

construction TECHNOLOGY

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**Virtual and
augmented reality**

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Telematics

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Equipment of the future

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Trimble's SiteVision AR can help to aid communication between the field and office

Virtual and augmented reality are already being used in the construction industry but, as **Neil Ford** discovers, their usage is only going to increase in the future

Changing construction's view of reality

Industry commentators have been discussing the benefits of Virtual Reality (VR) and Augmented Reality (AR) for many years. The benefits in terms of training, marketing and planning are obvious, but they also have the ability to improve efficiency and worker safety by providing insights that established technologies cannot offer. Although the two are often confused, it is the widespread adoption of AR that has the potential to revolutionise all aspects of the construction sector.

To avoid any confusion, it is worth explaining the difference between the two terms. VR refers to the creation of an entirely simulated environment and has a relatively long history in the construction history, particularly in demonstrating how any project will look once completed. By contrast, AR involves superimposing computer-generated images on real world images.

AR is an excellent tool for communicating complex information, as it adds context by overlaying data and other information on the

Conewago Enterprises, a US-based design-build general contractor uses CM Labs' Vortex construction equipment simulators to reduce operator training costs

real world for the end user. Variations, known as assisted reality and mixed reality are also being developed, and all these technologies can incorporate other sensory information, including sounds.

The pros and cons of VR

VR can be used to simulate real world situations and scenarios, and to give workers hands-on experience and training prior to entering a jobsite. "This helps to educate and plan, which improves overall productivity and the safety of workers on site," said Scott Crozier, general manager of Trimble's Civil Engineering and Construction Division. He added that it is currently used for sharing designs and building information modelling (BIM) data with the client, "which helps put the information into a 'language' that the client can more easily understand."

The technology also allows remote operation. For instance, at Bauma China in November, Sany demonstrated its unmanned driving VR technology for excavators. Operators will be able to control machinery and carry out digging work from thousands of miles away. Shi Xiangxing, head of Sany's Excavator



“ Mixed reality tools, which merge real and virtual environments, will likely be the next frontier for safety, operations, communications and inspections ”



Operators can now be trained on all manner of construction equipment before they physically enter the machine

Conewago Enterprises, a design-build general contractor in the US, uses CM Labs' Vortex construction equipment simulators to reduce operator training costs. It previously rented equipment and hired instructors for one-on-one training, but now says it has cut training costs by 60% by using the simulator for rough-terrain cranes, crawler cranes, excavators and wheel loaders. The strategy has also increased pass rates for its trainees in crane operator certification exams.

Electric Control Institute, said that this technology means that operators will no longer need to be present in difficult weather conditions, commenting, "He or she could sit comfortably at his office to see the big screen and check the real-time monitoring.

"All the big data, including the machine performance, work efficiency etc. will be delivered to the monitoring centre." In the longer-term, he is confident that VR will be used for three-dimensional 3D imaging and long-distance wireless transmission.

Martin Lehner, CEO of Wacker Neuson Group, said that the company are currently working on a virtual variant configuration. He explained that customers will be able to view different variants before purchasing in the future, allowing them to configure their chosen machine individually. Wacker Neuson already relies on VR in product development.

"It allows our customers to test the products virtually at an early stage of development and give their important feedback directly to our engineers. This makes development more agile, faster and more efficient," he said.

Another use of this technology is through simulators which can be used to train operators before their equipment even arrives. Drew Carruthers, product line manager for construction products at CM Labs Simulations, directs the development of his firm's Vortex construction equipment simulators, which are designed to cut costs and increase productivity. They are used for mobile or tower cranes, backhoes, excavators and wheeled loaders.

"The growth potential for this technology in construction is huge, as cost of technology comes down," said Carruthers. "Mixed reality tools, which merge real and virtual environments, will likely be the next frontier for safety, operations, communications and inspections in construction."



