INTERNATIONAL MOLYBDENUM ASSOCIATION
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Duplex bridge in a box

A dated concrete footbridge crossing a railway in the UK presented a familiar accessibility problem: passengers unable to use the stairs faced a lengthy detour to cross the tracks. Replacing it with an accessible bridge with elevators would normally involve months of onsite construction. A radically different approach reduced the most disruptive part of the work to just 36 hours.



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Britain's railway is in desperate need of modernization. Saddled with a heavily utilized existing network that often dates to the Victorian era, it relies on a construction model that has seen little change in 50 years. Its operator, Network Rail, has ambitious targets for public accessibility and sustainability, which it must pursue at a time when funds are limited. All told, a complex picture to resolve. Even modest improvements, such as upgrades to station footbridges, are costly and frequently beset by overruns. It is within this context that a new approach to railway footbridge construction emerged.

From project to product

The typical solution for rail station bridges is a painted carbon steel truss, a design more or less unchanged since the 1970s. While this approach is structurally efficient and requires minimal initial outlay, it creates a future liability of closing the bridge for costly repainting. The costs of repainting are driven by the logistics of working in a live rail environment, which necessitates suspended scaffolding, encapsulation to prevent environmental contamination, and even scheduled rail line closures to ensure worker safety. With major maintenance interventions typically required every 25 years, this operational expenditure can vastly exceed initial costs.

Conventional construction methods also demand a prolonged and often disruptive site presence. This period can have significant effects on passengers, affecting scheduled train services and restricting access to boarding platforms. Total site time for a complete footbridge project often takes eight months or more. The installation of a standard elevator shaft alone can require up to 26 weeks of onsite work. And when all is said and done, the average project timeline for a typical bridge is four years.

Bead blasting gives the stainless steel cladding a clean, uniform matte finish that reduces glare and is easy to maintain.





Elevators at either end of the AVA footbridge provide accessible passage across the railway.

The AVA bridge concept provides a major rethink, shifting from a project-based philosophy to a product-based one. The concept originates from the Network Rail Footbridge Design Ideas Competition, organized by the Royal Institute of British Architects (RIBA) in 2018. Architectural firm Hawkins\Brown proposed a modular "kit of parts" method of construction that could be configured for a range of sites. It would be mostly assembled offsite using lighter materials than traditional approaches, dramatically reducing onsite construction time.

While falling short of winning the top prize, the idea provoked interest and was developed further through funding from the Transport Infrastructure Efficiency Strategy (TIES) Living Lab. The outcome was a new consortium bringing together the client, designers, contractor, and fabricator. Network Rail, Expedition Engineering, and Hawkins\Brown led the design, working with contractor Walker Construction and fabricator McNealy Brown. ARX designed the lift system.

AVA's product-based approach relies on material and structural choices that reduce onsite processes, particularly painting and concrete work. Molybdenum-containing duplex stainless steel is a key aspect of the design. The lean duplex alloy S32101, which contains about 0.2% molybdenum, was used for both the full-size prototype and the first operational bridge. It provides greater yield strength (450 MPa) than the carbon steel typically used in bridge construction (355 MPa). The higher design strength allows for a lighter structure and reduced demands on the foundations. The material requires no coatings during its





Prototype components illustrate the AVA bridge's construction method: stainless steel plates are folded into structural sections (left), which are assembled using preloaded bolts rather than welding (right).

120-year design life, removing a significant component of maintenance costs. For more demanding environments, such as coastal locations, the design could instead use the more corrosion-resistant duplex grade 2205, containing around 3% molybdenum.

Design details

The bridge uses a novel modular structure consisting of 1.2-meter sections, which are folded from 6-millimeter stainless steel plate. The bridge span can be configured with different numbers of modules to suit the requirements of a particular station. The modules are joined using a lapped-plate detail to create bridge spans of up to 20 meters. The module dimensions were chosen to suit standard fabrication equipment. Using 6-millimeter plate and a maximum sheet size of 1.5 by 3 meters keeps fabrication within the capacity of widely available laser cutting and brake press equipment. The resulting modules are light enough to be assembled in the factory using relatively small lifting equipment before being transported to site.

AVA staircases being assembled in the fabrication workshop, reducing the work required onsite.



