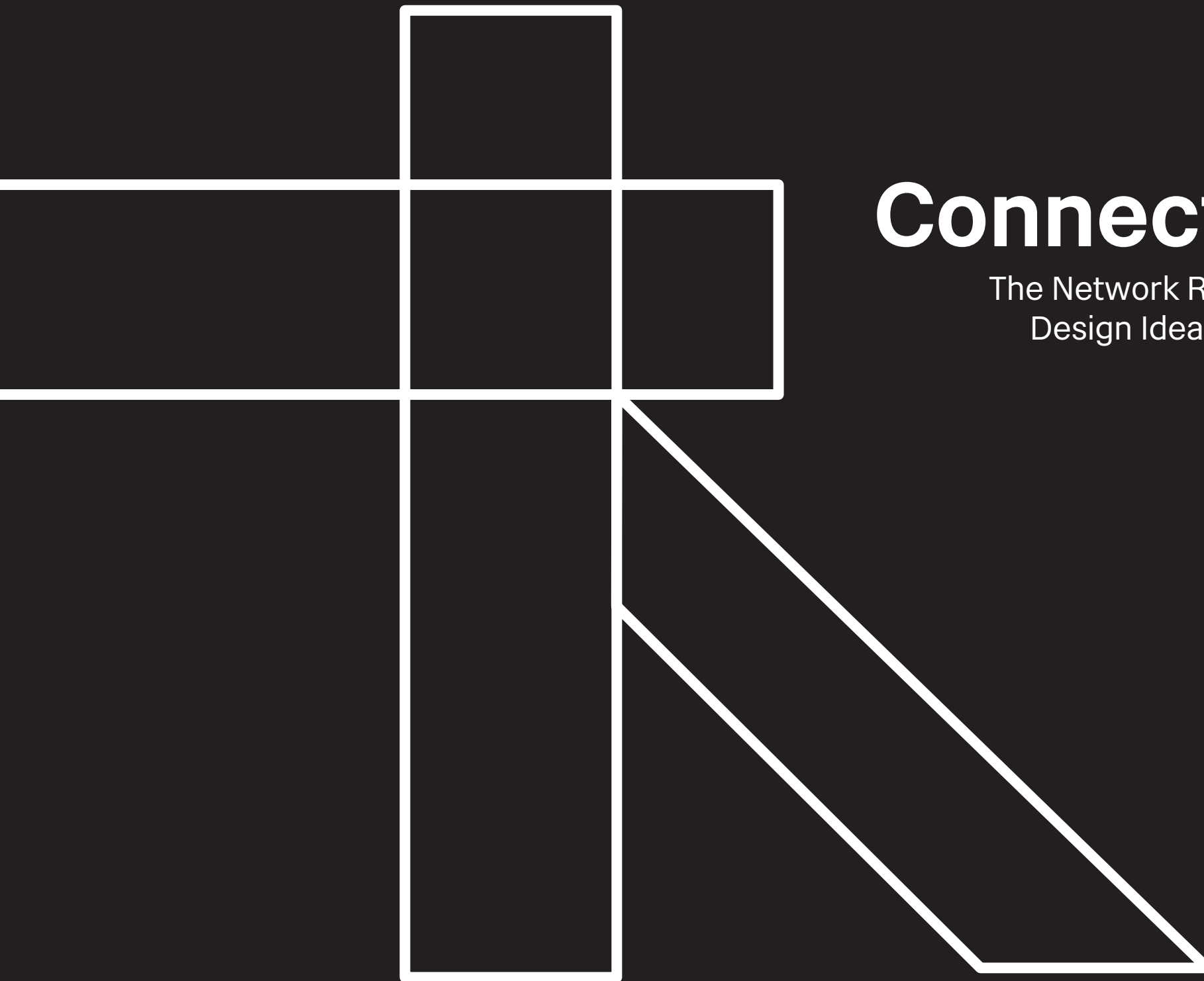
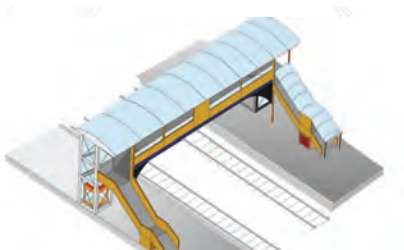
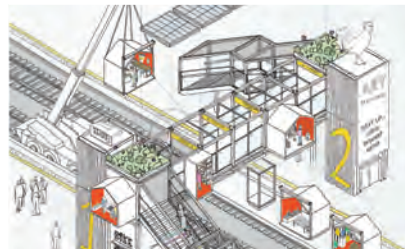
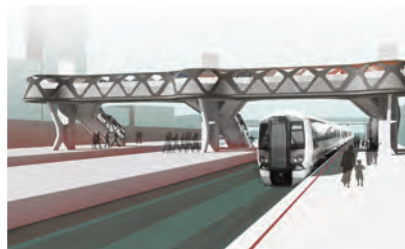
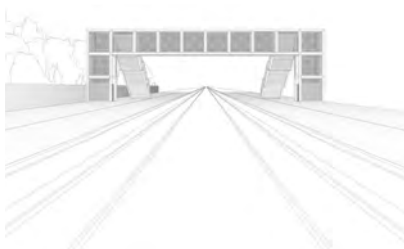
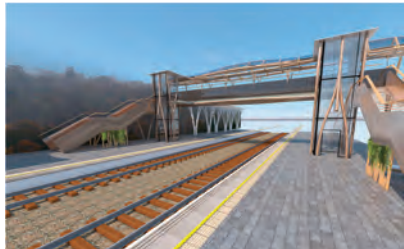




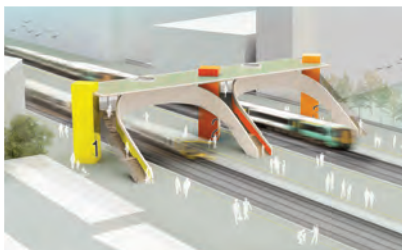
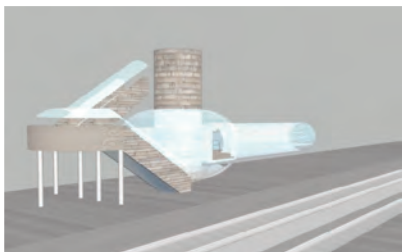
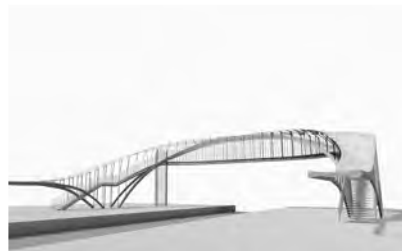
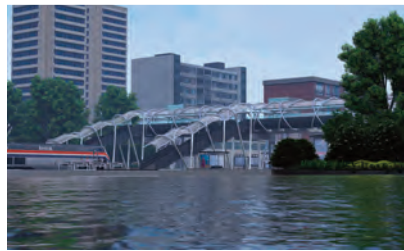
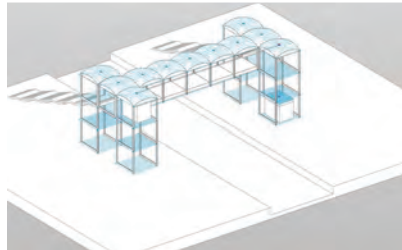
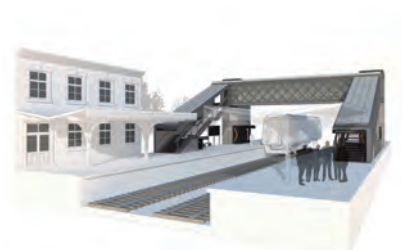
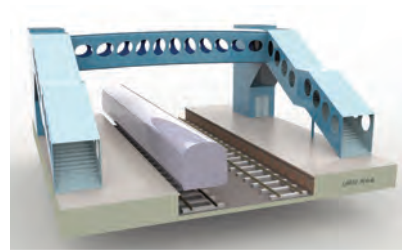
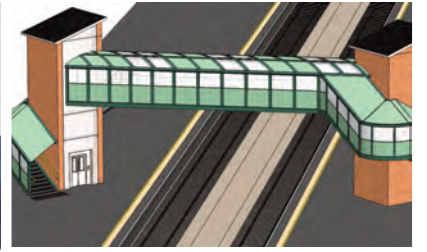
# Connections

The Network Rail Footbridge  
Design Ideas Competition

Daniel Wright











# Connections

The Network Rail Footbridge  
Design Ideas Competition

Daniel Wright

with foreword by

Anthony Dewar and Frank Anatole





---

# Contents

|                                       |     |
|---------------------------------------|-----|
| Foreword                              | 7   |
| A Legacy of Connections               | 9   |
| Creative Connections: The Competition | 19  |
| Winning Design & Highly Commended     | 31  |
| Long-listed                           | 37  |
| The Field                             | 57  |
| Making New Connections                | 161 |
| Bibliography                          | 181 |
| Credits                               | 182 |
| About the Author                      | 183 |



---

# Foreword

**Anthony Dewar, Professional Head Buildings and Architecture, Network Rail**

**Frank Anatole, Principal Architect, Network Rail**

The built environment is powerful. It shapes our everyday experiences whether in our own homes or out and about; meeting friends, engaging in leisure activities, shopping, exercising or as part of our professional lives. And at the heart of being 'out and about' is our transport infrastructure. The efficiency and comfort of the journey can make or break our experience. We at Network Rail take this seriously. We want our passengers to feel that they can rely on us to have stress free journeys, so they can go about their lives with confidence that they can get from their starting location to their destination with ease.

Our built environment assets are critical to passenger experience. While footbridges may not be foremost in people's minds when they think about railway infrastructure, your ability to arrive at a station and know exactly where to go and what to do, without concern about safety and possible physical, sensory and language limitations, is key to many people's journeys. And we want to make sure we get this functionality right.

But our ambitions are also greater than functionality. We believe that footbridges could, and should, be so much more. What if they could bring joy? What if they contributed to your sense of welcome, inclusion and place? Or your sense of pride in where you live? What if they could serve more than one purpose, so whole communities feel the advantages of their existence and not just the person crossing a track? What if they made an attractive contribution to the wider environment? While a footbridge may be inanimate it still has a civic role, and it is our responsibility to ensure that these assets enhance experiences as far and wide as their

presence can be seen and felt. They are, after all, public assets and therefore belong to everyone, so they should serve to benefit every member of society as extensively as possible.

And what about the future? How might our environment, technology and even aesthetic preferences evolve with time? It is not just economically prudent to consider changing needs and attitudes, but a sustainable approach requires that our buildings and structures stand the test of time and require minimal intervention. We want to ensure that we are not just expecting change but are ahead of it, because this, too, is about ensuring we are supporting people's comfort and delight.

To achieve these goals is a challenge, but we were clear in our approach. If we want to realise the widest array of goals, then it feels natural to get the widest array of ideas to help us. Holding an international design competition allowed us to harness thinking that reflected a spectrum of people's own priorities, along with our own. We also held exhibitions, live and online, to give everyone access to see and maybe even debate the entries we received from around the globe.

As you leaf through these designs, we hope you are inspired by the possibilities that they represent. Not just in thinking about footbridges but about how successful built environment design anticipates, accommodates and serves people's and communities' needs and desires. We also hope you are excited by Network Rail's approach to good design, which means putting you at the heart of everything we do, and about using these footbridges which may soon be coming to a station near you. ■





# **A LEGACY OF CONNECTIONS**

---

# A Legacy of Connections

## Up, Across and Down

Every day, hundreds of thousands of rail passengers make the same journey: up, across and down. Passengers have been doing so for well over 100 years, before even setting foot on a train. It is a journey vital to their ability to use the passenger railway.

They are crossing one of Network Rail's footbridges.

Though it is an often overlooked piece of railway infrastructure, the railway footbridge is essential to the modern railway. It provides access to station platforms while keeping passengers safely away from the tracks. The very earliest railways allowed passengers access directly over the tracks, and these flat crossings lingered for decades in some locations (and still do at many minor foot crossings). The advantages of separating passengers on foot from trains on track became apparent soon enough though, and remain obvious today; fast, heavy trains, and slow, fragile humans are not a comfortable mix.

Grade separation was the obvious solution and there were only two ways to achieve this: subways under the tracks, or footbridges over them. While subways have relatively little visual impact on the station environment, footbridges are very conspicuous interventions, and many older examples have become much-loved landmarks amongst their local communities. It is believed that the earliest station footbridge was built in 1840, just 10 years after the opening of the Liverpool & Manchester Railway, the first truly recognisable modern railway.

This book is an exploration of how Network Rail, Britain's railway infrastructure owner and operator, sought to recapture the honest engineering and beautiful appearance of earlier railway footbridges, and refashion those designs for the 21st Century.



Lattice, Newcastle

## Making Connections

Early railway footbridges were often constructed from wrought iron in a lattice pattern, with a distinctive arched appearance across the main span. That enabled the flights of steps which ran parallel to the platforms to be kept as short as possible with the upper steps placed at either end of the main span itself. Not only did this reduce the overall distance walked across the footbridge compared to having a main span which was level



Truss, Witley



Plate girder, Bosham



Precast concrete, Clandon



Double-deck footbridge, Surbiton

throughout, it reduced the visual impact of the footbridge, by lowering the ends of the main span. Numerous examples of this sort of bridge can be found on the railway network, with a large number having been refurbished sensitively by Network Rail. Many have been given statutory protection through 'listing' regimes, recognising their architectural and engineering importance.

By the inter-war period, footbridges were often built using a simpler plate girder method of construction, which led to a plainer appearance. Precast concrete footbridges were sometimes used as an alternative, particularly by the Southern Railway, to a not-dissimilar overall pattern.

Lightweight truss bridges were an alternative later approach.

Unsurprisingly, the frequency of new footbridge construction reduced considerably over the course of the 20th Century. Most locations that needed footbridges already had them and replacements were only necessary from time to time. Station rebuilds often involved new footbridge construction, and occasionally this generated a reworking of the traditional footbridge concept or a tweaking of its purpose. The inter-war rebuild of Surbiton station included a double-deck footbridge. The upper level was intended for moving parcels (the railways had a 'common carrier' obligation at the time which meant many small packages needed moving





Coventry

around stations). The lower level was divided laterally into a section for railway use and another allowing non-rail users to cross the tracks, to provide access to the residential housing developments expanding south of the station.

Banbury was among the earliest large stations to be completely rebuilt by British Railways, following nationalisation of the British railway network in 1948. The station's 1958 rebuild included a footbridge inspired by contemporary motorway service stations in North America and



Chichester

Europe, where dining areas were placed on bridges over the roadway. As a result, the new footbridge was much wider than traditional examples, in order to accommodate a restaurant and waiting areas. It kicked off a series of major station rebuilds in a contemporary style which integrated footbridges fully into the overall station design.

Harlow Town (1959-60), Coventry (1959-62) and Chichester (1961) stations all featured integrated footbridges as part of their rebuild. While the architecture of these stations is now much admired as examples of the post-war style, budgetary constraints meant that some of British Railways/British Rail's work on footbridges at smaller stations was less developed. With a low rate of construction and a diminished focus on their appearance, except as part of major projects, railway station footbridges evolved into an overlooked piece of infrastructure.

Then, at the beginning of the 21st Century, with the British railway network once again privatised, the station footbridge experienced an unexpected renaissance and assumed a new importance.