Microsoft's HoloLens



Martin Lehner, CEO of Wacker Neuson Group

Microsoft's HoloLens is a mixed-reality platform

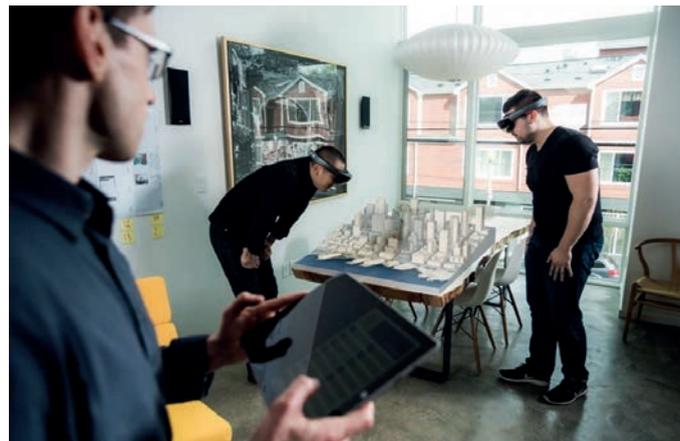
Training technology

Lord Fairfax Community College in Virginia is exclusively using simulators to train people in a sector where there are big workforce shortages. The US' National Commission for the Certification of Crane Operators is

currently conducting a study comparing performance on certification exams when operators train on live equipment versus a simulator. Simulators can also help to identify the causes of accidents and compile risk reduction measures.

However, VR is not without its problems. It has some inherent limitations, such as motion sickness and the hardware can quickly become out of date.

Julian Priebe, head of construction trade press at Liebherr, said that good VR solutions with exact position tracking and attractive visual representation still require extensive hardware equipment, such as a gaming laptop or external sensors. "In order to reach a wider circle of users, an easy-to-use, mobile and qualitative solution would have to be developed," he added.





The augmented revolution

AR has become more widely used since it became available on smartphones, while smart helmets and glasses are taking its usage to a new level. There seems to be a consensus that AR is still at the early stages of being used in the construction industry, but that it will become an integral part of the design and construction process in the near future.

This technology can help mechanics or engineers trying to identify problems with complex pieces of machinery, including through 3D modelling of blueprints. They can view it through their phone's screen, with information hovering over the screen's overlay in real time. Companies are now using AR to demonstrate products and product options to potential customers through the use of different scenarios.

Trimble uses its SiteVision AR application to aid communication between the field and office, by allowing staff in both locations to view the same plans. One of the main applications is in construction inspection, where a design can be loaded and placed to scale. An inspector or site foreman can then use SiteVision to confirm the progress, work completed, or to identify any errors on site. This could be used for utilities, grading, roading and earthworks. Crozier said, "It has the potential to reduce change orders by identifying errors early, improve productivity and reduce the cost of a project."

In November, Trimble demonstrated the use of the Microsoft HoloLens (a VR headset with transparent lenses for AR) for prefabricated rebar. "With this technology, two people can view and collaborate around a piece of prefabricated rebar and view the design model at the same time. The HoloLens scans the environment constantly, and differences to design can be detected," said Crozier.

AR scenarios and data goggles with a camera will be used to perform remote maintenance on machines in the future, according to Wacker Neuson. The service technician onsite with the machine will be instructed by a remotely-located expert. The service technician will share the view of the machine with the expert via the camera, enabling the latter to assess the situation and help find a solution.

The growing use of VR and AR has encouraged construction firms to set up joint ventures with technology specialists to

Increasing numbers of OEMs, such as Wacker Neuson, are investing in VR and AR

“ This technology can help mechanics or engineers trying to identify problems with complex pieces of machinery ”

investigate and develop industry solutions. For instance, Liebherr Tower Cranes has entered into a development partnership with the Center for Construction Robotics at RWTH Aachen to develop construction industry digitalisation from the pre-production phase, throughout the added value chain to the semi-automated construction site. Liebherr Group mainly uses VR in marketing and communication but also in its tower and crawler crane divisions. The Liebherr planning tool Crane Planner 2.0, which is an application for crawler cranes and duty cycle cranes in hoisting operation, allows the construction site to be planned in 3D to make it better understood. Liebherr's sales team use 'Crane Planner 2.0' to present new machines to customers and at trade shows.

Priebe of Liebherr, explained, "The user can either stand at a virtual planning table and move the machine and simulate the lift, or go directly to the construction site and move freely in space. The understanding of the three-dimensional geometry (sizes, heights and distances of the construction site, the machine and the load) is significantly better than on the display of a flat monitor."

