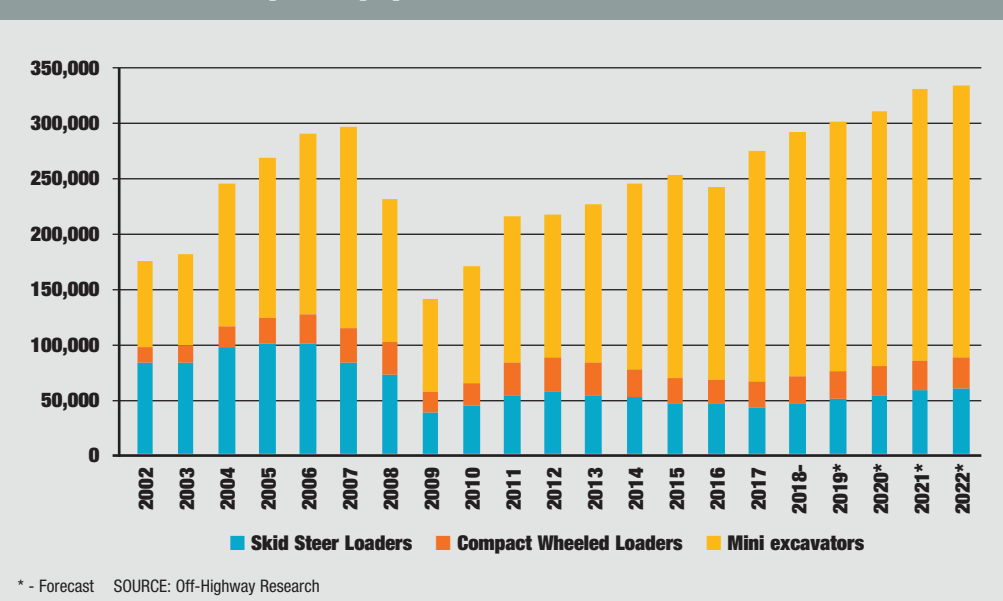
In contrast, the global skid-steer loader segment today is less than half the size it was at its peak in the mid-2000s, with a highwater mark of just over 100,000 machines in 2005. About 80% of global demand for skid-steer loaders is in North America and, over the last 10-15 years, sales have been impacted by the emergence of compact tracked loaders both here and in the wider world. Off-Highway Research believes the global market for skid-steer loaders and compact loaders combined is growing gently.

Similarly, compact wheeled loaders (under 80 HP/60 kW engine power) have a patchy geographic appeal. Some 95% of global demand is in the mature markets of Europe, Japan and North America. Within these regions Germany is the stand-out market, accounting for some 7,850 units, or 33%, of the total global market of 23,900 machines last year.

The patchy appeal of both skid-steer and compact wheeled loaders mean their growth prospects are not as strong as those for mini excavators. However, with equipment markets generally in an upswing at the moment, sales are still expected to increase, to 27,600 compact wheeled loaders and 59,700 skid steer loaders by the year 2022.

Germany is the stand-out market, accounting for some 7,850 units, or 33%, of the total global market of 23,900 machines last year

## Global sales of compact equipment



## 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 USA and Japan, it offers unrivalled market insights, helping its clients to set their global strategies, and plan and invest for profitable growth.

For more information, please visit [www.offhighway.co.uk](http://www.offhighway.co.uk)

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