Access for All-funded footbridge with decorative elements on lift towers, Bearsted

## Access for All

With much of its infrastructure dating from the Victorian era, the British railway network had, by the end of the 20th Century, long faced a struggle to meet the needs of all passengers. This became increasingly evident with the passing into law of the Disability Discrimination Act (1995). The British railway network was privatised around the same time, and addressing the needs of passengers with mobility impairments proved a particular challenge. Although the newly privatised train operators were able to offer accessible taxis as an alternative, these had to be booked in advance, which meant that passengers forced to use these services did not enjoy the 'turn up and go' experience of rail travel that passengers expect.

Making stations accessible to all passengers was clearly desirable, but the arrangements and responsibility for making such changes were unclear in the immature privatised railway. The train operating companies were usually in receipt of short-term franchises, bid for on the basis of agreed outputs and increasing premium payments or decreasing subsidy.



Access for All-funded footbridge, Cheadle Hulme





Access for All-funded footbridge, Brockenhurst

They could not take on the financial implications of substantially modifying the stations under a franchise they might no longer be operating when the changes were completed. Railtrack, the first post-privatisation owner of the British railway network's infrastructure, was the ultimate long-term owner of the stations. Having little direct relationship with passengers, except at its small number of directly-operated major stations, it found it difficult to programme such projects. Its successor, Network Rail, faced its own pressures, and was unable to commit to the necessary work until government funding became available.

It was in 2006 that the first round of funding to make stations more accessible was announced by the Department for Transport, in what was

called the "Access for All" scheme. A significant amount (though not all) of the monies was allocated to the creation of an accessible route within each station targeted, including full step-free access from station entrance to platforms. The programme has continued on a rolling basis ever since, and by March 2020 had delivered step-free, accessible routes at more than 200 stations across Britain.

Some stations have seen lifts added to existing subways, others have seen the conversion of existing but increasingly lightly used parcels/goods lifts into public facilities. Sometimes, new lifts have been added to existing footbridges, though this has generally only been possible where the main span of the footbridge is already flat along its length, unlike the early





Access for All-funded footbridge, West Byfleet

arched footbridges.

Though all these 'retrofit' solutions have their place, it has not always proved possible to modify or add to existing facilities. Instead, brand new accessible footbridges funded by Access for All monies have become an increasingly common sight across the railway network, as the most effective way of delivering step-free access within a station. They are amongst the most numerous types of new structure to have been built across the passenger railway network over the last 15 years.

These footbridges have radically improved access to stations for passengers with mobility impairments, though there remains more work to do across the whole journey experience, especially getting on and off the train, where staff-operated ramps are still generally required.

## A Challenge for Railway Design

The way things look is important. While the appearance of railway infrastructure should never override its effective functioning, there is no reason why things cannot function well and look good too. British railway transport has proved this in the past, many times, long after the Victorian railway's dramatic - flamboyant, even - early architecture and design. In the 1930s, London Transport under its design-focussed chief executive



Access for All-funded footbridge with ramps, Chirk

Frank Pick proved that good design and architecture helped passengers use London's Underground, and the rest of its transport network, more easily and efficiently. British Railways' Design Panel, set up in 1956, demonstrated many times that good design was appreciated by passengers, innovating on both the exterior and interior of trains.

As the British railway is supported with public money, it has sometimes



been easy for modern-day critics to claim that cash spent on railway aesthetics is 'wasted' and all that passengers want is a railway that functions effectively. The truth is that the railway already functions incredibly well on a day-to-day basis, despite its massive complexity. And another truth is that since humans have lived in caves, they have sought to make their environment more visually attractive and culturally meaningful. It is an irresistible instinct - and one that serves a purpose.

Railway stations are gateways to the communities they serve. They play an important role in local placemaking and in the railway being a good neighbour to the places it passes through. Their height makes footbridges highly visible elements of stations and the wider urban environment, especially in smaller settlements. Thanks to their intricate and pleasing designs, many early railway footbridges have become admired local landmarks.

In this particular aspect of their design, the Access for All footbridges have generally been engineering-led, focussed on practicality and useability and with limited consideration of their aesthetics and status as a landmark within the station and beyond.

Rather than being a separate or non-essential issue, the aesthetics of a footbridge are, in fact, just as important as its functionality. Some proposed accessible footbridges have foundered at the planning stage due to complaints from nearby residents about their scale and appearance. As a result, passengers in these localities have missed out on having a step-free route delivered at their local station - and for some that means the continued inconvenience of having to book a taxi to another rail station in advance, rather than being able to turn up and use the one on their doorstep.

Although they share a generic overall design and are often identifiably similar, the Access for All footbridges are actually bespoke, each designed as a 'one-off' for the station at which they are built. 'Bespoke' usually conjures up visions of unique, one-of-a-kind luxury, but unfortunately this has not been the case with many of the Access for All footbridges. Their appearance has tended towards the utilitarian, with orthogonal cross sections and straightforward linear 'up-across-down' morphologies. Although attempts have been made to apply decorative elements to some, helping them appear more sympathetic to their surroundings, this has not always been completely successful.

Although Access for All-funded footbridges are usually equipped with lifts, examples at smaller stations have sometimes used long ramps as an



Cambridge North under construction



Reading



Telford Central

alternative means of providing a step free route between platform level and the main footbridge span. Although more accessible than a steps-only footbridge, these ramped footbridges have drawn criticism for their visual intrusion and the lengthy routes which have been imposed on passengers unable to use the stairs. Apart from the Access for All projects, similar designs have also been constructed in other lower-footfall locations where new footbridges have been required, for instance where stations have been remodelled due to track upgrades and electrification.

## Positive approaches

Other footbridges, funded by different routes than the Access for All scheme, have demonstrated alternative and improved design

approaches. Several new stations and major station rebuilds have featured footbridges which effectively deliver step-free access while responding to the local environment and also being attractive pieces of infrastructure in their own right. Cambridge North station in East Anglia, designed by Atkins and opened in 2017, features a footbridge clad in metal panels perforated with a design based on the appearance of cellular automata (complex patterns arising from the iterative application of simple rules to a grid). The footbridge cladding matches that on the station building, and is an appropriate aesthetic for a station serving nearby science and business parks.

Alongside the improvements and electrification of the Great Western Main Line from London to South Wales and Bristol, the complete rebuilding of Reading station saw the installation of one of the largest footbridges on the railway network. Designed by Grimshaw, the rebuilt



station was officially opened in 2014. At some 30m wide by 135m long the footbridge acts as more than just a means of transferring between the station entrances and the platforms and is effectively a concourse in its own right. Under a sophisticated and attractive slatted wood ceiling, it contains retail facilities and passenger waiting areas which complement those on the platforms below. It is served by stairs, escalators and lifts and is fully integrated into the design of the rest of the station. The canopies which run along the platforms flow up and over the footbridge, guiding passenger movement through the station.

Telford Central station in the West Midlands gained a dramatic new footbridge in 2018. It links to a second footbridge of a nearly identical design which spans an adjacent road and gives direct access to Telford town centre. The two bridges work together, as designed, to provide a landmark entrance to the town from its railway station.

With the Access for All footbridge programme showing every sign of continuing into the future, the contrast between designs like those at Cambridge North, Telford and Reading, and some of the outputs of the Access for All footbridge programme, prompted Network Rail to consider urgently how the gap in aesthetics could be addressed.

## A New Architecture and Design Agenda

Network Rail is a company on an architecture and design mission. In addition to about 2,400 footbridges, it is custodian of over 2,500 stations large and small, hundreds of signal boxes, 30,000 bridges, tunnels and viaducts, and 20,000 miles of track. Much of the estate is historic and many of its assets are listed for either or both their historic or architectural importance. Network Rail is the protector of a distinguished history of railway architecture and design and aspires to continue that tradition into the future.

In the two and a half decades since privatisation, Network Rail and its predecessor Railtrack have achieved some notable design successes including the refurbishment and repair of many stations (including Brighton, London Waterloo and Carlisle) and the reconstruction and extension of others (such as Leeds, London King's Cross and Birmingham New Street). But at times both companies lessened their focus on architecture and design responsibilities, compared to their nationalised

predecessor British Rail, especially when safety or performance issues rose up the public agenda, requiring increased attention.

Anthony Dewar joined Network Rail in 2007. When he was appointed Professional Head Buildings and Architecture in 2017, he saw a key part of his role as rebuilding within Network Rail the design rigour that the British railway system displayed during its architecture and design high points. As well as the landmark architecture we now associate with the early railways, later examples included developments like Design Research Unit's 1964 corporate identity for British Rail. Introducing the 'double arrow' symbol and Kinneir Calvert Associates' Rail Alphabet typeface, the result was one of the most cohesive and impressive corporate identities of the later 20th Century. Dewar found support from Andrew Haines, a new Network Rail Chief Executive with a keen interest in design matters who joined the company in 2018, and from Sir Peter Hendy, an existing Chair with similar interests.

Multiple work streams were set up internally to enhance the company's focus on design issues. Dewar was also keen to demonstrate to the outside world that Network Rail was serious in its intentions. An early focus of work was on railway footbridges. Taking together the Access for All footbridges, plus additional station footbridges funded from other sources, and examples installed at foot crossings away from stations, Network Rail had installed some 200 footbridges since 2006.

Dewar was concerned about the appearance of the Access for All footbridges which Network Rail had been delivering, and their lack of sympathy with either the local environment or the design of the stations into which they were being placed. The only standard footbridge Network Rail had on its books was a version which had stepped access, without lift or ramps. His proposed solution was to create a new catalogue of standard footbridge designs which could be used by Network Rail across its estate, especially at stations, all of which would represent more interesting, attractive, and usable products than the engineering-led footbridges which had been delivered so far through the Access for All programme.

Some of the standard footbridge designs in Dewar's planned catalogue would be procured through traditional framework contracts for architecture and engineering. But to try to find new approaches to the footbridge challenge he decided on what, at the time, was a very unusual approach for Network Rail: a design competition. ■



# **CREATIVE CONNECTIONS: THE COMPETITION**

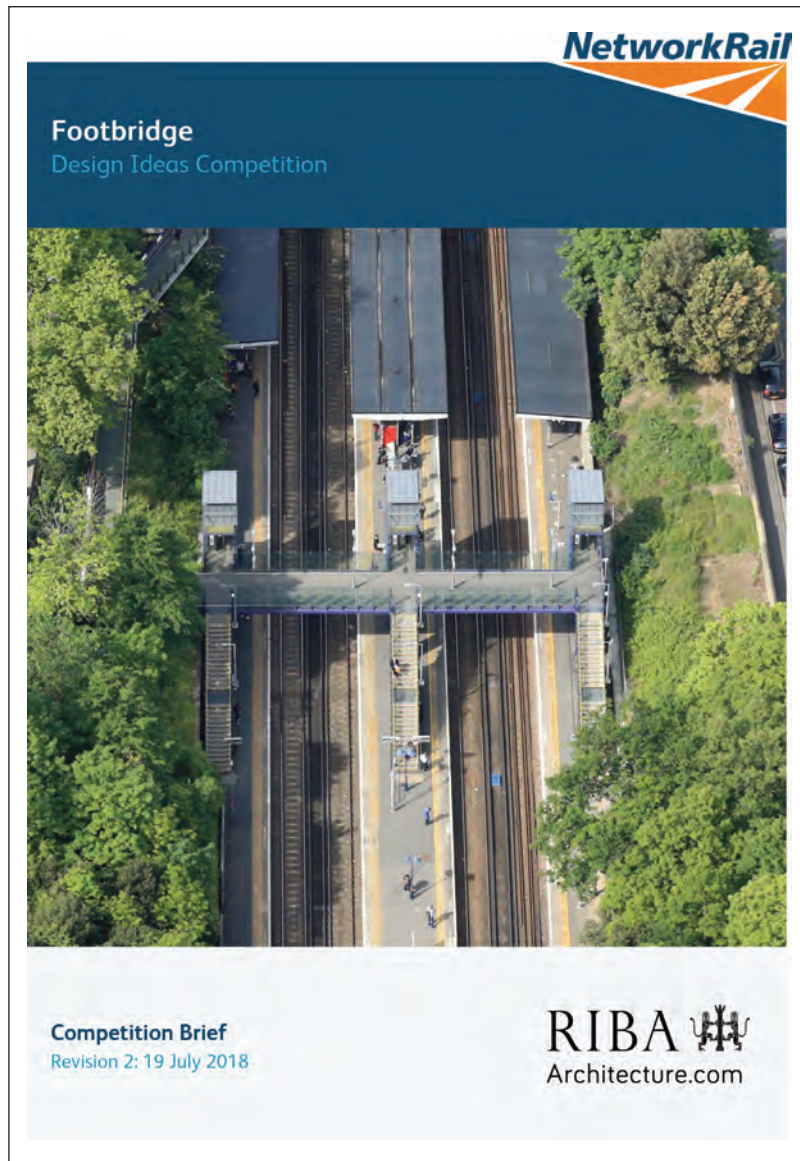
# Creative Connections: The Competition

## A Design Competition for the 21st Century Railway

The competition would be a very public statement, on the world stage, of Network Rail's reinvigorated interest in better design for railway infrastructure; the pursuit of what the competition would term "the excellent ordinary". The publicity the competition was expected to generate would assist in making the outside world aware of Network Rail's ambitions, and also raise the profile of good design within the company.

A major consideration was that the competition should ideally lead to a footbridge design (or designs) which would be real and deliverable. Some recent design competitions held by other parts of the railway industry had led to winning designs that did not make the leap from visualisation to physical product, while other examples of railway industry-led visions for the future of passenger railway infrastructure had failed to move beyond concept designs.

Network Rail and its predecessors had gone a generation without running a design competition of that sort, and so turned to RIBA Competitions to deliver and support the competition. Part of the Royal Institute of British Architects (RIBA), RIBA Competitions has been running design competitions for over 40 years and was well placed to undertake the work. Being part of the RIBA, its involvement would also underline the seriousness of Network Rail's intent. Founded in 1834, the RIBA is a global



professional membership body well known and well regarded around the world, whose purpose is to deliver better buildings and places, stronger communities and a sustainable environment.

Under the aegis of RIBA Competitions, the Network Rail Footbridge Design Ideas Competition launched on 22 June 2018.

## The Competition Brief

The Footbridge Design Ideas Competition brief invited proposals for an “elegant and effortless means of providing accessible footbridge provision within urban built station environments”. The design was expected to be innovative, challenge presumptions and raise expectations for the quality of future designs, while also taking into account practicality, construction and maintenance.

One of the first people Anthony Dewar involved in developing the competition was Network Rail Principal Engineer Ian Grimes. He worked on the brief to help give it a ‘light touch’ feel, limiting technical requirements, and helping to ensure the widest possible participation. Grimes would remain involved with the competition, becoming one of its judges.

Although the competition’s primary focus was on the development of footbridges within an urban station environment, entrants were also encouraged to consider how their designs might be adapted for use in rural areas, conservation areas, or locations away from stations where pedestrians need to cross the railway track.