Outlook

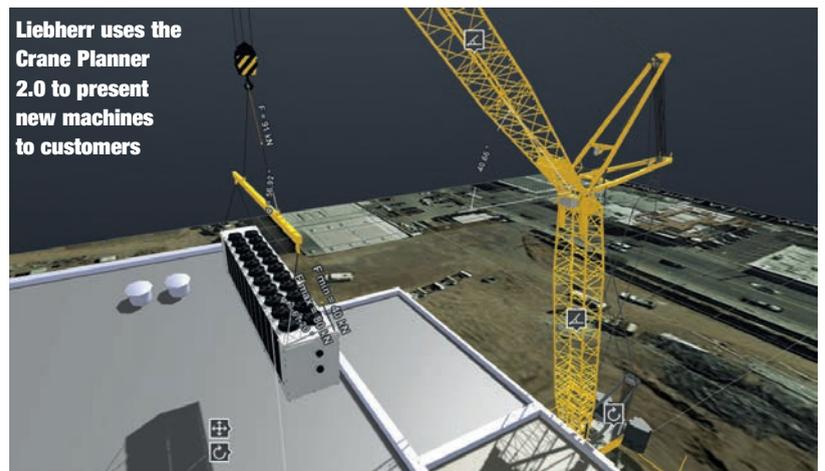
There are already countless applications for AR and VR technology in the construction industry and many others are likely to become apparent over time.

One obvious application is to integrate VR technology in BIM to visualise design and BIM information in the field, but this function is still at an early stage of development. However, Crozier said, "As capability and ease-of-use of the technology continue to improve, I believe we'll see an acceleration in field and office use."

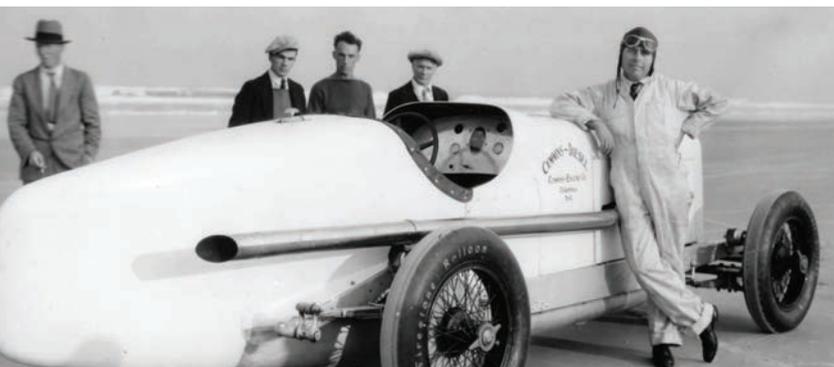
Carruthers of CM Labs Simulations said that the use of AR will continue to grow, partly because the entry costs are low, in contrast with VR. Mixed Reality technology is likely to be embedded into all field survey and machine control offerings before too long.

AR and VR are likely to be used in the future to help overcome the many problems that beset projects at the planning stage. It can be much easier to identify potential difficulties through AR and VR than blueprints and drawings.

With the world's biggest technology companies investing substantial time and money into VR and AR, and most leading construction companies taking this area seriously, future developments in this sector are likely to happen quickly. **ic**



Liebherr uses the Crane Planner 2.0 to present new machines to customers



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Mega data

Telematics solutions can offer vast amounts of data, helping companies to be more efficient and keep their machines safe.

Joe Malone examines the current capabilities of telematics and explores where this sector may develop in the future

JCB's LiveLink monitors fuel economy, operation and maintenance, helping to enhance machine life

Thinking about the advancement in technology in the construction equipment industry, it is most common to focus on the largest and most impressive machinery. From earthmoving products to cranes, their capabilities can seem endless.

However, the reason that these impressive machines are able to last the distance, operating at top-level efficiency throughout their lifetimes is, at least in part, due to data. Indeed, the numbers and figures that are collected via computers operating and embedded into these machines may not be visible, but the influence they have is immense.

To know that a machine is healthy is to know its metrics. Knowing its metrics means that it can be predicted when maintenance work needs to occur before a problem even happens. The powerful, behind-the-scenes industry that is telematics is producing solutions like never before, and companies dare not sit still in this fast-paced industry.

A huge advancement in the market has undoubtedly been the ability to geofence

“ The powerful, behind-the-scenes industry that is telematics is producing solutions like never before, and companies dare not sit still in this fast-paced industry ”

With Trimble Geogates, each Geogate syncs with the Trimble Fleet Management system every ten minutes

