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COME TO THE CARNIVAL

Underwater sculpture park celebrates
Grenadian culture and history

STRUCTURAL PRECAST

Reducing floor-to-floor cycle times
with precast columns

FORMWORK AND FALSEWORK

Slipform or jumpform – let the
project requirements decide

REVOLUTIONISING INFRASTRUCTURE DELIVERY THROUGH A MODULAR APPROACH

Phil Robinson of **Laing O'Rourke** looks at how an off-site manufacturing approach is being applied to the construction of bridges.

Off-site manufacturing, a core component of modern methods of construction, offers many benefits, including: faster construction times; reduced safety risks; better workforce schedules; increased efficiency; and, in many cases, greater scope for carbon reduction.

Recognising these benefits, Laing O'Rourke has adopted an innovative approach by deploying off-site manufacturing techniques for bridge building. Bridges are a proven modular product. Due to its high degree of repeatability, bridge construction is well-suited for a 'kit of parts' approach, meaning

components can be manufactured in factories and then easily assembled on-site in a variety of arrangements.

MODULAR BRIDGE BUILD

For Laing O'Rourke, modular bridge build solutions have been successfully deployed on several large-scale UK infrastructure projects. The business' modular approach comprises standard precast components that can be readily configured to specification, using advanced design automation and digital configuration tools. The company's Digital Bridges Toolkit enables designs to be developed and refined efficiently, reducing the design period and creating agility

BELOW:

Modular bridge build in action.

in developing and assessing design options.

Like specifying design features on a new car on the manufacturer's website, the Digital Bridges Toolkit enables rapid optioneering, allowing a range of designs, components and materials to be compared on a like-for-like basis to a high level of detail. This minimises the risk of variance between the proposed and final product, and increases accuracy and confidence pre-build. Estimated carbon footprints can also be calculated for various designs.

The digital toolkit is continually being developed to include further bridge products and assembly options for a larger variety of bridge



types, particularly for rail and road networks, to keep pace with evolving market requirements. The firm is working closely with clients and designers to develop that capability.

Development and implementation of the digital toolkit requires collaboration and technical engineering expertise from across the construction value chain, including contractors, clients and designers. This combined expertise takes into account design, materials, manufacturing and assembly considerations, enabling a deeper understanding of how components will feasibly fit together.

Once designs are set, the manufacturing of components takes place off-site in a factory environment, resulting in greater reliability of programme and delivery times by minimising

delays due to weather-related or other external impacts. Laing O'Rourke's off-site manufacturing is conducted at its Centre of Excellence for Modern Construction in Nottinghamshire – Europe's most advanced concrete products manufacturing facility – before components are transported and assembled on-site.

Across the industry, clients and contractors are increasingly using the modular build model, with programme, workforce size and sustainability benefits being realised on a large scale.

RAILWAY TRACE BRIDGES

In 2020, Laing O'Rourke worked with its client to design and build 35m-span bridges using a modular approach, achieving the following outcomes:

- Programme timeframe reduced by 50% (from 37 to 19 weeks).
- 8% reduction in embodied carbon, based on calculations of an equivalent traditionally designed, in-situ reinforced concrete abutment.
- 84% reduction in on-site resource. With much of the workforce transferring to an off-site environment, on-site construction was completed in three weeks, with a six-strong workforce.

A LOOK TO THE FUTURE

The modular build model is replicable for a range of products in a variety of sectors.

“As new, lower-carbon materials – such as low-carbon concrete – become available, the embodied carbon footprint associated with different choices can be easily calculated and modelled, helping to further the low-carbon construction agenda.”

Through its Product Based Building Solutions system, Laing O'Rourke has proven that digitally and physically configurable 'kit of parts' buildings can be built at scale and tailored to meet the needs of individual sectors, including education, healthcare, commercial and defence.

Additionally, as new, lower-carbon materials – such as low-carbon concrete – become available, the embodied carbon footprint associated with different choices can be easily calculated and modelled, helping to further the low-carbon construction agenda. For bridges, in-depth testing and analysis have identified where alternative, lower-carbon concretes can be used as part of a modular approach.

Innovation in low-carbon reinforcements has also progressed, which can impact the overall embodied carbon of final structures. For instance, by replacing steel reinforcement with basalt on Laing O'Rourke's modular bridge abutment solution, it is possible to reduce the carbon within the off-site manufactured components by 22%.

ACCELERATE CHANGE

Deploying innovative techniques, like off-site and modular construction, will help to accelerate transformative change within the construction industry and solve some of its greatest challenges.

As the industry strives towards net zero, it will need to deploy new materials, systems and approaches. A digital, modular building approach is just one solution and one that can transform infrastructure build by increasing speed and agility in a low-carbon way. **C**

LEFT:
HS2 trace bridge.

INSET:
Bridge assembly.