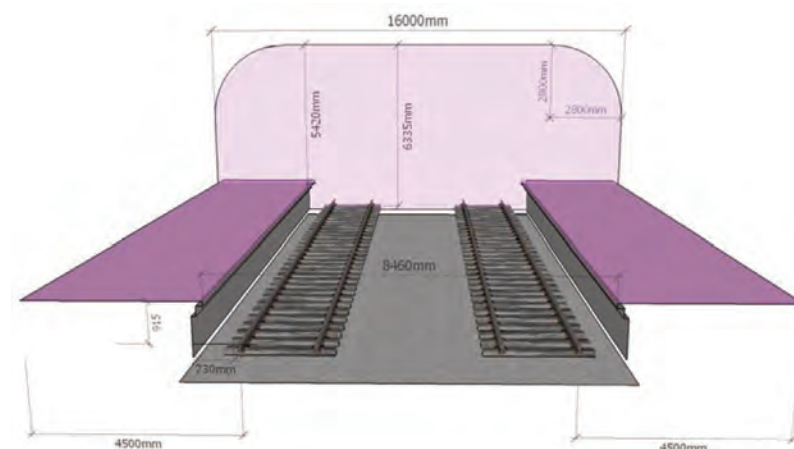
Bearing in mind the drawbacks of the ramped footbridges installed by Network Rail in recent years, the brief stipulated that all the competition designs were to have lifts. Solutions based around ramps and escalators on their own were dissuaded, with the brief pointing to the expanding demographic of rail passengers requiring lifts to access the railway that included not just older people and wheelchair users, but cyclists and those with heavy luggage, pushchairs and so on.

The brief asked for the footbridge to incorporate a roof on the main span - and on the staircases where practicable. However, the design also had to work in a roofless configuration. Any roofless footbridge designs proposed had to ensure they did not preclude the later addition of a roof. The landing zone of the footbridge was required to be as compact as possible and

allow for passenger circulation and waiting.

The safety critical nature of the railway was stressed, and the brief gave some basic parameters to work around. A clearance of 6.335m over the tracks was required, to ensure the main span of the footbridge would give sufficient clearance to overhead line electrification equipment, and at platform level no part of the footbridge could be closer than 4.5m to the edge of the tracks. Minimum widths for the bridge (2.4m) and stairs (1.6m) were mandated, as was minimum headroom on the footbridge (2.5m except under beams, bulkhead or signage where 2.3m headroom was permitted). The bridge had to be a single span with a clear span distance of 16m. Pedestrian loading and wind loads had to be considered, but to keep the competition open to as wide a range of applicants as possible, detailed calculations were not required.

Where the footbridge crossed the tracks, it had to have edge protection not less than 1.8m from bridge deck upwards, and to be smooth and non-perforate on the inner edge; this was to guard against trespass or passengers accidentally getting too close to overhead line electrical equipment running below the footbridge’s main span. The competition particularly highlighted the need for an aesthetic approach which addressed the visual impact of these elements.





Entrants were also asked to take into account the constraints of the railway network, particularly that construction and maintenance access to the railway is restricted. The footbridge itself should be economically efficient to fabricate and transport, and simple to construct on the existing railway. Materials should be carefully selected and specified to ensure structural integrity, longevity and facilitate maintenance and cleaning - but their properties should also help to reduce the amount of on-site construction time (and disruption to operational railway activities).

Additional considerations included:

- Minimisation of embodied carbon where appropriate
- Minimisation of overall life cycle energy, especially for lighting, lifts, security and communications
- Inclusion of measures to prevent the risk of condensation
- Use of materials and finishes designed not to distract train drivers (i.e. having regard to glare)
- Avoidance of red or green colours so as not to distract drivers from railway signals
- Consideration of lighting and services as part of the approach to safety and the overall design aesthetic
- Special consideration of the lighting of open footbridges in the absence of a canopy to carry the light fittings
- Minimisation of light spill to the local neighbourhood and upward to the night sky
- Exploration of measures to integrate passenger information and art into the footbridge

The competition was “open”, meaning that anyone was free to enter provided they met some basic eligibility criteria. Other design competitions invite a small number of competitors to submit entries after initial expressions of interest are returned; an open approach was favoured as being likely to lead to a wider range of ideas.

To qualify, entrants were required to be practising architects, structural engineers, civil engineers (or teams within those disciplines) or students of architecture, structural engineering or civil engineering.

Each entrant was asked to provide no more than two A2 sheets detailing their footbridge design. As with the generic brief, this was intended to

ensure the widest possible range of entrants, by not asking for burdensome amounts of detail. The sheets were to include:

- A three-dimensional visualisation of the proposed footbridge
- A plan and cross-sections/elevations of the footbridge
- Concept sketches illustrating the design principles employed
- Sketches or diagrams showing how the bridge could be adapted as roofed or roofless versions
- Details of the major structural elements, treatment of elevations, and the palette of materials and finishes
- Brief explanatory notes outlining the key drivers behind the design and its distinctive elements

In addition, entrants were also asked to supply up to three digital images representative of the ideas proposed in their footbridge design.

In order to preserve anonymity, each entrant was allocated a unique registration number, reproduced on their entry sheets. The competition judges would have no idea of the identity of each entrant. The winner could just as easily be a yet-to-graduate student as a large, well-established architecture practice or engineering company.

A prize of £20,000 was offered for the footbridge which best responded to the design challenge outlined in the brief. Perhaps the greater prize, however, was the chance for an entrant to see their footbridge design deployed on the British railway network. The competition brief cautioned that it was seeking ideas to contribute towards and influence new standard designs rather than a solution that would necessarily be implemented. However, Anthony Dewar’s firm hope was that the winning design would be something practicable and buildable which could be added to the new catalogue of standard footbridge designs, with the winning entry progressing through detailed design development during Network Rail’s 2019-2024 funding and operating period.

The deadline for the return of entries was 18 September 2018. All that was left to do was see whether the competition was a success. Would it encourage a wide selection of architects and engineers to enter? Would the proposed solutions be viable? Would they showcase improved aesthetics? Would they challenge conventional wisdom?

The answer was a resounding yes.



Network Rail Chair Sir Peter Hendy (right) with William Tonks and his parents

## A Global Response

A total of 121 entries were submitted to the competition, from more than 20 countries across several continents.

As shown in this book, entries were submitted by a diverse range of

individuals and organisations. They came from students as well as qualified architects and engineers. Some of the entries were from large practices and companies with famous names, already well established in

railway engineering and architecture. Other entrants had no previous experience in railway projects.

The range of solutions proposed was extensive, diverse and imaginative. Designs ranged from the immediately practical to the daringly innovative.

Responding to the competition brief's direction to reduce on-site construction time, many of the entries took a kit-of-parts or modular construction approach, or suggested innovative construction techniques. Others proposed the use of advanced materials with lower embodied energy than the steel, concrete and brick materials traditionally used to construct railway footbridges. Some entries took a playful, or abstract, approach, concentrating more on the aesthetics and emotional experience of using the footbridge than on the materials or assembly method. A number cast off the conventional orthogonal approach to footbridge design, proposing footbridges shaped as rings, tubes and circles.

Sustainability was a common theme in many of the entries, with some making sustainability and biodiversity the primary focus of the design. Some of the footbridges drew power from solar photovoltaics or even the movement of passengers themselves. Still others focussed on the human experience and a sense of 'ownership', proposing bridges that allowed community input to the design and community use of spaces within them. Cladding systems that worked like a 'pick list' were a popular concept, allowing footbridges to be externally dressed in a way that sympathised with, or reflected, differing local environments.

While all the bridges included lifts, to deliver the accessible solution required by the brief, some of them employed lift or pod technologies unlike anything currently to be found at a British railway station.

There were, in short, as many different responses to the competition brief as there were entrants submitting designs.

The competition also succeeded, as Dewar had hoped, in promoting Network Rail's new emphasis on better design and architecture. The competition was not only covered extensively in the specialist media but also captured the attention of the wider world. This was demonstrated not least by the competition receiving an entry from Tamworth-based 10-year-old engineering enthusiast William Tonks. Unfortunately, Tonks did not meet the competition entrant criteria of being a qualified or a student architect or

engineer, but he and his parents would nevertheless meet Network Rail Chair Sir Peter Hendy during the official opening of an exhibition which showcased the results of the Network Rail Footbridge Design Ideas Competition to the public (see page 162). Hendy expressed his hope that Tonks might become one of the next generation's railway engineers.

Before that exhibition could be staged, the competition needed to be judged, and a rigorous process employing considerable professional expertise was undertaken on all 121 entries submitted.

## The Judging

All the footbridge design proposals entered into the competition were assessed in a two-stage adjudication process, against the following criteria:

- Quality of response, design aesthetic and resonance of the approach with the aspirations set for the project
- Response to the practical challenges and technical constraints set in the brief
- Creative and innovative approaches with elements that could potentially be incorporated into a realisable standard footbridge design
- Clear communication of ideas to explain the ethos and drivers behind the proposals

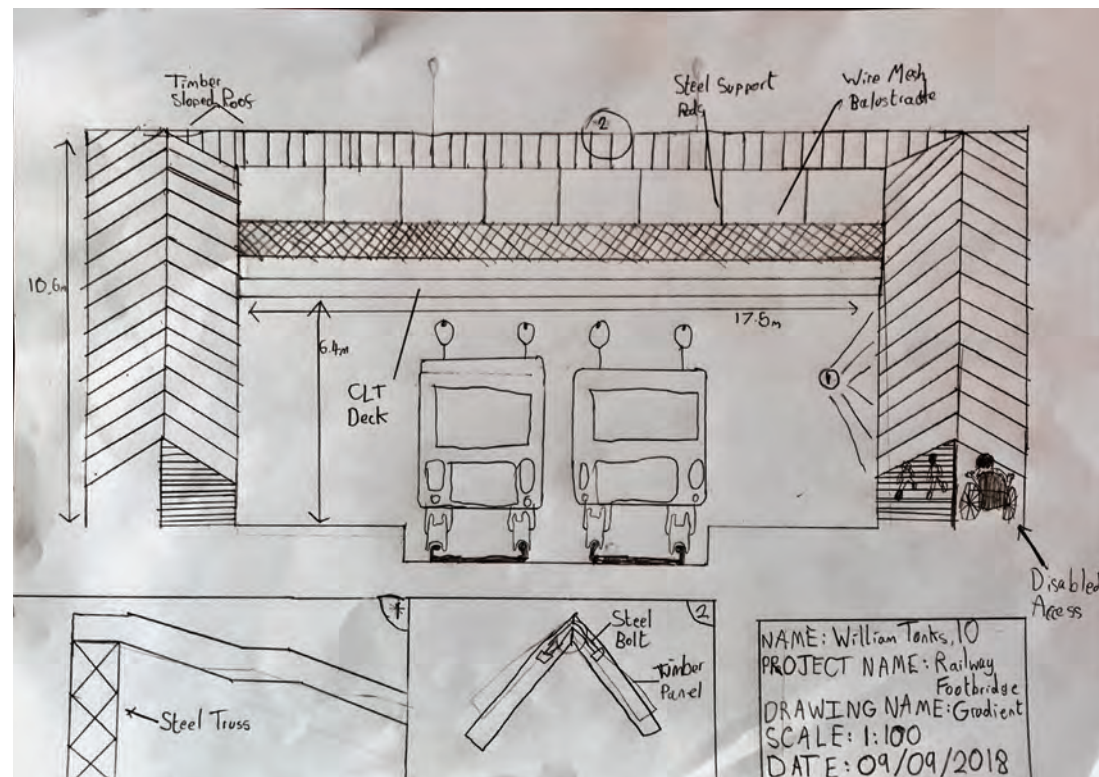
Adjudication panels were assembled, comprising 10 judges from both within and beyond the rail industry, and with a diverse range of experience in railways, architecture, engineering, design, inclusion and the arts. ■



## William Tonks

### Gradient

William Tonks' footbridge combines metal and timber construction. The main span has a floor of cross-laminated timber, a material which, by its nature, insulates the main span from electrical supply wires below. The footbridge is supported on steel truss columns, and steel is also used to make supports for the pitched timber roof. The roof unifies the appearance of the footbridge by running along the access routes which lead up from the platforms to the main span and then along the main span itself. The access routes are split laterally, providing both steps and an accessible step-free route between the platforms and the main span, the main span itself being finished with a wire mesh balustrade. ■





**Rowan Conway**

Director of Innovation and Development, Royal Society of Arts at the time of the competition, and Head of Mission Oriented Innovation Network at UCL Institute for Innovation and Public Purpose, since 2019. Conway has over 20 years' experience in innovation, research, communications, engagement and strategy and is passionate about design and innovation.



**Anthony Dewar**

Professional Head Buildings and Architecture, Network Rail. Dewar's career has seen him specialise in railway engineering, and since appointment to his current role in 2017, he has been leading a programme to rebuild the excellence of architecture and design within Network Rail. He took the lead in creating the Footbridge Design Ideas Competition.



**Paul Finch OBE**

Editorial Director of *The Architectural Review* and *The Architects' Journal*. Finch is also programme director of the World Architecture Festival, and a former Chair of the Commission for Architecture and the Built Environment.



**Ian Grimes**

Principal Engineer, Network Rail. Grimes started his career as a building surveyor before moving into the rail industry firstly with Metronet Rail and then in 2008 with Network Rail. Grimes helped develop the brief for the Footbridge Design Ideas Competition.



**Margaret Hickish MBE**

Managing Director, Design 4 Inclusion. Hickish was Network Rail's Access and Inclusion Manager for six years between 2013 and 2019, developing and championing principles of inclusive design across the country, and introducing the company's built environment access panel. She died in February 2021.



### **Kay Hughes**

Founder, Khaa, a project design business set up by Hughes. She was Head of Design and Principal Design Adviser at the Olympic Delivery Authority for the London 2012 Games. She later worked for the National Infrastructure Commission developing the National Infrastructure Design Group. Hughes became Design Director of HS2 in 2019.



### **Jonathan McDowell**

Director and co-founder, Matter Architecture (acting as the RIBA Architect Adviser for the Competition). McDowell previously worked for 20 years as a partner at McDowell + Benedetti, the architectural firm he co-founded, and was involved in all of the projects produced by the practice including urban design and masterplanning, arts and cultural buildings, bridges, healthcare, education, commercial and residential projects.



### **Andy Savage MBE**

Executive Director, Railway Heritage Trust. Prior to joining the Railway Heritage Trust in 2010, Savage was Deputy Chief Inspector of the Rail Accident Investigation Branch of the Department for Transport. His appointment followed a long career in railway civil engineering and, latterly, contractor safety.



### **Trevor Wilson**

Senior Architect, Network Rail. Wilson is a Chartered Architect specialising in civic buildings, with a particular focus on construction in relation to sustainable development. He is a BREEAM (Building Research Establishment Environmental Assessment Method) Accredited Professional.



### **Chris Wise**

Senior Director, Expedition Engineering. Wise has previously been a Professor of civil engineering design at Imperial College London and UCL, a Visiting Professor at Yale and in 2019 became Commissioner at the Royal Commission for the Exhibition of 1851 which supports industrial education through grant funding.





# The Judging Experience

**Jonathan McDowell, Matter Architecture**  
RIBA's Architect Advisor for the competition

This ideas competition was a brilliant opportunity to push forward the quality of footbridges, which are such an important part of our experience using railways, so I was delighted to be invited by Network Rail and RIBA Competitions to join the panel as the RIBA's Architect Adviser. The competition was chosen by Network Rail as one of the first steps in their determined multi-pronged push to radically improve the quality of design across all aspects of the network, led by Anthony Dewar and his team at Network Rail with strong backing from the top of the organisation.

Over six months we developed the competition brief with the primary aim of generating ideas which would challenge the constraints and presumptions that have so hampered the quality of UK rail bridges for many years. We were looking for fresh ideas which would influence and provoke the design of future bridges rather than for complete technical designs.

The competition brief generated a plethora of ideas, with 121 submissions received from over 20 countries and spanning the whole range from lone students to experienced multi-disciplinary design teams.