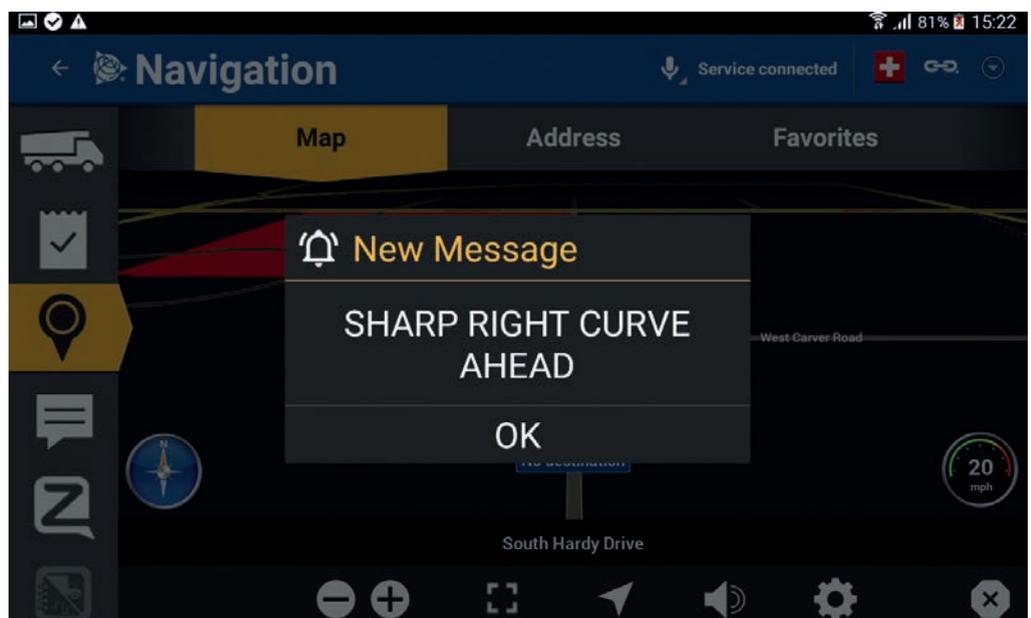
an area, meaning that if a machine exits a designated geofenced area, the equipment owner will be notified and the machine may stop working.

Safety first

Trimble is one such company to offer a virtual marker tool that is integrated into its telematics solutions. This triggers a text or text-to-text notification to the driver, or back to the dispatcher, via a system message.

Named Trimble Geogates, the manager can set the gate by vehicle direction or vehicle type and choose either text alerts, voice alerts of both.

When the user enters Editor View, they can add gates easily by drawing a line perpendicular across the road on a map. Each Geogate will sync with the Trimble Fleet Management



Too much data?

Data stored but not yet used could still prove useful in the future

A company operating in any given industry must have a forward-thinking plan. That means, while telematics has its strengths and weaknesses right now, there must be a road to new innovations. Scott Crozier, general manager of Trimble's civil engineering and construction division, believes that in the future the telematics industry will merge smaller elements together, creating a more in-depth service.

He commented, "The future of telematics will tie utilisation and productivity into project management and financial reporting software. Aggregating BIM and as-built data, project planning and estimating data and actual cost data, allows learning that will be coupled with artificial intelligence to optimise project productivity and instruct autonomous machines."

Interestingly, Crozier believes that too much data is not a bad thing. With the collection of real-time data, there is a lot of information being collected, stored but not used.

However, Crozier said, "Significant value is created from data captured today, and as computer-driven learning and intelligence capability increases, data that is not used today will be used in the future. It is important to capture data today to be ready for a time when technology can utilise it to optimise and eliminate processes, improving the construction industry's productivity."

Uploading masses of data can be beneficial for the future, believes Trimble's Scott Crozier



system every ten minutes.

Adding gated areas has provided an extra layer of security for equipment owners, ensuring their equipment isn't being misused or, worse, stolen. Rental companies which often own thousands of units of equipment, have found it to be a vital tool.

Some of Trimble Geogates' applications may include a warning before a potential hazard, instructions for the driver about where to wait, location data to find a specific stockpile or loading machine, and vehicle identification entering off-limits areas, as previously alluded to.

Speaking of increased security, Case Construction Equipment has launched an advanced version of its Eagle Eye Telematics solution. The aim is also to increase operational efficiency, and this latest version will provide live tracking for the operator, creating geofencing, setting a pre-defined area on a map beyond which the machine will no longer work. Therefore both theft attempts and unauthorised usage can be logged, says Case.

This advanced solution comes with pre-emptive critical machine parameter alerts such as indication of engine oil pressure, coolant temperature, transmission oil temperature, hydraulic filter status and battery status. It will also help in keeping track of service history and sending service reminder alerts along with information on the nearest service centre location.

The new solution – which was launched at BC India in December – will be accessible to both iOS and Android users. Electronics company Bosch was brought in to help with the advancement of Case's latest product.

