

Large scale bridge projects are extensively planned for years in advance and are becoming bigger and more ambitious than ever before, reports **Catrin Jones**

The decision-making and planning that occurs before the construction of bridges demonstrates the work that goes on behind the scenes to produce safe and structurally sound crossings. Despite the planning that occurs issues can still arise, with some high-profile examples of this in recent years, such as the collapse of the Morandi Bridge in Italy. Thankfully, such incidences are rare and bridge builders are becoming increasingly ambitious in their plans.

Paul Sullivan, president, international business at Acrow, understands the need for solutions when difficulties arise in bridge construction. Acrow's international presence includes leadership in the development and implementation of bridge infrastructure projects in more than 150 countries. He says that greater government collaboration on large-scale infrastructure programmes and modular bridging as a key enabler in the delivery of sustainable infrastructure benefits the industry, as well as mitigating surrounding challenges.

"In the public sector, there has been an increased recognition globally that investment in key infrastructure assets, such as bridging, has a significant socio-economic impact on rural communities and a direct link to improved rural connectivity," says Sullivan.

"Additionally, in both the public and private sector, modular bridging has moved to the forefront of infrastructure development, resulting in an increased use of modular steel bridges to accelerate bridge construction, serving permanent planned construction projects or emergency response requirements."

Modular bridges can help to accelerate bridge construction and deliver connectivity quickly, safely, and efficiently in comparison to traditional bridge construction methods. Sullivan notes that the last 25 years have seen several real changes in the prefabricated modular steel bridge market, globally, with digital transformation and sustainability featuring as key drivers.

"We are responding with the adoption of digital technologies, such as BIM, VR and AR, as well as with the development of our own bridge configurator. We are also digitalising our processes to enable us to work more collaboratively in partnership across the supply-chain," he says.

"We anticipate a continued focus on



Adapting and overcoming

Given the massive weight of the Panther Island Bridge's falsework structure, a dozen 17-tonne Enerpac HSL-1507 strand jacks were needed



digital transformation moving forward, giving us the exciting opportunity to work on further digital innovation."

Global bridge projects

Max Bögl Group is building a new vehicular bridge across the Aftetal Valley in the North Rhine-Westphalia region of Germany, using automatic self-climbing formwork from specialist access provider Doka.

Supported by six piers measuring up to 66m high, the new Aftetal bridge will be 800m long and will stand over the valley at a height of almost 70m. It is being built as a bypass for the town of Bad Wünnenberg, which is situated between the larger town of Brilon and the city of Paderborn.

The bridge aims to reduce traffic congestion, while also making the 55km journey between Brilon and Paderborn easier for vehicle users. Construction of the Bad Wünnenberg bypass, of which the Aftetal bridge is the centrepiece, began in 2016. It is due to open for public use in the spring of 2022.

In the US, Texas Sterling Construction Company faced difficulties erecting the falsework for the three v-pier bridges that comprise the Panther Island Bridges in Fort Worth.

The main concern was removing the structure once the concrete was poured and hardened. Despite the loads weighing roughly 63.5 tonnes, the structural variations meant that individual lifting points could vary. Therefore, lifting capacity and the ability to control uneven loads needed to be a key consideration.

Engineered Rigging were called upon to identify a solution for the irregular loads. Drawing from previous experience working on the Cline Avenue Bridge in

Çanakkale 1915 Bridge, Turkey, is scheduled to be completed in time for the country's centennial in 2023



estimated cost is between £72-£98 billion (US\$95-US\$129 billion), a joint venture of Balfour Beatty and Vinci is to build the UK's first 'box-slide' railway bridge over the M42 motorway in North Warwickshire.

The railway bridge will carry HS2 passenger trains north to Crewe and south to Birmingham, as well as onward destinations such as the new Interchange Station in Solihull or London Euston.

Project leaders have decided to use the 10,000-tonne box-slide bridge structure to minimise disruption to motorway users during construction.