Initial sifting of submissions was undertaken by a Technical Panel including Network Rail representatives, Andy Savage from the Railway Heritage Trust, plus renowned engineer Chris Wise and myself. Over two

days we discussed the schemes, marking and moderating, with each panel member advocating particular ideas that had caught their eye. Submissions grappled with different aspects of the complex problem, to greater or lesser success. Across these we identified a number of common thematic approaches which were major drivers:

- Development of modular kit-of-parts construction systems
- Focus on structural form
- Use of innovative materials such as carbon fibre, fibre reinforced polymers and wood
- Focus on sustainability and reducing carbon footprint
- Civic approaches centred on making bridges places for people to inhabit and use
- Use of innovative people-moving technologies including lifts, escalators and pods
- Predominantly aesthetic approaches focussed on appearance and identity
- Schemes which focussed on refinement of current approaches
- More conceptual proposals, such as use of colour or tunnelling under instead of bridging over

The Technical Panel's long-list of highest scoring schemes was then given to the final Judging Panel, which included a wide range of experts from both within and outside the rail and bridge worlds: Kay Hughes as advocate of transformative design, Margaret Hickish, inclusion specialist, and Rowan Conway, innovation leader at the RSA, in addition to Anthony, Chris and myself continuing from the Technical Panel. Paul Finch, who as intended Chair had given insightful comments in the lead-up, was unfortunately unable to join at the last minute and I took over that role.

The panel began with a wide-ranging discussion of Network Rail's aspirations for the competition and how the ideas generated could best inform the forthcoming catalogue of footbridges. We went back and reviewed all the submissions that had not been selected by the Technical

Panel and decided to add one further project, making a long-list of twenty schemes. These were discussed at length, with panellists advocating pros and cons and how well each resolved the different thematic approaches. We agreed it was important not just to choose a winner, but to highlight and share the wide range of positive ideas within the long-listed and even those that had not been selected.

Finally, the jury settled on the two most accomplished proposals: the strategic kit-of-parts 'Modular Bridge of the Future' entry that would allow for a rich variety of social ingredients to be included to suit different contexts; and the bold, simple and elegantly resolved entry 'The Framing Bridge'. Both were felt to offer exciting new approaches to the design of footbridges and showed great potential for implementation. Finally, we concluded that the Modular Bridge would be recognised as Highly Commended and The Framing Bridge chosen as the worthy Winner. Indeed, it was an unexpected benefit from this ideas competition that the winning proposal was so well resolved that it could be considered as a design ready to be added to the catalogue.

Throughout the competition process the panel appreciated the expert and sensitive organisation by James Porter (Senior Competitions Manager) and Julia Davies of RIBA Competitions.

It is extremely encouraging that Network Rail has since taken active steps to publicise the whole range of ideas in the submissions - through the online gallery, the series of exhibitions in several locations, and now in commissioning this book - and has pushed ahead to commission the ideas competition winner along with several other designs from different processes to create a strong catalogue for the next generation of footbridges.

The start of a renaissance in railway design? ■





**WINNING DESIGN &  
HIGHLY COMMENDED**

## Gottlieb Paludan Architects, Denmark with Strasky, Husty and Partners, Czech Republic

### The Framing Bridge

Simplified geometric shapes provide an attractive, bold, architecturally adaptable solution in The Framing Bridge. The design is visually minimised with straight stringers on the stairs, that nevertheless provide for a landing halfway up, and no platform columns underneath. The dark-painted steel structure, deployable nationwide, contrasts with the light interior, the colour of which can be chosen to reflect local characteristics or artistic influence, in a design strategy the architects describe as: “Railway outside, site-specific inside”.

For users the bridge deck provides a welcoming space, enhanced at night with low-set luminaires on deck and stairs providing perfect visibility without disturbing the view. A wash of light on the interior gable wall sets pedestrians in silhouette.

The simplified design is highly identifiable and easily adaptable, both technically and architecturally. The main bridge span can be open or covered, as can the staircases, and the bridge span can be made longer to accommodate additional staircases for multiple platforms. Depending on site constraints the staircases can be positioned parallel to the railway tracks or rotated away from them. However configured, the flexible, modular system ensures that the bridge retains its aesthetic qualities.

The column-free design provides more space

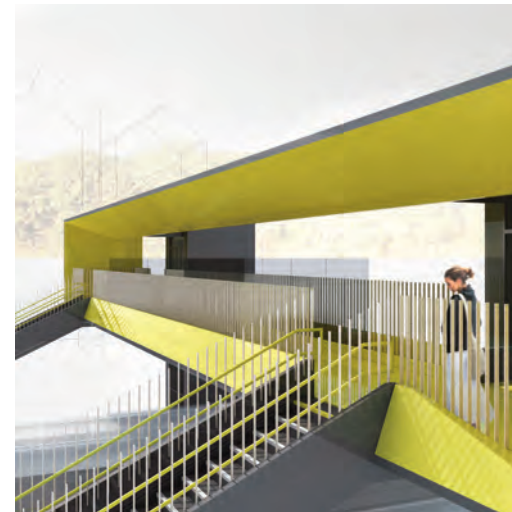
and improves sightlines on the platforms, and the accessibility-compliant design also facilitates flow at the lifts, with ‘waiting wings’ placed at the outer ends of the bridge span to ensure that lift users and stair users do not come into conflict. The lift towers are frame-like with solid sides and glazed fronts and backs, complementing the appearance of the main bridge span.

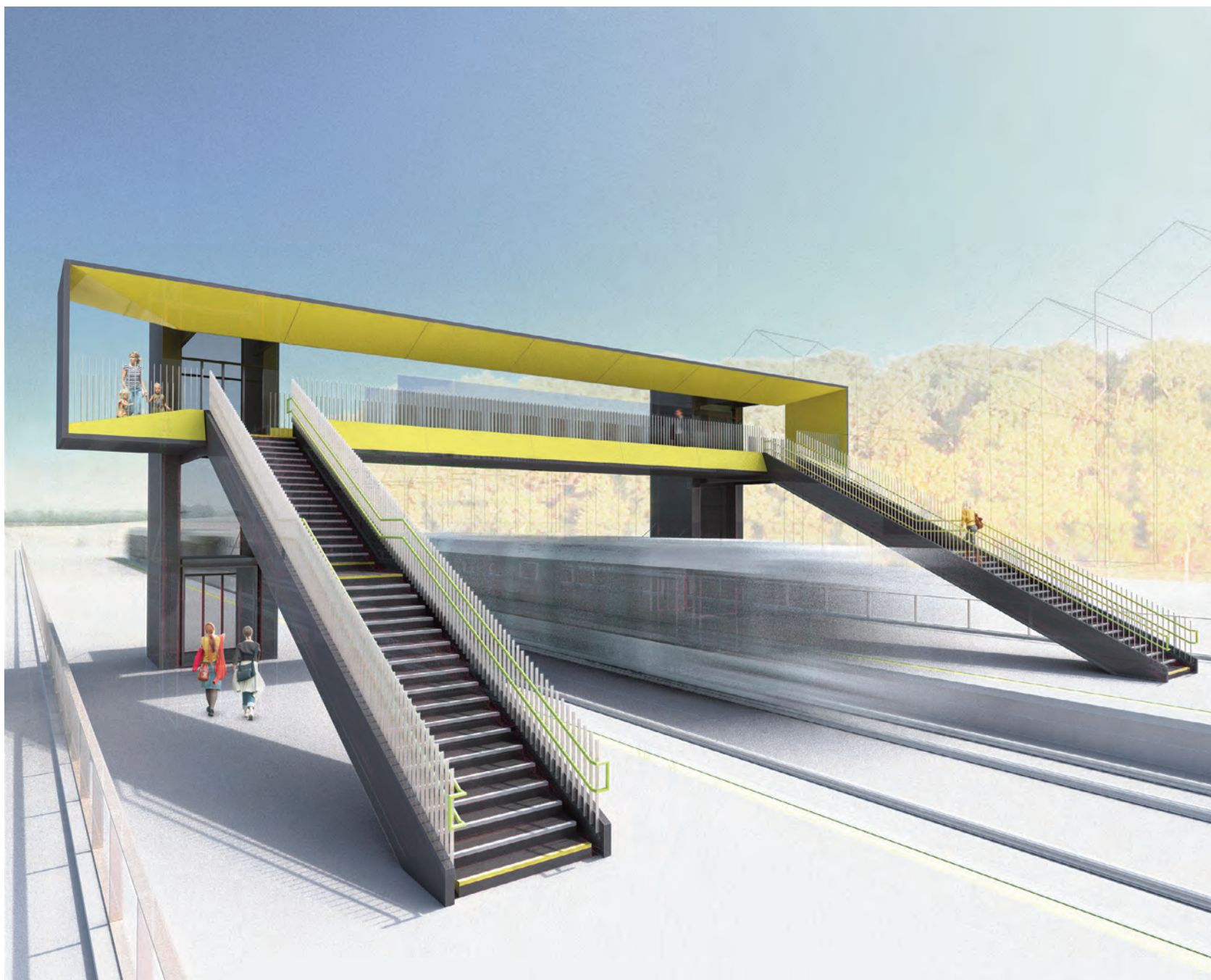
Easily replaceable glass fitted above the tracks protects users from overhead power line equipment. A positive experience of safety and security is achieved by the visually open, interestingly detailed bridge interior, enhanced by a sloping ceiling which emphasises the openness of the bridge.

The Framing Bridge is designed for industrial prefabrication and easy, on-site assembly with minimal impact on railway operations.

The judging panel said, “The scheme presents a bridge with a well-resolved design aesthetic that most convincingly addresses the wide range of practical challenges whilst proposing a bold, elegant and uncluttered response that would create an uplifting experience for the range of users and be readily adaptable to suit many different contexts.”

Network Rail worked with The Framing Bridge’s designers to adapt the concept into one of the options within Network Rail’s catalogue of standard footbridge designs for deployment on the rail network (see page 166). ■







## Hawkins\Brown, UK with WSP

### Modular Bridge of the Future

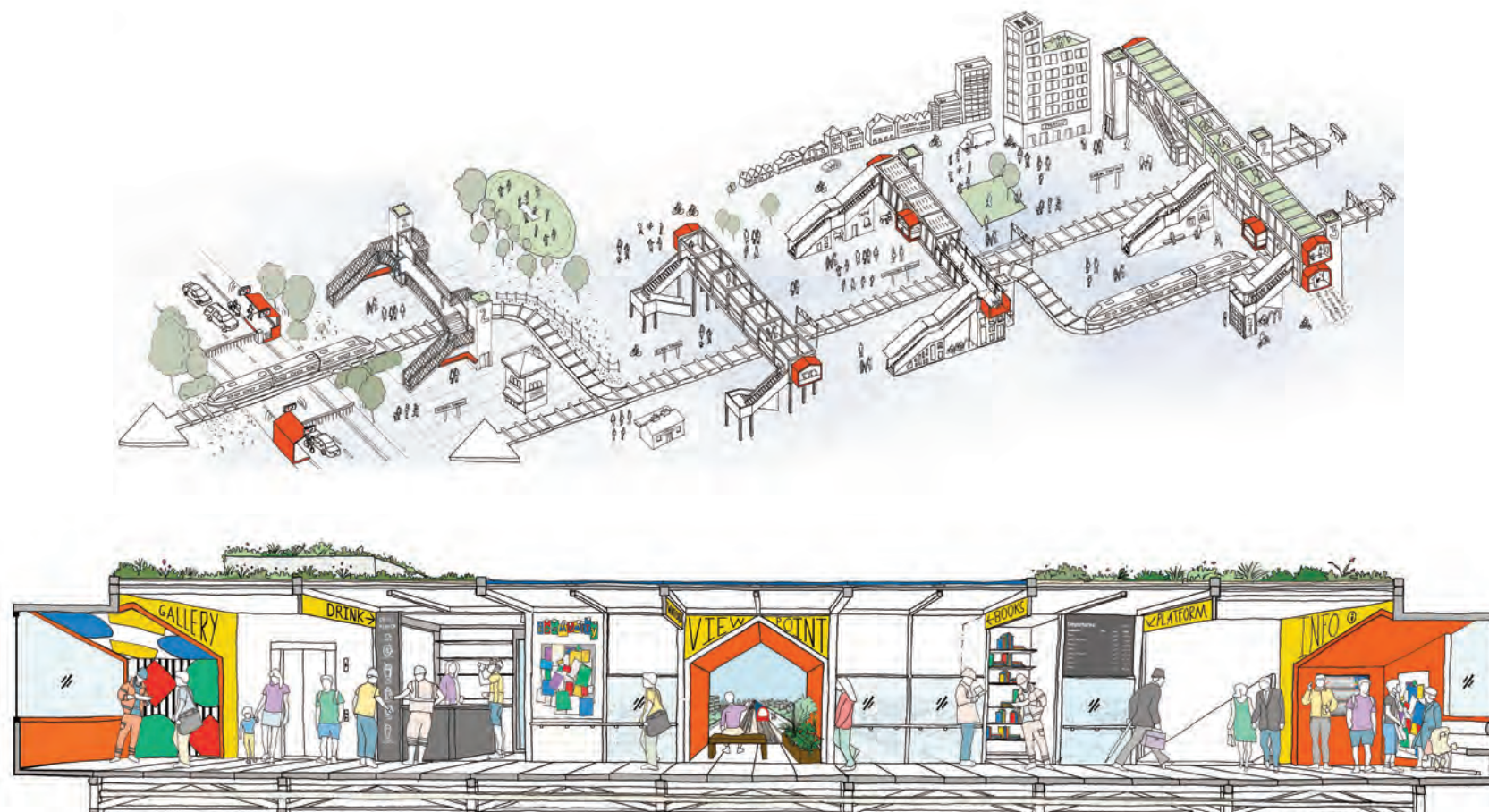
The Modular Bridge of the Future is an adaptable structure which can be tailored to serve the needs of local communities through the addition of 'activity pods' which can be varied from place to place and changed over time to ensure the footbridge remains relevant, ensuring flexibility and upgradability into the future. Inspiration for the footbridge was drawn from Victorian signal boxes, in particular those boxes which were placed on bridge structures over railway tracks.

To achieve maximum adaptability, the structural design accounts for multiple possible variations of layout. A Vierendeel truss makes up the main structure and its rectangular forms with rigid connections remove the need for diagonal bracing. This frees up the sides and top for various additional plug-in elements. A solid tri-truss base to the Vierendeel structure allows cantilevered elements anywhere along the footbridge and creates an easily accessible out of sight location for services. This structure can be doubled up side by side or as a double decker, should busier locations require it.

The footbridge is built from a family of parts, fully compatible with each other in any combination, and adaptable to serve different types of station in rural or urban locations. External parties would be encouraged to propose their own plug-in activity pods for inclusion, attached as the cantilevered elements mentioned above. The activity pods reflect local







community needs and desires, but could include cafes, galleries, viewpoints, book swaps or information points. Network Rail would retain control and approvals of the content of the activity pods, but if accepted, these new elements could be added anywhere throughout the network to add value and bring in revenue. Modular roofing elements on the footbridge's main span provide options including glass, solar photovoltaics or green roof panels. The exterior of

the lift towers provides a display space for artworks, while the top of the lift tower can be used as a sculpture space.

The bridge will be entirely prefabricated off site and assembled quickly on site. It will be delivered by train and installed using a road-rail crane. Designing each element off site for manufacture and assembly produces better quality, reduces cost, minimises risk and disruption to the network.