Ajay Aneja, brand leader, Case India, said, "Case India is focused on improving the customer's productivity. Keeping up

“ A huge advancement in the market has undoubtedly been the ability to geofence an area ”

FleetLink by Atlas Copco is its latest telematics solution



Case India worked with Bosch to develop its Eagle Eye Telematics solution, which it recently launched

with our mission, Case India made some significant upgrades to our state-of-the-art Eagle Eye Telematics technology.

"In an increasingly digitised India, this technology will assist our customers in managing their machines with a higher machine utilisation and preventive maintenance assistance, thereby providing higher productivity and profitability."

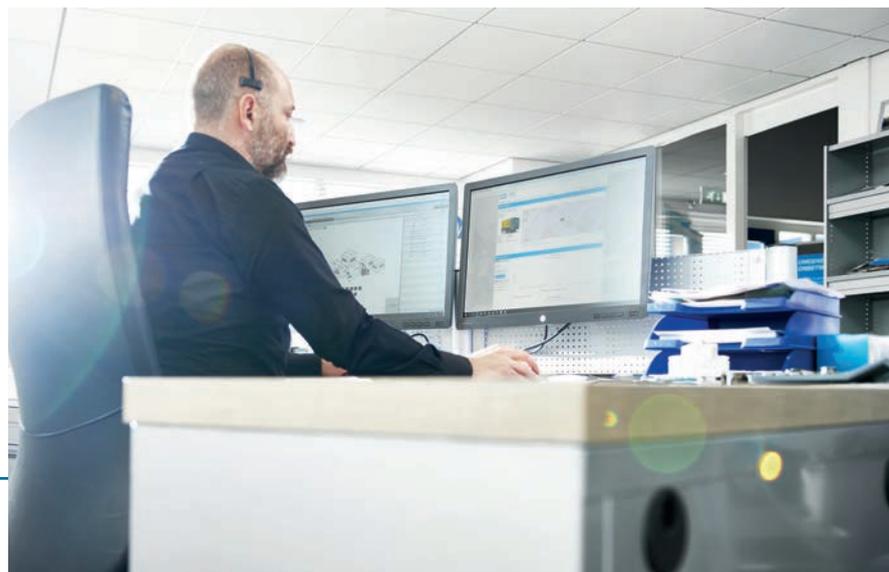
New launch

Brand-new to the market is JCB's latest version of its LiveLink telematics system, enabling mixed fleet operators to control all of their plant and equipment with one network. The company's own telematics system is reported by the company to be used on over 160,000 JCB machines worldwide.

Now these same remote machine monitoring benefits are available to customers who also operate non-JCB equipment. Indeed, the new JCB LiveLink Control Tower system allows fleet owners to import fleet data from any telematics system compliant with the Association of Equipment Management Professionals (AEMP) Telematics standard V1.2.

All machine information – whether JCB or competitive equipment – can then be displayed and interpreted in one web portal or integrated into a user's own IT system. JCB will also provide several Developer Toolkit services to assist with integrating machine data into existing systems and rental or fleet management software.

Some of the benefits to the company's new platform are said to be fuel economy monitoring, operating mode data and planned maintenance and breakdown prevention.





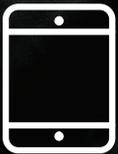
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Geofencing ensures the safety of equipment when working on site, with notifications alerting the owner if it leaves its zone

Geofencing is also a tool for JCB's LiveLink, thanks to its constantly-updated location system which alerts the customer to unauthorised movement of the machine. Having JCB LiveLink on a machine can also lead to reduced insurance premiums.

JCB's managing director, parts and service, Ian Sayers said, "Many customers run mixed fleets and most manufacturers now offer a form of telematics support. This means fleet operators can be faced with a range of complex data, often in different formats.