David Speight, client project director, HS2 Ltd said, "At HS2 Ltd we're always looking for innovative ways to reduce our impact on local communities, and this UK-first 'box slide' provides a quicker and safer solution."

The bridge was originally designed as a traditional structure, however this "would have meant significant traffic disruption for motorway users, with around two years of reduced lane widths, 50mph speed limits and weekend and night closures," HS2 Ltd said.

Elsewhere, Mammoet recently assisted Rijkswaterstaat and contractor combination KWS – VES – DDM to remove a steel arch bridge in Vianen, Netherlands.

The bridge arch weighed 5,000 tonnes and was approximately 30m high. To complete the job, Mammoet built a large gantry system that would support and lift the arch.

Eight masts were mounted on a pontoon placed under the bridge, which were linked to the eight lifting towers on the bridge. The pontoon took over the weight of the bridge at high tide.

With the bridge small enough to pass under the adjacent Jan Blankenbrug bridge, it headed for final demolition at the Mammoet shipyard at Schiedam, in the west of the Netherlands. There the steel will be reprocessed into raw material.

Paul van Gelder, Mammoet CEO, commenting on the project on social media, said, "Not an easy job due to the design of the bridge. But it was done safely and professionally by a team of different companies having the same objective."



East Chicago, it was suggested that strand jacks were a viable method.

Engineered Rigging's president, Christopher Cox, said, "Strand jacks offer the highest lifting capacity in the smallest footprint. They are also easy to configure and very safe to use which makes them a winning option in a variety of settings from civil infrastructure applications, such as bridge building, to critical lifts in the nuclear and heavy fabrication sectors."

Given the massive weight of the Panther Island Bridge's falsework structure, a dozen 17-tonne Enerpac HSL-1507 strand jacks were needed to fulfil the heavy lifting requirements of the project. In addition to being powerful, the strand jacks boast a compact, portable design that worked within the Panther Island Bridges' space limitations.

In the UK, on the country's HS2 high speed train line – for which the current

Artist's impression of the UK's first 'box-slide' railway bridge over the M42 motorway

Trillion dollar infrastructure package

The new infrastructure spending budget set by President Biden will deliver US\$550 billion of federal investments to projects over the next five years, with repairing the nation's bridges a key aspect of this. ➤

Mammoet recently helped remove a steel arch bridge in Vianen, Netherlands



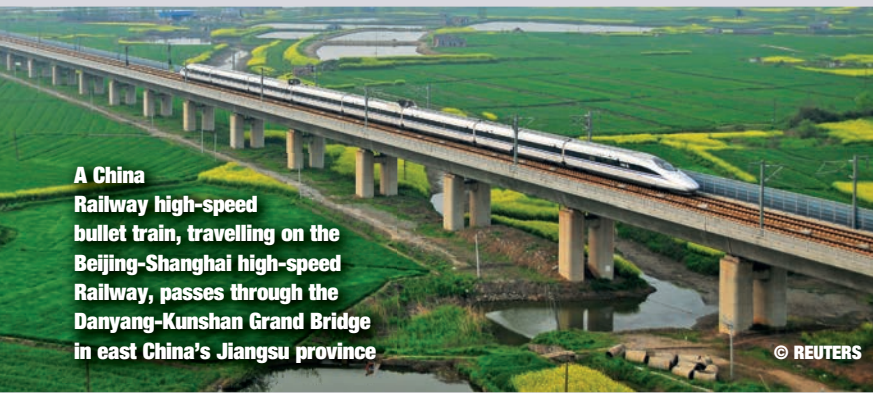
Record-breaking bridges

Three notable bridges that battle extreme weather

The Danyang-Kunshan Bridge in China is the world's longest bridge with a length of 164km. The sturdiness of the bridge, which required approximately 408,000 tonnes of structural steel, allows it to withstand massive natural disasters such as typhoons and earthquakes of magnitudes reaching eight on the Richter scale. Furthermore, the bridge is also able to withstand impacts from naval vessels that weigh up to 272,000 tonnes.