The judging panel said, "The scheme presented a strong strategic approach, proposing a simple modular kit-of-parts that would enable a standardised bridge system to be adapted via the use of simple prefabricated, clip-on modular elements to different contexts and settings ranging from the historic and rural to large scale urban interchange, with the footbridge being conceived as a social engine focused on people and place." ■



**LONG-LISTED**



From the 121 entries to the Footbridge Design Ideas Competition, a long-list of 20 was drawn up by the technical panel for further consideration by the judging panel. One winning entry and one highly commended entry, detailed on the preceding pages, were eventually selected. The remaining 18 entries on the long-list are featured in this section, with descriptions of the designs drawn from the designers' entry sheets, and comments from the judging panel included. Entries are presented in order of the unique registration numbers allocated to competitors.

The judging panel found itself impressed by the quality of the submissions and the range of approaches put forward, challenging current methods of providing accessible and safe routes across the railway not only above ground, but also below. ■

## Luca Poian Forms, UK with Soluxn

### Ultralightweight Carbon Fibre Footbridge



Inspired by the latest advances in automotive and aerospace technologies, this footbridge uses carbon fibre composites to create its structure, including the suspended deck and roof. The main element of the horizontal bridge assembly is the visually distinctive variable section inclined chord, which branches out from each of the platforms and comes together over the middle of the track. This cantilevering

member supports both the functional bridge deck below and the roof vertical supports where necessary. The whole comes together to form a truss like assemblage, minimising the visual impact of the horizontal elements. The bridge features panoramic glass lifts and the main span, too, is transparent. All the bridge components are prefabricated in the factory, lifted into position and assembled on site. This

kit-of-parts method offers a practical and simple approach resulting in a sleek and distinctive contemporary aesthetic that captures the spirit of the carbon allotropes era.

The judging panel felt that the design demonstrated, "A clear expression of structural form and newness that explores the efficient use of material and the potential of new carbon fibre composite technology." ■

## Weston Williamson + Partners, UK with AKT II

### Winding Bridge



Fibre-reinforced polymer (FRP) was chosen as the main component of this bridge on account of its affordability, minimal maintenance requirements and high strength-to-weight ratio which reduces the raw material requirement, making for a lightweight structure which is easier than traditional structures to transport and install. FRP filament is wound around a rotating mandrel to form the tubular sections that make up the span of this footbridge.

Structure is provided only where necessary, maximising perforations to light, air and views, while the length of the span is adjustable for

various scenarios. The stair treads and handrails are made of pultruded FRP while the balustrade panels are moulded. The steel structure of the lift tower is clad in FRP. Modules are scaled for transportation on a flat-bed lorry, with prefabrication reducing the time on site. The structure of the lift core bears the load of the bridge, enabling it to be quickly craned into place and minimising disruption to operations and existing infrastructure. The approach creates a catalogue of flexible components that can be combined in site-specific combinations.



The winding process used to create the bridge span can be adjusted to vary the pattern, while the colour of the FRP can be specified to create a prominent landmark or a more passive structure; light grey reduces visual impact against the sky, pale green fits into natural surroundings.

The judging panel noted the proposal's "...distinctive aesthetic that explores the potential of lightweight low-maintenance fibre-reinforced plastic (FRP) and filament winding technologies to form standardised elements of structure and enclosure." ■



## Atkins Architecture, UK

### One Journey

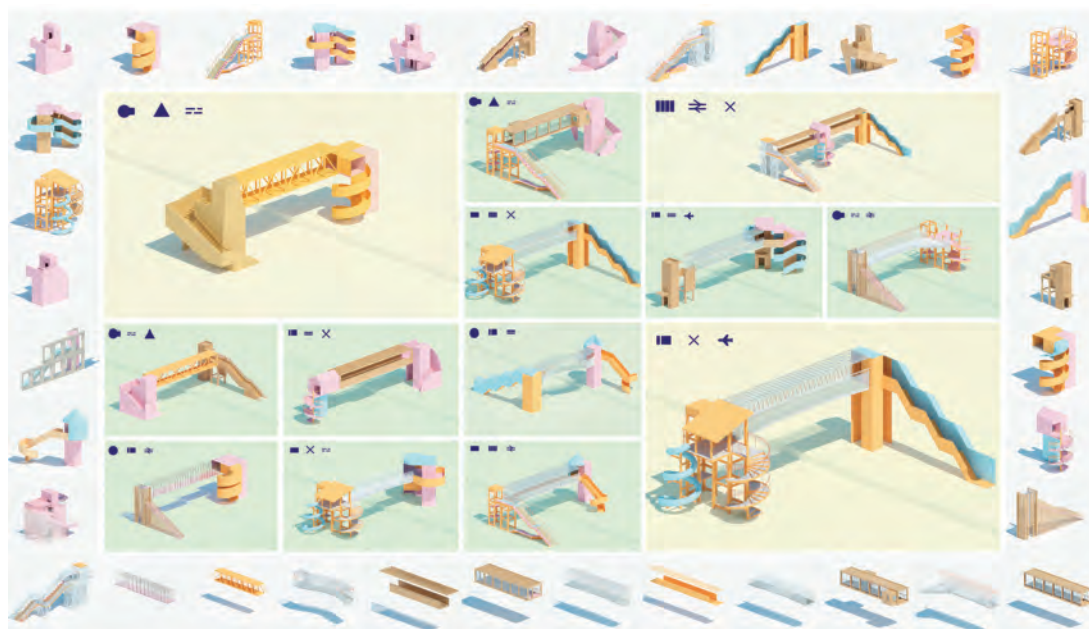
Challenging existing presumptions of railway footbridges, this design is based around a single sweeping staircase combined with a pair of pods that travel all the way across the footbridge, from end to end. Users experience an uninterrupted journey over the tracks and no longer have to transfer from a lift to a bridge span and back to a lift again. This new accessible footbridge consists of a primary tubular 'monocoque' framing system which houses and supports prefabricated stair modules and provides the rail system to the self-powered 'lift' pods. A semi-translucent fabric envelops the structure to protect users from the elements whilst allowing views out. The proposal respects electrical clearances and uses materials that are easy to maintain and have a long life span. Fabrication, installation costs and construction time on site can be greatly reduced by utilising parametric steel fabrication and cutting and robotic welding techniques, and developing simple 'bolt together' structural bays. The result is a design applicable and sympathetic to a variety of locations from the city to the countryside.

The judging panel commented, "A strong expression of a new form of crossing accessible to all, proposing how a single sweep of steps could be integrated with potential new pod lifting technology to unify the experience for different users." ■



## PHASE3 Architecture + Design, UK with AKT II

### Exquisite Express



Taking inspiration from the Surrealist game 'Exquisite Corpse' in which each participant takes turns writing or drawing on a sheet of paper, folding it to conceal their contribution, and then passing it to the next player for a further contribution, this proposal celebrates the footbridge as a fun typology rather than simply functional infrastructure. Instead of one single solution, the Exquisite Express offers flexible designs that respond to diverse contexts, both rural and urban. This kit-of-parts approach seeks to develop a catalogue of footbridge elements to suit a variety of

conditions. Each footbridge can be tailored to address not only physical constraints but also different community representation. By using locally sourced and prefabricated parts, the Exquisite Express envisions a bigger economy-of-scale that embraces surrounding neighbourhoods; creating a legacy of interconnected manufacturers, local craft as well as possible scenarios for future maintenance. A universal joint allows individual segments to be removed, customised and upgraded through time, without dismantling the entire footbridge. This motivates a circular



economy, in which elements may be repaired, recycled, upcycled and re-appropriated. As such the Exquisite Express creates an open-ended building system that brings together components in a playful and enriching way, allowing the creation of delightful, quirky and unexpectedly beautiful designs.

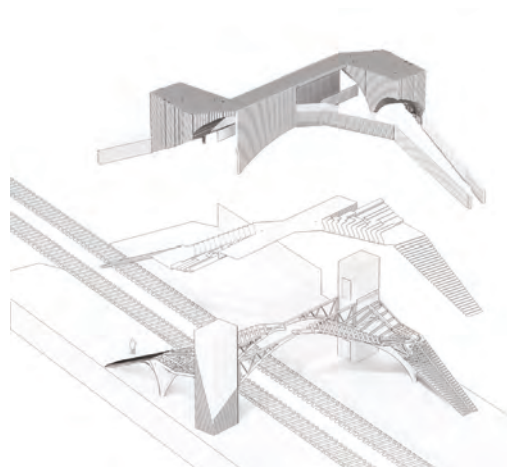
According to the judging panel this proposal offered, "A playful strategic approach that proposes how a catalogue of bridge elements in a diverse range of aesthetics can be combined to create great variety beyond function to suit different contexts." ■

**Walsh Structural and Civil Engineers - Andy Fisher, UK with Miguel Costa, Melanie Davison, Priscille Rodriguez and Jan Verhagen**

**The Tortoise and the Hare**



This footbridge design is the result of a debate about the speed of life. In stations, some people are rushing to catch trains; while others have time to wait. Waiting for a train, rather than being on the move, is widely seen as a waste of time - a perception that this project seeks to address by encouraging people to slow down and live in the moment. Separating the stair and lift access routes across the bridge allows the stair route to be adjusted and reduced in length, with a generated shape that refers back to early arched footbridges. For people rushing to make



their train, the design provides the most direct route. Crossing the two routes on a diagonal allows the angled stepped route span to be supported by the span serving the step-free route, creating a wider communal deck, used by all. The spaces between the two routes provide areas for passengers to sit and recharge. The experience here is carefree. Views of the platforms, approaching trains and the surrounding landscape or city are offered, along with comfortable seating, sound cocooning, podcasts, Wi-Fi, charging points and a small



library. This space can be tailored to the needs of each station. The vision of this project, of separating the slow from the efficient route whilst still keeping them firmly connected, is to create a strong identity for the bridge; a manifesto to slow down whilst respecting others.

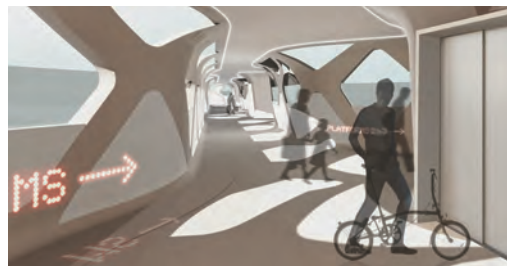
The judging panel said, "Challenging the presumption of the need for speed this scheme focuses on people's experience, proposing a place for a slower pace where people can linger as an alternative to the more direct crossing." ■



## CF.Architects, UK with Cake Industries

### Unity from Utility

This proposal aims to unite the three main components of a footbridge - bridge, stairs, and lift - while separating lift and stair passenger flows in a coherent, unified and carefully sculpted design. Glass reinforced polymer (GRP) with uni-directional carbon fibre reinforcement is proposed as the main material because of its lightness, extremely low maintenance, high durability, repeatable moulding and structural properties. A monocoque structure provides the bridge span and the stair enclosure, constructed using techniques from the yacht building industry. The stairs are angled to reduce transfer distance and improve visibility. Each segment is made by filling a mould with layered carbon and glass fibre, impregnated with resin and cured in an autoclave. A foam core is used to separate the thin layers of fibre to create efficient structural sections. These are created in a factory environment, providing the opportunity to mass produce elements for multiple stations and locations. The elements are extremely light and can be transported to site fully fitted out with interior fixings and installed rapidly with a single lift during a single possession. The form of the footbridge has been developed as a unified, efficient, highly flexible and single component structural solution, based around a modular kit-of-parts. It can be adapted to numerous configurations



and extended from single to multiple spans according to the location.

The judging panel commented that this design has, "...a strong sculptural form based on a glass-fibre reinforced polymer (GRP) composite structure that unifies stairs and bridge while providing generous spaces for passengers." ■





## Softroom, UK with Eckersley O'Callaghan and Inverse Lighting

This design focuses on transparency and lightness of form; a slim steel box girder bridge construction with full-height glazing maximises views over and along the station while crossing the tracks, and views up and into the bridge for passengers waiting on the platform. At either end, the bridge is supported on a staircase structure that provides an open waiting area, with the folded form of the stair acting as a canopy above. The staircase canopy is broken up into louvred sections, offering views out when descending and allowing users to see

approaching trains. Steel is used to construct the main bridge deck, staircase and lift towers because of its versatility, strength-to-weight ratio, ease of fabrication and known design properties. Fibre reinforced polymer sandwich panels, provide the lightweight canopy. A deep grey paint finish to the structural steel ensures that the steel looks good across its design life span and blends with differing contexts. The surface qualities of textured stainless steel cladding to the underside of the stair and lift towers animate these surfaces and add

brightness without glare. A single linear LED light fitting tracks the form of the bridge, creating a continuous loop from one side of the footbridge to the other, providing the required light levels and emphasising the elegance of the structure while minimising light spill.

The judging panel commented, "A simple, slim and elegant evolution of current footbridges that appropriately combines a range of different materials to create a spacious and uncluttered experience for passengers." ■

## [Y/N] Studio, UK

### A Bridge with a View



This footbridge aims to improve the utilitarian experience of some modern railway footbridges, and tackle insufficient covered waiting areas at some stations, which can be expensive to provide on multiple platforms. A Bridge with a View is a wide covered footbridge - both a building and a bridge - that provides ample covered waiting space with a picturesque view over the landscape. The layout of the bridge span in this design draws inspiration from The High Line linear park in New York City created on elevated disused railroad infrastructure. The main span of the footbridge is wide enough to allow room for a bench where

passengers can sit and watch out for their train arriving, while a planted bed along one side of the bridge softens the interior and provides a contemplative place to wait. A Bridge with a View is designed as a steel plate girder footbridge in two separate pieces (deck and roof) which can be prefabricated and craned into place on footings formed on either platform.

Externally the footbridge is clad in cast metal panels. These are designed to mimic traditional timber detailing in stations but will have the longer lifespan of metal. The form of the footbridge makes a simple and legible silhouette that combines both the



contemporary and the traditional. Plate girder bridges, common across the British railway network, provided inspiration for the construction of this footbridge as they are durable, efficient and cost effective to construct. In this case the traditional appearance of a girder bridge is inverted, allowing the structure to be seen by users on the inside.