"This invariably means logging into and viewing several

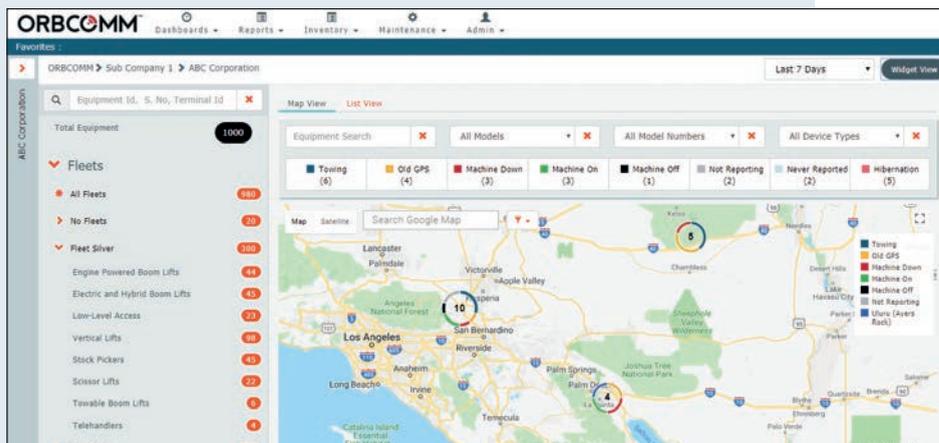


incompatible systems in order to get a comprehensive overview of the entire fleet's performance, whereabouts and service requirements."

Sayers added that JCB's latest platform eradicated this problem by consolidating information from across a complete fleet on to a single dedicated system. This, he said, allowed those responsible for fleet management to interpret data from multiple sources, enabling more informed, more effective and faster decision making.

The fourth industrial revolution?

US telematics provider discusses the future of the sector



Collecting data could help improve all aspects of the construction industry

Over the coming few years, digitalisation, automation and other smart technologies will transform just about every business on the planet as part of the fourth industrial revolution, according to Orbcmm.

The company believes that 2019 will be the year that analytics will start to deliver on that promise, leveraging telematics data to deliver results. But beyond telematics data, it believes there's an opportunity to use other business data to make a difference to the bottom line in the industry.

Telematics solutions commonly provide detailed machine data, including parameters like engine oil, transmission and brake temperature, engine RPM, speed, tire pressure, fuel consumption and emission levels, to name just a few. This data can be analysed and combined with historical failure data and industry knowledge to predict an upcoming failure and to take corrective action. Doing this proactively avoids unscheduled maintenance and unplanned downtime.

While this is an improvement over traditional maintenance approaches, Orbcmm believes there is more that can be done. Other sources of data can improve analysis, such as operational data. For a construction company, this might include machine operator schedule and history, technician maintenance assignments, or to which project part of the fleet is assigned. Analysing this data provides insight into how, when, and by whom a machine is being used and maintained.

Combining telematics data with logistics data could allow for greater insight into drivers who are particularly tough on their machines, flagging the need for driver coaching. For heavy equipment OEMs, this data could facilitate better design and performance of their machines. Applying analytics to this aggregated data could lead to new insights.

Intelligent systems

Sweden-based Atlas Copco says that demand is growing quickly for intelligent digital solutions capable of providing accurate and timely information. This demand, it says, is coming from the construction, mining and rental sectors. As a result, the company has developed two smart connectivity solutions – FleetLink and Power Connect – said to give customers the information they need to increase productivity and make it easier to do business.

FleetLink is a telematics system designed to optimise fleet usage, reduce maintenance costs and save time and money. The platform enables

customers to remotely manage their machines, whether big or small, anytime and anywhere; with the latest fleet information always at hand.

It also offers an effective way for users to remotely communicate with their machines, with high-end digital monitoring tools, such as geofencing, remote function lock out and automatic reporting, keeping them connected to their jobsite, equipment and team.

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Telematics has helped increase productivity in the construction industry and will develop even further



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Technology is changing the construction industry at an increasingly rapid pace. **Katherine Weir** asks industry experts to predict what construction equipment could look like by the year 2029



This autonomous compactor can be controlled through a machine manager application from Trimble

Construction 2029

While looking towards the future is a constant thought for original equipment manufacturers (OEMs) and technology providers, it is news such as the 2020 release of an exoskeleton suit – enabling the wearer to lift 90kg for extended periods – that brings the future a little bit closer.

Sarcos, the US-based robotics manufacturer, has spent 17 years and approximately US\$175 million in research and development to create the Guardian XO Max. The suit requires 400 Watts (W) of power while walking at human speed and takes only one minute for operators to get in and out of.

Could this be commonplace on the construction sites of the future? With a strength amplification of 20 to 1, the Guardian XO Max is said to make 100 pounds (lbs) feel like 5lbs to the wearer. The suit contains sensors integrated into the exoskeleton, allowing the operator to ‘intuitively control’ the robot in a way that ‘leverages his or her instincts and reflexes’ – minimising the need for human training, according to Sarcos.

Construction in 2029

For international manufacturer Liebherr, when it comes to new technology the next ten years will see them focus on the flexibility of product design, the continued use of building information modelling (BIM) and increased customer input.