Located in South Korea, the Incheon Bridge is a 13km toll bridge composed of a centre cable-stayed bridge section, approach bridge sections, and viaducts. The main purpose of the structure is to provide direct access between Songdo and Incheon International Airport. The bridge itself can withstand storms and earthquakes with magnitudes reaching a seven on the Richter Scale.

Considered the longest cable-stayed bridge in the world with a total length spanning 3,100m with a 1,104m distance between the towers, the Russky Island Bridge in Russia, needed significant design consideration. It is located in an area that faces extreme weather conditions and temperatures that can dramatically change at any given time.



A China Railway high-speed bullet train, travelling on the Beijing-Shanghai high-speed Railway, passes through the Danyang-Kunshan Grand Bridge in east China's Jiangsu province

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In the American Society of Civil Engineers' Report Card on US infrastructure, the report said that 42% of all bridges are at least 50 years old, and 46,154, or 7.5% of the nation's bridges, are considered structurally deficient, meaning they are in 'poor' condition. Approximately 178 million trips are taken across these structurally deficient bridges every day.

The US department of transportation will allocate the federal money through a variety of programmes. Some funds will be distributed directly to state transportation agencies whereas the rest will be awarded to selected applicants through competitive grant programmes.

The legislation does not highlight specific projects that will receive the funding so it is up to state and local agencies to decide how they will apply for the funds. It could take months for the

The 785m long Aftetal bridge is the centrepiece of the Bad Wünnenberg bypass; it will be opened to traffic in 2022



An Acrow bridge in Italy – the company says that the bridge sector has a continued focus on digital transformation

department of transportation to implement adequate procedures and set the qualifying criteria.

A project that could greatly benefit from the infrastructure package is the Brent Spence Bridge that passes over the Ohio River. A popular trucking pathway for goods from Florida to Michigan, it is one of the most congested interstate corridors in the country.

To alleviate the traffic that frequents the bridge, funding could be used to build a new bridge directly next to the existing structure to reduce traffic as well as towards bettering the condition of the Brent Spence Bridge.

According to reports from CNN, Mark Policinski, CEO of the Ohio-Kentucky-Indiana Region Council of Governments, commented that, "The proposal has been on the shelf for years and the design is ready to be implemented."

From the US to Turkey, and news that since delivering an engineering solution for the Çanakkale 1915 Bridge, Doka Turkey has continued its work on this record-breaking project as it takes another step towards its scheduled completion, in time for the country's centennial in 2023.

Having delivered a solution for the bridge between 2018 and 2019, Doka Turkey was called upon again to continue its work on this extensive corridor across Turkey's western region, this time as a partner on the V01, V06 and V08 viaducts located in Malkara, Gallipoli and Lapseki. Doka Turkey delivered a solution for the anchorage blocks, approach viaducts and the viaducts themselves.

For the approach viaducts and viaducts, a 'push and slide' method was used by incorporating two separate, prefabricated bridge moulds of 38m, with a total area of 3,500m². As one of the key features, a specially designed, 25m edge mould trolley system was created to complete the bridge segment casting without the requirement of scaffolding. In order to save time, the system was fixed to a 500m rail resulting in faster progress, without sacrificing safety.

With safety remaining a top priority, the Doka Turkey team used a combination of scaffolding, equipped with pier working platforms and stair towers, to provide easy and secure access, and an MF240

Climbing System to make fast progress. Large-area formwork Top 50 was used in combination with Load-bearing tower D2 to ensure a consistent workflow.

Doka Turkey managing director, Ender Özatay, said, "The client had many concerns regarding the project, in particular ensuring that it remained on time and on budget. Thanks to the precision elements used, they were very happy to see that no corrections or amendments were required."

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