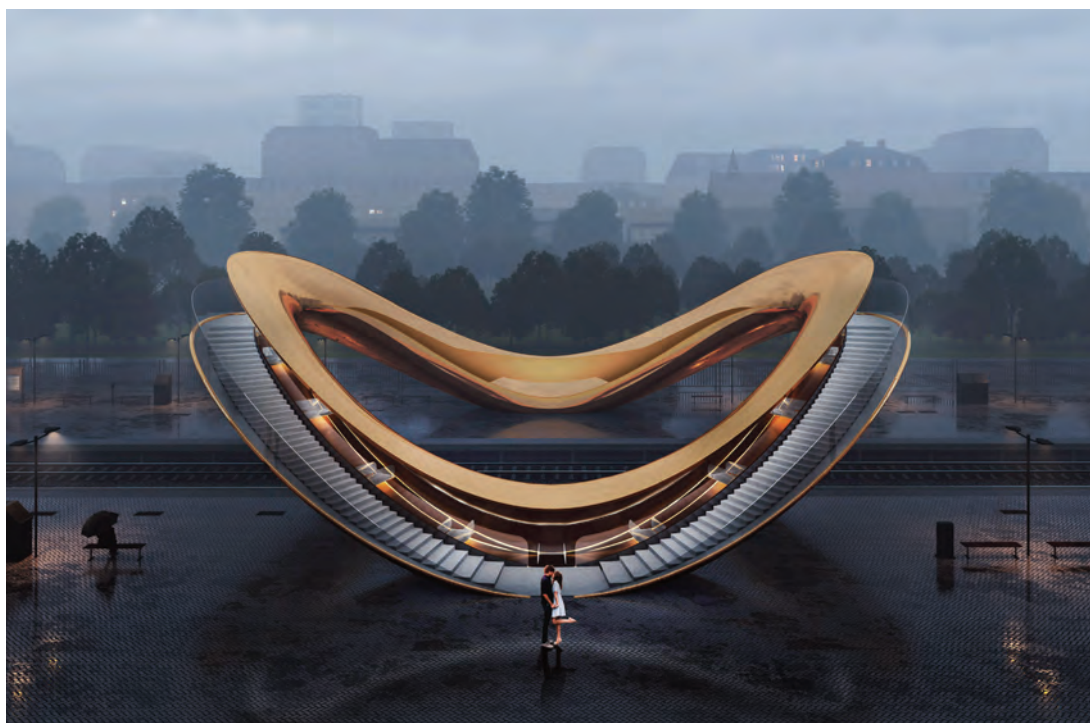
The judging panel said, "Using a simple aesthetic based in traditional forms and materials, the proposal unifies bridge, stairs and lift into a single building and provides generous space for people to enjoy waiting." ■



## Xing Design Studio, People's Republic of China

### The Ring

Rather than a purely functional footbridge, The Ring is a striking and sculptural utilisable art piece. More playfully, it asks the question, "Railways are like city fingers, why don't we put a ring on it?" The structure is a symmetrical cantilever arch, composed of two C-shape steel shells, reinforced by stiffened plate sections. Within the structure, steps and bicycle/luggage ramps are provided on both sides, increasing its traffic capacity



compared to traditional footbridges. A mechanical lift system with 12 cable-hauled lift units runs continuously around the inner edge of The Ring with each lift unit stopping briefly at the bottom of the footbridge to allow passengers to get on and off. The cable system balances weight to save energy. Each lift unit is supported underneath by a triangular structure which connects to stabiliser tracks, keeping the lift units upright while moving around the footbridge. The intention is that the exterior of The Ring can be customised to serve various locations, incorporating designs from fashion brands, institutions, artists or local agencies, carving the character of the station's location onto the footbridge.

The judging panel considered this, "A bold proposal for a dramatic hoop form that integrates a double sweep of stairs with a potential continuous travelator/pod movement system, providing an innovative direct form of access for all." ■





## Pelizziaarchitettura, Italy

### Bridge to Fit



Standardisation and customisation are the watchwords for the Bridge to Fit design. The footbridge is constructed from a series of prefabricated steel frame boxes, 1.8m x 3.0m x 2.8m, which are simple to build and transport to site. These are attached to a truss beam structure and form the main bridge span, lift towers and staircase housings. The configuration can be varied to suit the particular needs of a station site: a compact layout in which the staircases double back can be used where

platform widths allow, while a linear layout in which the stairs run parallel to the tracks may work better where platforms are narrow. The use of small structural modules lends itself to the addition of small waiting areas off the main bridge span where passengers can rest, meet and keep a look out for the arrival of their train. Once the layout of the bridge has been defined the customisation begins, with a variety of roof and cladding choices matching the dimensions of the structural modules. Closed or open,



transparent, translucent, opaque, living/green walls or a combination of these are some of the available options. Cladding materials include glass, polycarbonate, wood or perforated metal. Roofs can be flat, pitched, barrel vaulted or cross vaulted.

The judging panel commented, "A simple and well-scaled modular system with a clear structural logic offering a potentially elegant range of material options for enclosure to suit different contexts." ■

## Squire and Partners, UK

### Velox Bridge

The blurred lines of a speeding train are invoked in the essence of this design. Two glazed precast concrete frames stand on each platform, one containing the lift and the other housing the staircase. The glazing itself is formed from a series of vertical clear concave acrylic panels creating a 'fluting' effect that blurs the appearance of the lift cars moving up and down inside the lift towers and pedestrians walking up and down the staircases. Vertical metal bars, each coloured differently and

evoking the colours in a collection of vintage Edmondson card railway tickets, line the bridge span and the upper part of the two staircases. The latter project out of the concrete frames, giving the sense of a single flowing object, weaving up, around and between the fluted elements. Closely spacing these bars, allowing just enough of a gap to perceive a person walking behind them, continues the blurring theme in a different medium across the bridge span itself. In the covered version of the

footbridge, the coloured metal bars are extended every two metres up and over the bridge, forming a frame to which clear acrylic roof panels can be fixed.

For the judging panel this footbridge offered, "An elegant and light material treatment of a conventional bridge structure." It agreed that Velox Bridge delivered on its aesthetic proposition, with screens and translucent panels producing "a blurring of appearance analogous to speed". ■



## Marks Barfield Architects, UK with COWI

This concept embraces modern construction techniques and material innovations already commonplace in automotive, marine and aerospace design to create a beautifully sculpted and structurally efficient freeform bridge featuring full height glazing on the bridge span and fully glazed lift towers. The design uses fibre reinforced polymer (FRP), on account of its high strength and low weight, and its well-established off-site manufacturing processes and techniques. The bridge, stair and lift tower elements are provided as a kit-of-parts, fabricated in a controlled factory environment ensuring high accuracy, quality and low waste. The manufacturing process

involves resin bonding and laminating layers of glass fibre mesh into large scale preformed moulds - a process that eliminates stress concentrations and visual discontinuities. The moulds typically become cost neutral after eight to ten uses and repeatable components will offer economies of scale. Site specific components can also easily be produced by introducing a potential extension zone, in the middle of bridge spans for instance. The use of large-scale components with simple discrete bolted connections reduces construction time and costs. FRP has less embodied energy, uses less water and causes less air pollution than concrete and steel manufacturing processes.

The judging panel was impressed with the design's, "Bold freeform sculptural forms using a refined kit-of-parts with large factory-moulded fibre reinforced polymer (FRP) structural components complemented by glass/steel enclosure."

Network Rail felt that the possibilities offered by this footbridge design and its use of FRP as structural material merited further investigation. It decided to work with Marks Barfield Architects and COWI to develop it for future inclusion in Network Rail's catalogue of standard footbridge designs (see page 174). ■





## Sweco Architects, Sweden with Sweco Civil and Sweco Structures Framing



This design is in the Nordic style of its Swedish creators' homeland, with a particular focus on timber elements. A series of tall, glued laminated timber portal frames supporting glazed walls, provide a protective wrap to the bridge deck and stairs and a lofty and airy feel to the footbridge, improving passenger flow and ensuring the comfort and wellbeing of users. The frames support lighting and signage as well as the lateral glazed safety barriers and a sloping, sedum-clad green roof which allows the bridge to play a part in improving urban biodiversity. The timber used in the design can



be sustainably sourced to offset the footbridge's carbon footprint, producing a more sustainable construction typology. The design focuses on the ability to implement off-site manufacturing techniques to simplify the on-site erection sequence, breaking up the individual components into a modular system.

The judging panel said this footbridge was an, "Interesting exploration of the potential for timber on railways, utilising sustainably-sourced laminated timber deck elements and frames in areas where passengers could enjoy the qualities of timber." ■

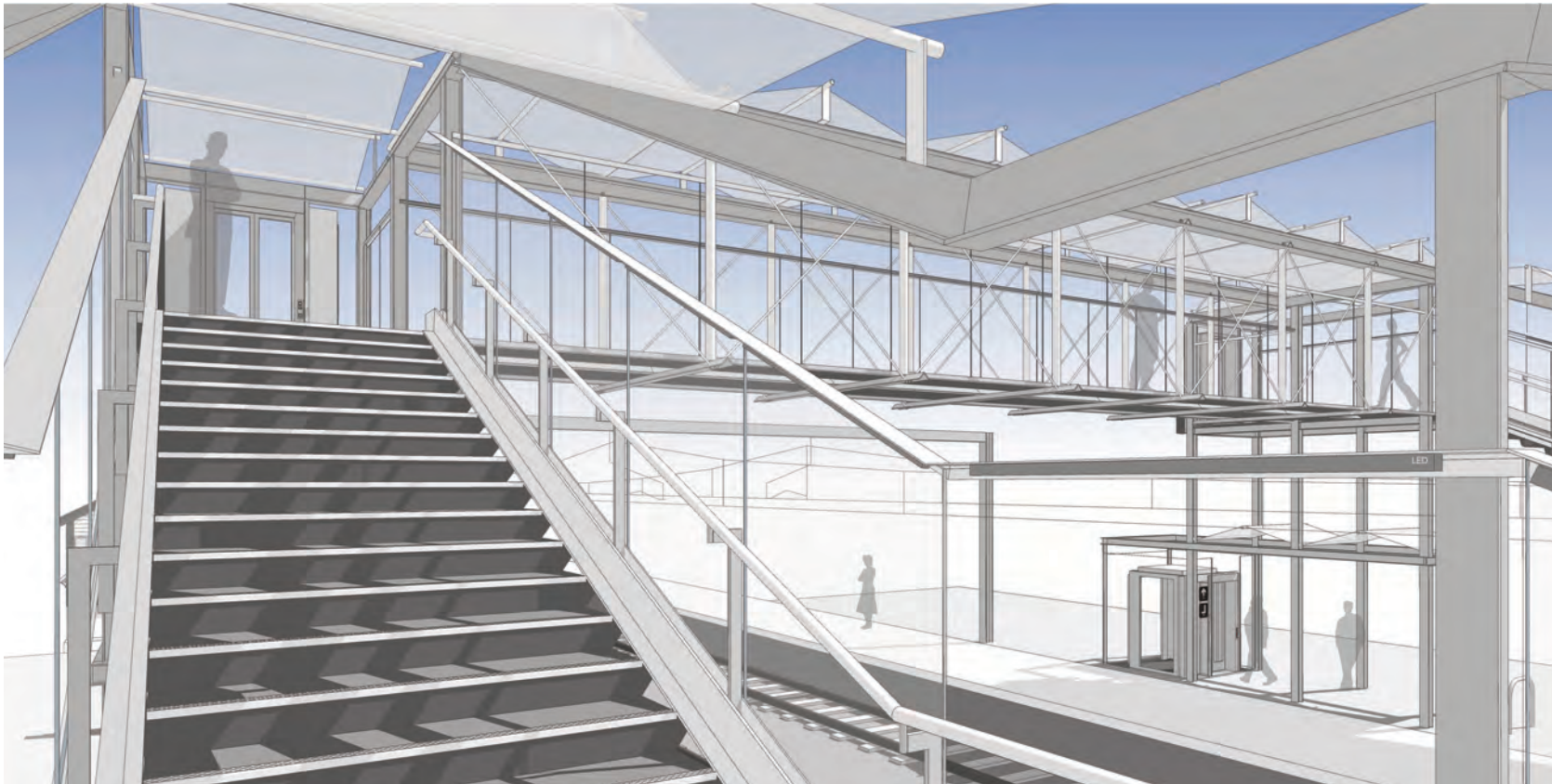
## Method Architecture, UK

Inspired by a footbridge at Truro station, this is a careful update of footbridge design, an evolution of the design heritage of the British railway network. Using a modular 2.4m grid, this is a design based in engineering, with elements that have been refined to achieve an elegant and lightweight structure. The main structural elements are galvanised steel, complemented by stainless steel handrails, toughened laminated glass balustrades and a

polytetrafluoroethylene (PTFE) coated glass cloth roof. The use of standard components that require minimal fabrication reduces manufacturing time and cost. Components can be pre-assembled to reduce erection time on site and where site access is difficult the bridge can be delivered in smaller parts. If parts need to be replaced, the cost of replacement is low. Embodied energy and carbon footprint are reduced by keeping the

structure as light as practicable. The lightweight and transparent design gives legibility to the layout of the bridge, aiding navigation by the public, while enhancing personal safety to make the bridge accessible to all users.

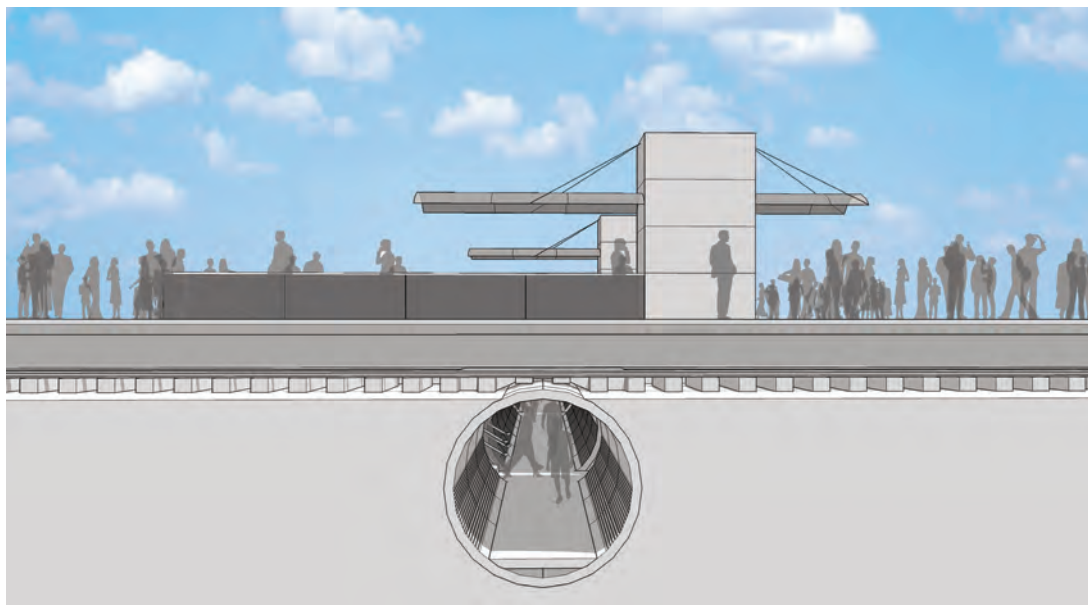
The judging panel described this entry as, "An evolution of conventional footbridge designs, using a pared-down catalogue of steel, glass and PTFE fabric components to create a lightweight and open experience." ■





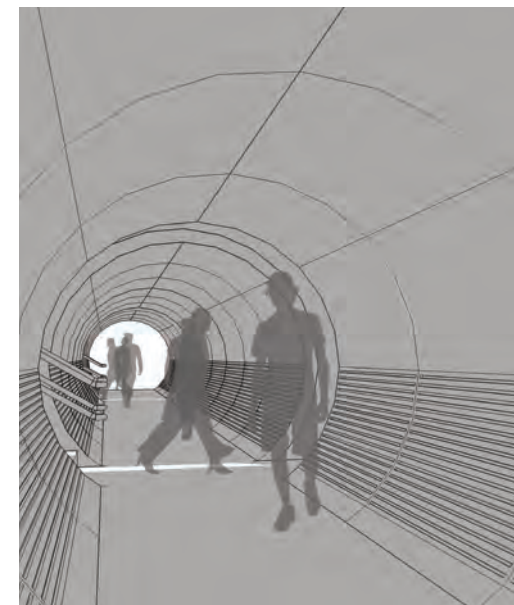
## Kashdan Brown Architects, UK

### UnderRail: Over-bridge versus Under-bridge



This design considers a radical alternative to the entire concept of railway footbridges by doing away with a bridge over the tracks entirely and putting the whole crossing underground. Noting that technological advances in precision controlled micro-tunnelling mean that sizeable underground ducts can be created with the minimum of noise and vibration experienced at the surface, this design is for a subway rather than an elevated bridge. With overhead electrification of railways needing significant intrusions into local and historic landscapes, such as the introduction of extended ramps and new lift towers, this proposal instead suggests that

directing passengers underground reduces visual impact and avoids the complications of designing around overhead power supply equipment. Quick pedestrian access to the tunnel level is achieved by cutting it through the ground as high as possible. Replacing the standard railway track sleepers over the tunnel apex with a reinforced concrete 'linked' combination sleeper will allow the apex of the tunnel to be positioned a mere 0.2m below the underside of the rails. Passengers need descend only 3.8m down into the tunnel, compared to climbing some 5.8m up a footbridge. The smaller level change will improve accessibility and the entrances to the



tunnel will disrupt the platform area less than the footprint of a footbridge. Passengers are automatically protected from rain, wind and cold by the natural enclosure of an underground connection. The simple tunnel shape allows for a modular internal cladding, the material and texture of which can be varied depending on budget and site specific requirements for acoustics, graffiti or impact resistance.