Dr Gerold Dobler, communication and brand management at Liebherr, said, “The conditions and requirements of customers, the environment and society and the associated challenges in the different applications are becoming more and more diverse. That’s why Liebherr aims to develop new design concepts that offer the user a high level of variance and flexibility and, at the same time, maintain the internal complexity at a manageable level for the manufacturer.

“Liebherr machines are used worldwide in a very broad range of applications – from gardening and landscaping

The Guardian XO Max from Sarcos is said to make 100 pounds (lbs) feel like 5lbs to the wearer



At Bauma China, Sany showed an ‘unmanned’ excavator at work controlled by operators through virtual reality



to road construction, through to tunnel construction, as well as in different areas of material handling. In order to be optimally prepared for different national emission laws and other regulations (e.g. health and safety), current and future machine concepts at Liebherr have a modular design.”

The German-based company believe that the role of BIM will be even larger in the construction industry in the future,

and it is a focus for many of their teams, as is automation.

“The machinery itself will do some tasks autonomously; further features will assist the operator to optimise performances,” commented Dobler.

Another trend that the manufacturer is seeing is the increased attention paid by customers to the design aspects of their machines. Liebherr expects this to continue, with an even closer working relationship in the design process in the future.

Trimble, known for its positioning technologies, believes that we are likely to start seeing ‘autonomous-only’ machines, designed and built to be operated



autonomously with no provisions for a seated operator in a cab.

John Naughton, business area manager of Trimble's civil engineering and construction division, commented "I predict that, while earthmoving machines will not look drastically different, there are likely to be upgrade modules available for unmanned and autonomous operation."

Naughton also believes that increasing amounts of sensor technology will be on, or around machinery, to provide live site updates to all machines on any given site.

Scott Crozier, general manager of Trimble's civil engineering and construction division, said "I predict that, in ten years, there will be a rise of electric machines, with many cities requiring only electric machines. Automated, manned and unmanned machines will exist, and these will be managed locally for some applications and operated and managed remotely in other applications."

A key prediction from Trimble is that the equipment of the future will be more intelligent and able to offer guidance to operators; how to more efficiently and effectively operate their machines, improving performance of both skilled and unskilled operators.

This is a point which Christian Grante, director, emerging technologies at Volvo Construction Equipment (Volvo CE) also makes. "Automation enables us to make machines that are more independent from their operator's direct control. As such, the productivity of an automated machine is not directly dependent on one operator. Therefore, in some cases, smaller machines can be more productive than larger machines," he commented.

Volvo CE recently released the results of their Electric Site research project, which is taking place at a quarry in Sweden. One of the machines involved in the project is the HX2 – a prototype autonomous, battery-electric load carrier – which is smaller than a conventional load carrier and doesn't have a cab. Grante believes that, "This kind of downsizing will bring about many benefits. Smaller machines are easier to maintain and transport, and the robustness of the complete hauling system can be improved. Looking forwards, I believe that we will have machines that can collaborate with people instead of being controlled by them, unlike the conventional machines we have today."

Global manufacturer Sany says that equipment working on construction sites in the future will be autonomous and Internet



Liebherr Tower Cranes has entered into a development partnership with Centre Construction Robotics at RWTH Aachen

of Things (IoT) based. Kim Lee, vice president of Sany Group, said, "You can imagine that the machines will be so intelligent that they can achieve unmanned operation and work autonomously. The benefits are that the machines will know what the most efficient way is to fulfil a project, which can save time and money for the owner.

"It will also remove the need for human beings to go to dangerous environments for work – for example, our operators would not need to work in the North Pole in weather below -40 degrees. He/she could sit comfortably in their office to check real-time monitoring. It's not a far-away picture of the future. We believe that, with everything connected, IoT will make our work more intelligent and easier."

Positive change

The base needs of any contractor will always be to work efficiently to complete a job on time and within budget, so any equipment/technology that helps them to achieve this will be welcomed. Getting qualified and skilled staff to fulfil these timescales is also an issue that is expected to continue in the future.

For instance, Liebherr recognises the difficulty its customers have in some countries finding qualified professionals for their construction sites. Its mobile crane division is working to simplify crane operation to make it even safer to operate, regardless of experience. E-learning is a tool that will become more important for this industry, the manufacturer argues.