To facilitate both assembly and disassembly, the design avoids onsite welding and uses only bolted connections. These connections rely heavily on A4 bolts, which are made from Type 316L stainless steel with a minimum molybdenum content of 2.5%. These bolts have similar mechanical properties to conventional 10.9 structural carbon steel bolts. Almost 13,000 of them, altogether weighing 1.7 tonnes, were provided by Bumax for the first operational bridge. The bolts were designed as preloaded assemblies to ensure no slip occurs in service and prevent loosening due to vibration. They were pre-lubricated and tightened following a carefully specified four-stage process to prevent galling, a form of wear in which the mating surfaces of stainless steel fasteners can stick together during tightening. The connection design followed guidance in the then-draft Eurocode prEN 1993-1-4, as no standard for preloaded stainless steel bolts had yet been issued. The recommendations were based on results from the SIROCO research project on slip-resistent connections, co-funded by the European Union and industry partners, including IMOA.

Significantly less disruption

The high degree of preassembly involved in the AVA concept means onsite construction can be reduced from a typical 35–45 weeks to around 15 weeks. The project timeline also decreases by almost 60%, from

the typical four years down to 20 months. Elements such as the main bridge span and stair assemblies can be transported to site and craned into place within 36 hours, requiring only a single possession, a scheduled period when the railway is closed to train traffic so work can be carried out safely.

The use of shallow lift pits minimizes excavation, reducing site preparation time and the risk of encountering buried utilities or unexpected ground conditions. A specialist “configurator” computer program, which helps tailor the design to specific site needs, cuts the time required for planning and approvals.

The modular bridge product philosophy also includes the integration of mechanical, electrical, and plumbing systems. The AVA lift modules are pre-commissioned and tested in a factory, an approach that reduces lift installation time from up to 26 weeks down to just two. Service runs for power and data are concealed behind hinged panels that can be accessed from deck level, allowing for convenient, safe future maintenance. The bridge deck is made of a non-slip aluminum surface with a service life of 60 years or more, another pragmatic choice that is easily replaceable and eliminates concrete work.

Stowmarket to the world

The first operational AVA bridge was installed at Stowmarket, Suffolk, in late 2025. Network Rail approved the AVA design for widespread adoption. Its Footbridges & Subways Design Manual compares AVA with other standard station designs across criteria including passenger experience, safety, maintenance, buildability, cost, and sustainability. AVA achieves the highest overall score in this comparison. Its sustainability credentials include an extended design life and high potential for reuse through the modular design approach: if no longer needed, modules could be reused in bridges elsewhere.

The cost comparison is equally striking. Despite the higher material cost of duplex stainless steel compared with carbon steel, AVA has the lowest estimated initial capital cost of the four covered station footbridge designs in the comparison. Its minimal maintenance requirements deliver additional savings over its 120-year design life. The team now is seeking to refine the product to bring down costs further. The AVA Consortium maintains that a structured order portfolio is key to achieving further cost reductions to the scheme by unlocking economies of scale and spreading upfront manufacturing and design costs across multiple projects.

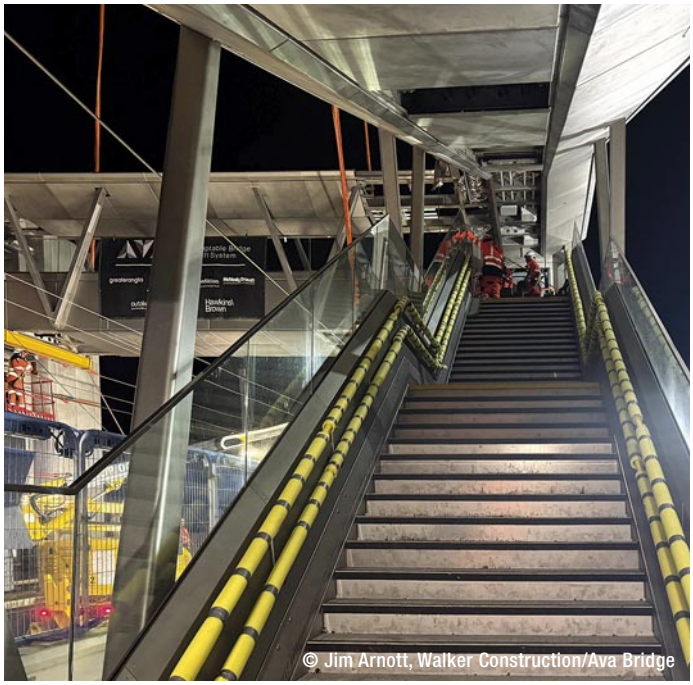
The AVA bridge at Stowmarket illustrates how manufacturing principles, such as standardization, offsite preassembly, and using advanced materials, offer a compelling approach for railway footbridge construction. While the concept is still early in development, it highlights the potential of treating bridges as adaptable products rather than bespoke construction projects. With it comes a vision for a more efficient modernization of railway stations, both in Britain and abroad. (Max Cooper)

The prefabricated staircase being craned into position at Stowmarket station.



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The installed staircase, with its stainless steel structure, glass balustrades, and integrated handrails.


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