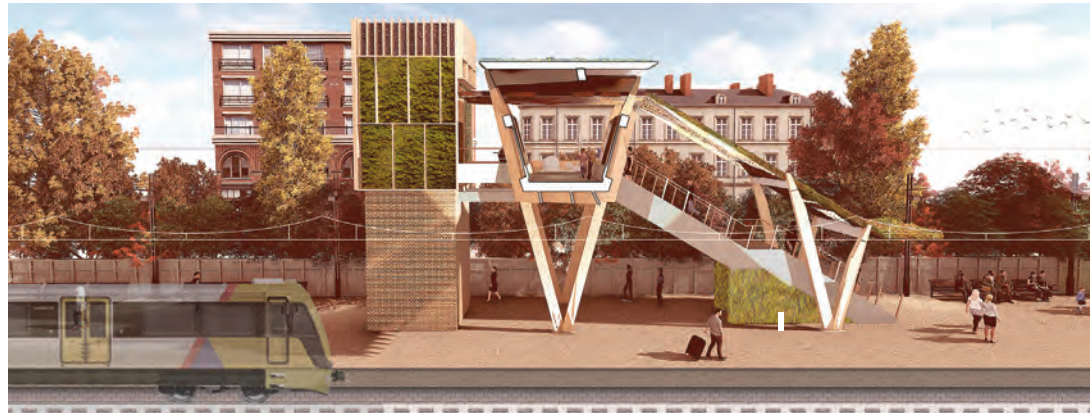
The judging panel said this design issued, "A direct challenge to the presumption for crossing above the tracks, instead proposing the advantages of micro-tunnelling to minimise the height passengers need to travel and visual intrusion on platforms." ■



## AWW, UK with Mott MacDonald Clean Air for All Bridge

A structure that not only enhances the user experience but actively improves the local environment was the starting point for the Clean Air for All footbridge. Panels of moss on both the walls and roof of the footbridge absorb carbon dioxide and trap particulates - improving local air quality and acting as a carbon sink. The moss can absorb 11.5 times the amount of carbon per square metre than a typical tree. The use of a composite steel and glued laminated (glulam) timber frame together with a recycled plastic deck help reduce the embodied energy of the structure by up to 40% compared with a standard Network Rail footbridge. The footbridge's balustrade panels are chosen to respond to the character, landscape and heritage of its context. The lower portion of the lift towers appear separate from the main bridge, enabling alternative finishes to be incorporated. Deciding on the finish of the adaptable parts of the bridge could be part of a community engagement project. V-shaped columns supporting the bridge deck and stairs maximise available platform space.

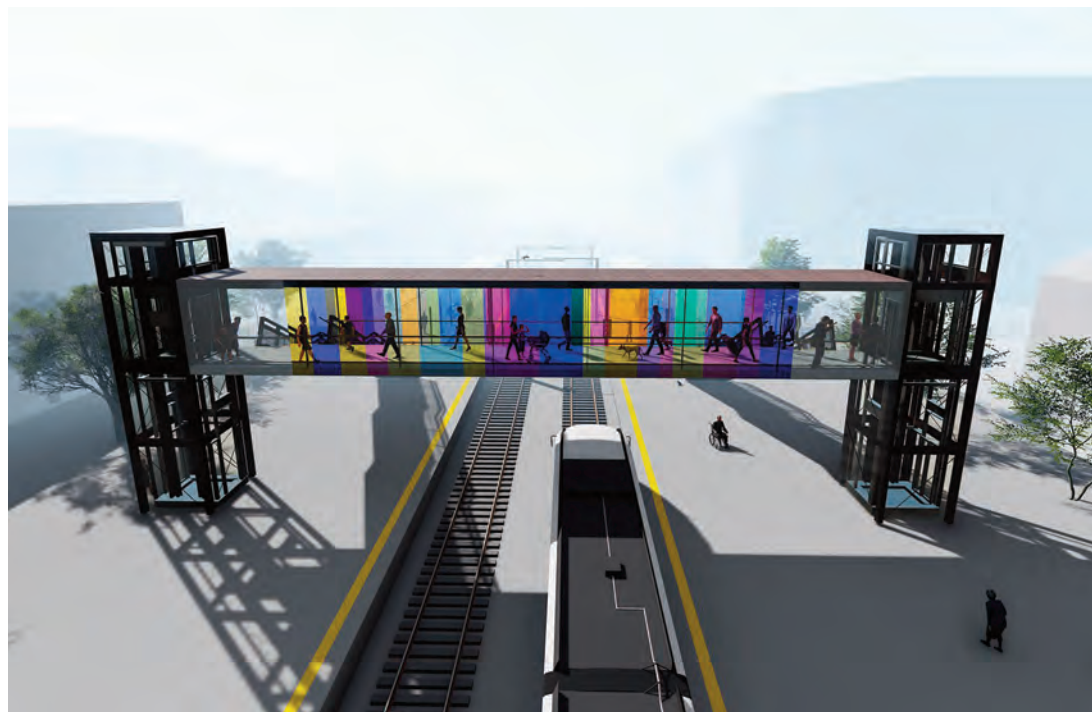
The judging panel noted this design's focus on, "Promoting the reduction of embodied energy and carbon emissions through the use of glulam timber structures, recycled plastic deck and with moss blanket roofs/panels to absorb particulates." ■



## Metropolitan Studio of Architecture, Pakistan

### The Rainbow Bridge

The design of this footbridge takes its inspiration from the rainbow, a natural optical phenomenon which occurs irrespective of location and never fails to excite. The intention for this footbridge is the same: a crossing that can be installed anywhere across the railway network, no matter the immediate environs of the station, and which is nevertheless a source of excitement. Extensive glazing is a key feature of this design,



with fully glazed lift towers and full height glazing on the main bridge span. It is the glazing of the main span itself that is coloured like a rainbow and both the colours and the main span's position in the sky help passengers feel as though they are walking within a rainbow. Because the coloured glass panels are arranged as blocks rather than as traditional rainbow stripes, users' views of the landscape outside will change every few steps as they encounter each new colour. The experience is expected to encourage confidence in using the bridge and maintain users' interest in the crossing even if they use it repeatedly.

The judging panel said that this design was, "A simple aesthetic proposition to use a rainbow of colour to uplift people's everyday experience, in a way that could readily be applied to a great range of circumstances." ■



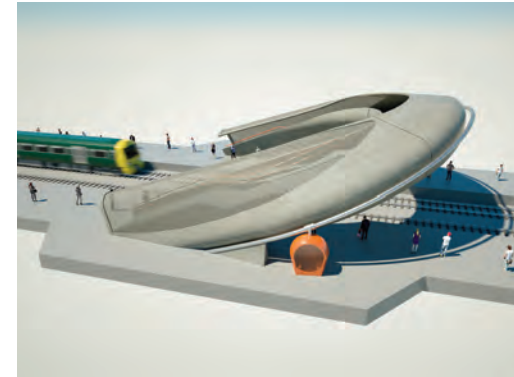


## Fereday Pollard Architects, UK



The architects of this footbridge note Leonardo da Vinci's comments on stair design that in square corners, "nuisances are apt to be committed". Acting on da Vinci's warning they have avoided corners in this design and created a swept-path experience for users. This horseshoe-shaped footbridge transforms the up-across-down movement through traditional footbridges into a

continuous curve, consolidating the sequence of movements through space, and improving the passenger experience and journey time. The bridge itself appears as though moulded from a single piece with balustrade and part mesh-effect canopy wrapping around the walking route. A lift pod suspended from the outer edge of the footbridge transports passengers in one movement between



platforms, providing a solution that is easier and cheaper to install and operate than conventional lifts.

The judging panel described this as, "A bold proposition to create a singular new form of crossing, integrating a continuous sweep of stairs with the potential for innovative technology to transport lift passengers in one arching movement." ■



**THE FIELD**

The Footbridge Design Ideas Competition attracted 121 entries. As well as the winner, highly commended and 18 long-listed entries, the remaining field comprised 101 entries featuring footbridges of nearly every conceivable shape and colour, showcasing the unfettered imagination of the engineers and architects who designed them. The basic challenge remained the same, but each entrant approached it differently, developing their own solution. Those solutions reflected the preoccupations and priorities of the footbridge designers, from aesthetics to environmental or social considerations.

The following pages feature all 101 remaining entries, with brief descriptions drawn from information provided in the designers' own entry sheets. While each entry was unique, a number of thematic approaches were identified by the judges. Although the judges did not specify which footbridges fitted into each of these groupings, for the narrative purposes of this book entries are presented in an order that reflects these themes. Within each theme the entries appear in the numerical order of the unique registration numbers allocated to entrants. Some entries, of course, could easily fit into more than one group.

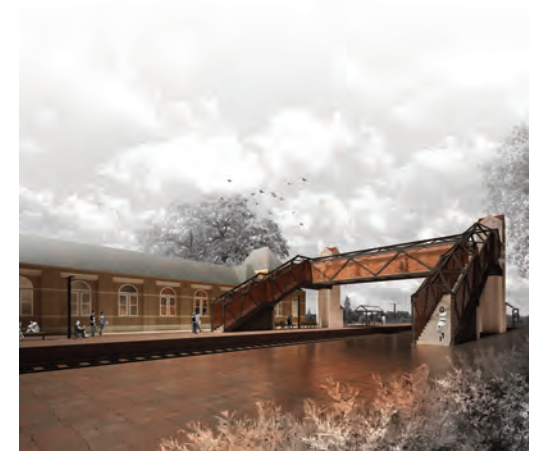
The entries start with designs based on the existing typology of the railway footbridge, transforming its external appearance in an attempt to create something more aesthetically pleasing, or more sympathetic to the environment in which it is likely to be placed. Then come those which focus on new or unusual construction materials. Next are designs driven primarily by a desire to improve the human experience of using a footbridge and its relationship with the wider community space. These are followed by entries proposing modular construction techniques and then by those with an emphasis on structural form. Entries which explore new lift technologies to help ensure the accessibility of a footbridge for its users are next, followed by entries with a key focus on sustainability or environmental considerations. The final group of entries are those which reimagine the whole form of a footbridge, sometimes to startling effect. ■



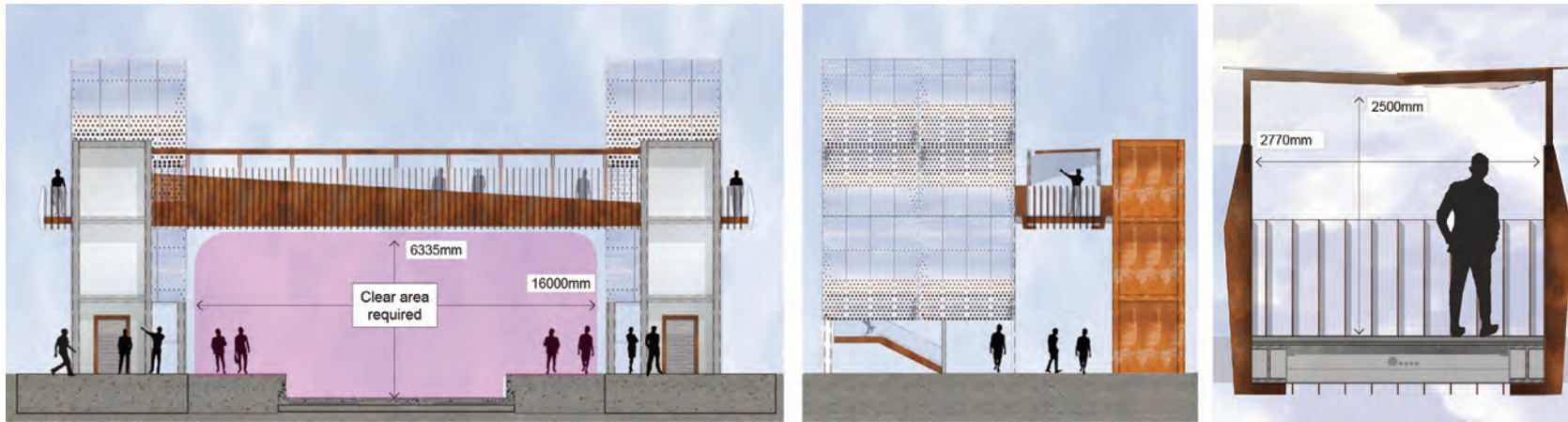
**Anna Kaim, Zeyang Cao,  
Warsaw University of Technology, Poland**

This modular bridge evokes a sense of place through reference to the weather. Specifically, the designers seek to capture the “characteristically mystical atmosphere” of a British landscape enveloped in fog and rain. Translucent panels on the bridge exterior make passengers inside appear as “slightly blurred ghosts wandering through a soggy forest”.