As well as this, Liebherr is also forming partnerships with ➤

“ Although machine automation will get the most attention for the foreseeable future, it is actually the intelligence that goes into informing the machine how and when to operate that will bring the biggest benefits ”

One of the autonomous, electric-powered HX2's at work on the Electric Site. It is fitted with a vision system, which allows it to detect humans and obstacles



The crane planner 2.0 combines detailed, interactive 3D models with all the relevant planning data



EQUIPMENT OF THE FUTURE

technology-based companies to bring more to its customer offering.

Dobler said, “Customer needs are one of the key drivers for our development teams. Liebherr Tower Cranes has recently entered into a development partnership with the Centre Construction Robotics at RWTH Aachen in the area of robotics for construction. The objective is to redesign the construction site of the future and to redevelop digitalisation from the pre-production phase, throughout the added value chain to the semi-automated construction site.”

Crozier from Trimble believes that, although machine automation will get the most attention for the foreseeable future, it is the intelligence that goes into informing the machine how and when to operate that will bring the biggest benefits. He said, “The key is to develop technology that optimises processes and projects, not just tasks.”

At the Trimble Dimensions user conference in Las Vegas, US, the company showed a number of solutions that Trimble believes will be ‘commonplace in ten years.’ One of these was a dozer and two compactors working autonomously on the same project, controlled through a machine manager application. There

were multiple cameras monitoring the site, tracking objects and monitoring terrain to determine progress and provide collision alerts. Eventually, the cameras will provide insights on how to perform tasks more efficiently.

A demonstration of the kind of technology we will see more of in the future occurred late last year when Swedish-based Sandvik saw one of the company’s 11m-long LH514 LHD (local haul dump) trucks self-navigate through a glass labyrinth. Laser sensors detected the walls, helping the machine to move through the labyrinth’s narrow aisles.

Jouni Koppanen, senior systems engineer for automation at Sandvik, said, “Autonomous systems improve safety and productivity for our customers. For the first time ever, the entire cycle can be automated, from loading to hauling and dumping. Nobody has been able to do that before.”

The AutoMine system means that Sandvik loaders and trucks learn the safest and most efficient route the first time they enter a tunnel. Guided by a set of lasers, the equipment’s intelligent system maps out



Sandvik’s LH517 LHD has an automated system which learns the safest and most efficient route, even underground

“ We will see design ideas emerge that will ultimately change the form factor of machines ”

The currency of the future

European committee discuss digitisation

At the 2018 Committee for European Construction Equipment (CECE) Congress, held in Rome by Italian construction company UNACEA, data was described as ‘the currency of the future’.

This observation was made by Enrico Prandini, president of CECE at the association’s Congress, which discussed the human-machine interface, and how customers of construction machinery are changing.

“Digital transformation will be the future,” Prandini told the Congress. “Data will be the currency of the future.”

Across Europe, in terms of technology, the main driver for industry transformation was said to be digitalisation. The results of an eight-month long project into the digital transformation of the construction industry was presented for the first time at the Congress.



Enrico Prandini



Virtual reality headsets and controllers for the Liebherr Crane Planner 2.0

and records a path. Sandvik’s algorithms, together with its sensors and gyroscopes, ensure the machine knows where to go underground – an environment in which GPS is not possible.

Working smarter

Naughton at Trimble explains that, although autonomous machines aren’t widely available yet, this is an area where he thinks we’ll see significant innovation

that will help improve efficiency in construction in the future. “As autonomous machines become more mainstream, I expect that we will see design ideas emerge that will ultimately change the form factor of machines like excavators, dozers and compactors that have remained largely the same for decades.”

At the Bauma China exhibition in November, Sany showed an ‘unmanned’ excavator at work. Lee said, “Many customers like this machine; through virtual reality glasses, the operators could control the excavator miles away (in other city) to finish the digging work.”

In a move to harness even newer technology, Trimble has partnered with specialist software company Neurable to explore the use of brain-computer interfaces (BCI) for the transportation and architecture, engineering and construction industries.

This partnership will leverage bio signals, such as brain activity combined with eye tracking technology, to improve training efficiency, driver safety and high-risk front-line worker safety as well as provide insights to augment the benefits of a simulation and design evaluation.

Dr Ramses Alcaide, founder and CEO of Neurable, said, “Until now, BCI has lived in the realm of academia and science fiction. By combining Trimble’s proven history of commercialising emerging technologies with our innovations in neuroscience, together we will explore how we can bring the value of BCI to real-world applications.”

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Trimble Connect for HoloLens uses mixed reality for project coordination by providing alignment of holographic data





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