The material for the panels is specified in line with the station locale - wood for rural settings and polycarbonate or perforated metal sheet for more urban locations. These panels are attached to prefabricated steel truss elements built up into standard modules, each one sized to fit in a lorry for ease of delivery. ■

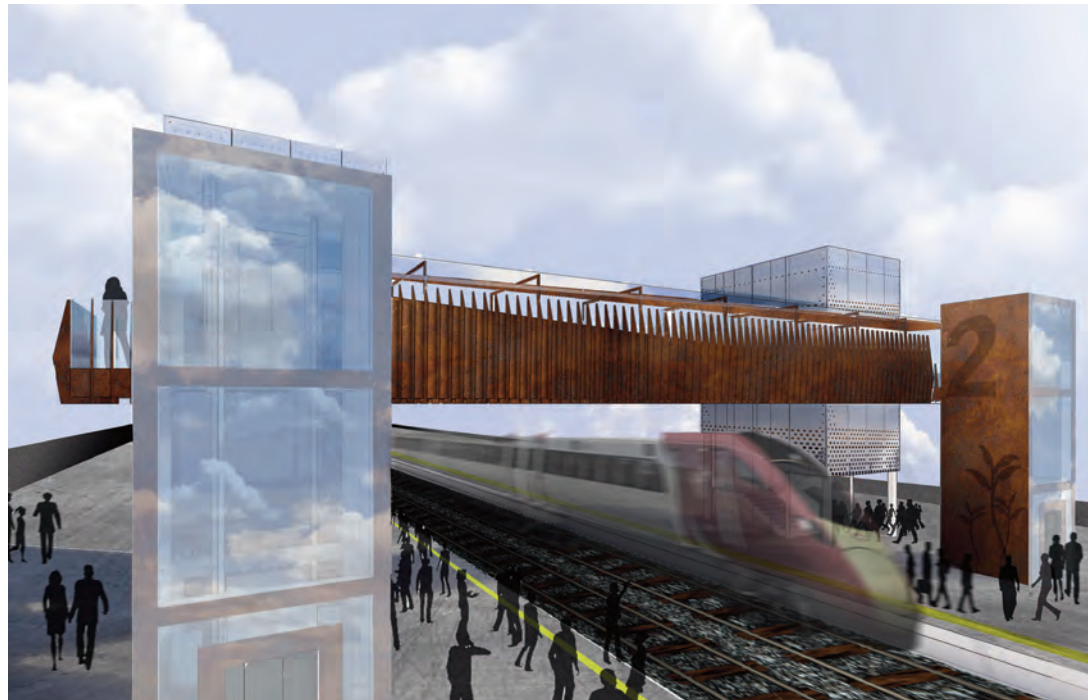






## Broadway Malyan, UK with Buro Happold Engineering

This design incorporates a low-maintenance Corten steel bridge span on which vertical fins act to stiffen the external structure, providing stability under lateral loads. Varying the depth of the fins softens the appearance, and gives an impression of movement and fluidity. The change between solid and glass balustrade follows the angled line created by the shapes of the fins, increasing the amount of glazed edge protection and letting in natural light. Staircases are housed within distinctive towers, clad in contrasting materials to the bridge span. This design is modular in concept, so staircase and lift towers can be rearranged according to site constraints. Public art and platform signage can be incorporated into the lift tower cladding. ■





## PARK Architect, USA with Moloney Engineering

### Informative Motion

Repetition and directional motion are incorporated into the wrapped framework of this design to convey the nature of repeated daily pedestrian movement upwards and then over the railway tracks. Not only are the wrapped frames recognisable and visible from afar, they are also adaptable to different lengths of bridge, providing an equalising

structural balance throughout its length. Circulation within the footbridge is compact, with the design guiding users to their desired platforms efficiently. The prefabricated frames of the staircases and bridge span are assembled on site, and are complemented by lift towers with glass modular facades. ■





## Identity withheld

### Accessorise

This design is deliberately restrained, allowing substitutions of key structural materials and cladding to contextualise the footbridge more effectively. On the exterior, use of laser cut sheets or perforated metal sheeting allows bespoke customisation with different patterns, while stainless steel mesh provides a low maintenance alternative to glass on the sides. The deck can be made from precast concrete or aluminium on a steel structure or a cross-laminated timber and concrete hybrid. Treatment of the lift towers will be one of the biggest elements in the contextualisation of the footbridge; they can be left exposed, rendered or clad. If constructed with a steel frame they can be enclosed in a range of materials from opaque etched glass to horizontal or vertical timber sheeting, to a ventilated terracotta rain-screen or even a vertical green wall. The translucent Kalwall roof enclosure provides a soft light by day and night. ■





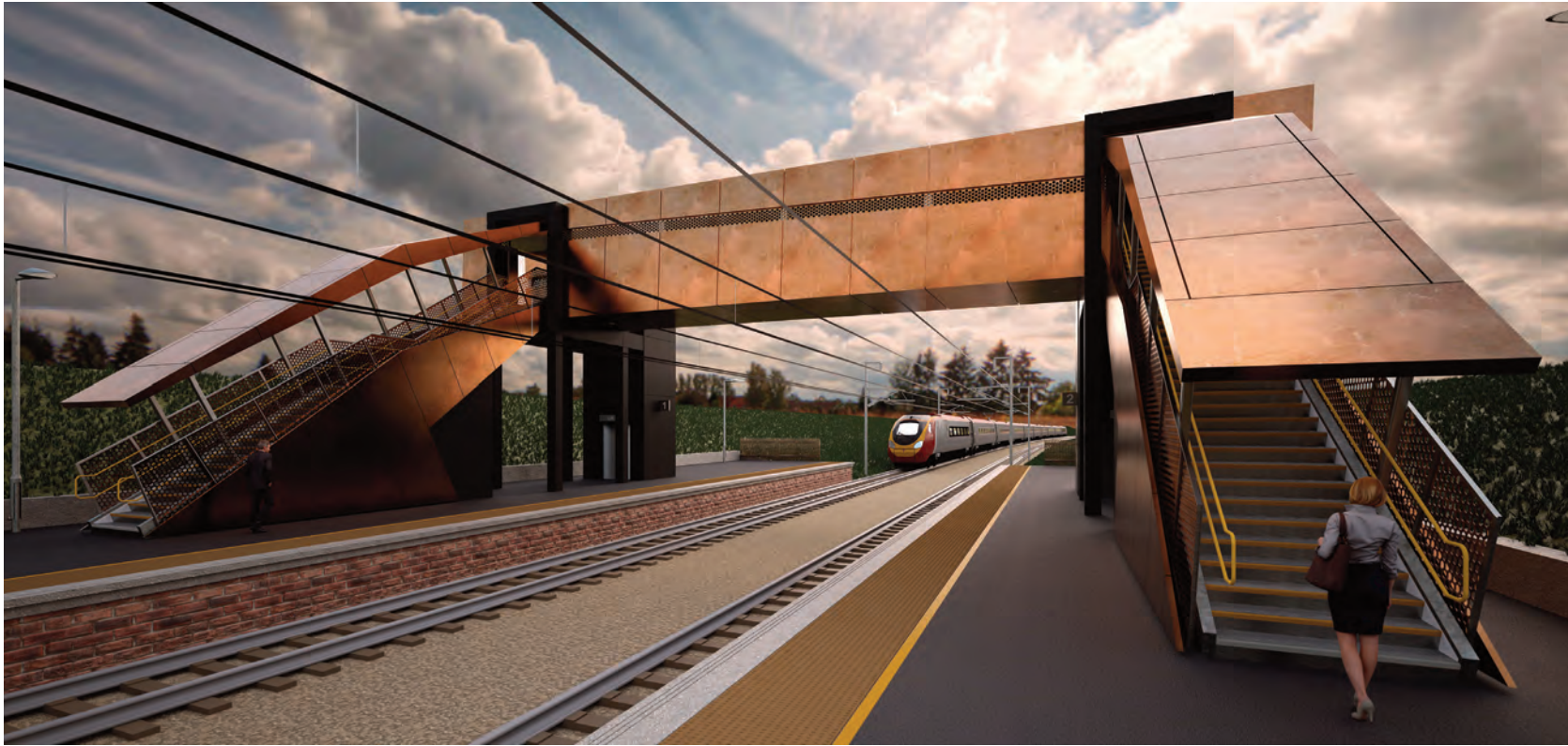


## Heat Island, UK

The plumage of the kingfisher, and the colours of the natural landscape provide the inspiration for the appearance of this footbridge. The colours are incorporated into a simple mesh panel system, set back from the structure which can be changed or customised to suit local contexts. Engineered timber is used

alongside conventional steel and concrete throughout. The sides of the bridge element are metre-deep engineered timber beams which stiffen and support the cross-laminated timber floor slab, and the interior of the footbridge benefits from the warmth of natural materials. The mass of the lift towers

is softened by textured cladding and the expressive line of the stair element is carried in the structural line of a steel web. The bridge and lift can be erected independently of one another and in any order, allowing for flexibility in planning, programming and configuration. ■



## Strzala Architects, UK

An alternating tapered channel that spans the railway lines forms the main element of this footbridge. For the covered version, a second reversed channel is added over the top with the two channels joined via perforated metal panels to let in natural light. Choice of the material is key to the design; in this example patinated metal panels in rich tones are attached to a steel structure. These striking



solid and perforated metal panels are echoed in the staircase design. The use of prefabricated concrete structural elements for the lift tower, stair and bridge supports complement the main bridge span form. The staircase design shares the materials and angular form of the bridge span. Extensive prefabrication reduces site installation time and disruption to the station. ■

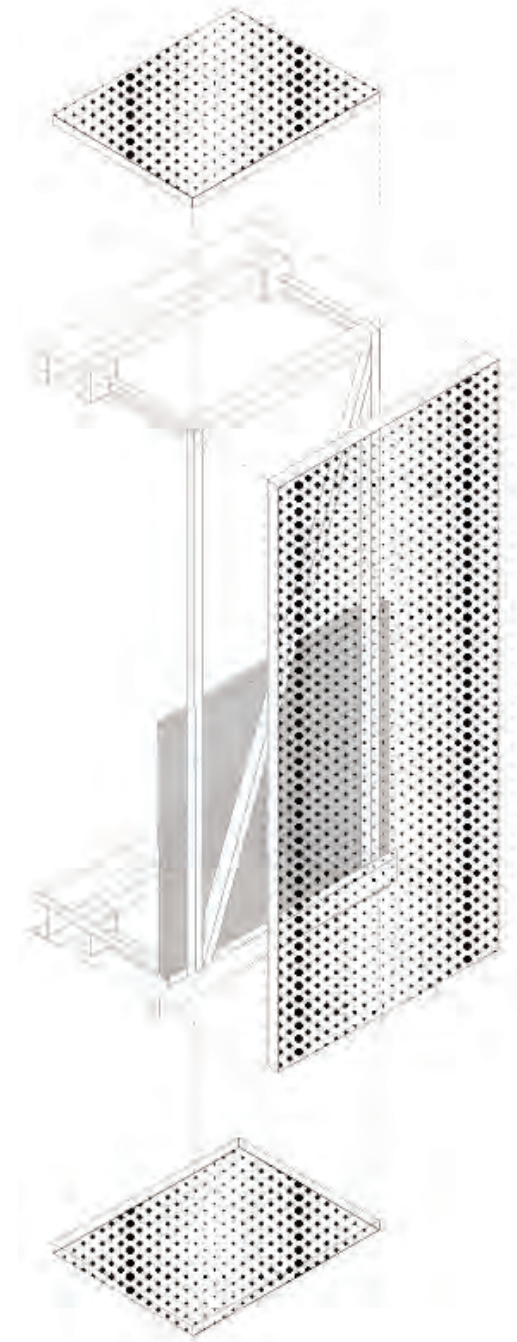




## Elaine Fanning and Suzanne Betts, UK

This footbridge celebrates the electrification of the railway by referencing the structure of the gantries that carry the overhead power lines. The trusses that span the tracks are bright orange, drawing attention to the footbridge. The perforated metal screens cladding the orange truss structure can be adapted to make the perforations unique to each destination: for example, jockeys on horses for racecourse stations or a mountain

range at a suitably scenic railway stop. The floor surface and stairways are the same colour orange as the primary structure and this colour can be further integrated into stations, with orange paths providing clear guidance to exits, entrances or ticket booths. With its colourful and patterned bridge spans this design injects a playful spirit into railway travel and at various points along the train journey. ■





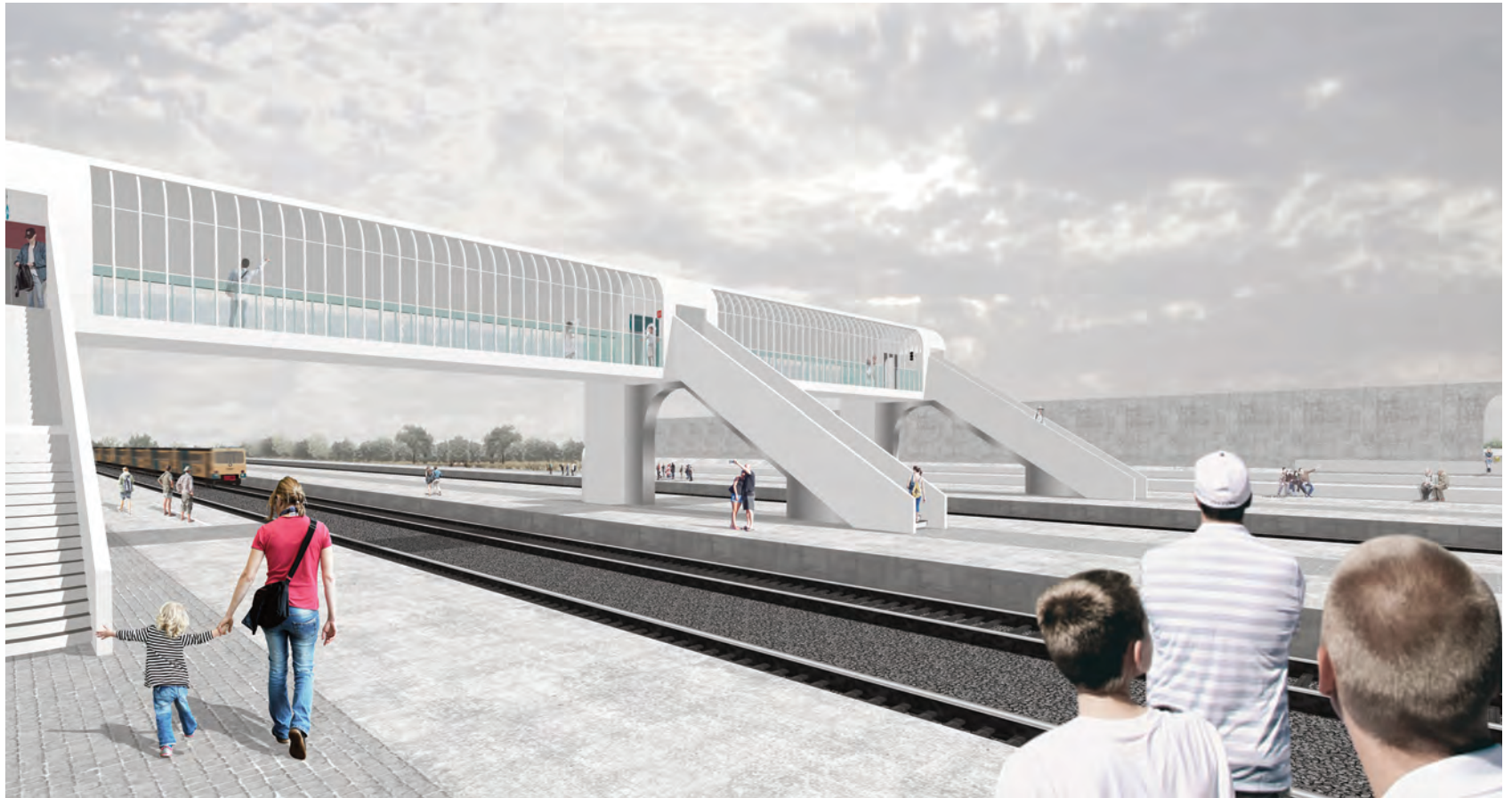


## Sweco, UK

This design is intended to blend into a variety of settings. It uses an identical half-through section on both stairways and deck to give a feeling of unity throughout the footbridge. A steel Vierendeel truss forms the sides of the half-through element, supporting a timber roof on wooden portals running over the full length of the bridge. The portals are installed at variable spacings bestowing a sense of “rhythm” on the crossing. Stairways and deck

are supported on two branching trestle piers under the landings, accentuating the lightness of the footbridge. Eliminating additional supports under the stairways makes it easier for passengers to circulate and see along the platform. Lift towers are clad in precast concrete panels up to deck soffit level with the upper level glazed. The main elements of the footbridge are fabricated off site. ■





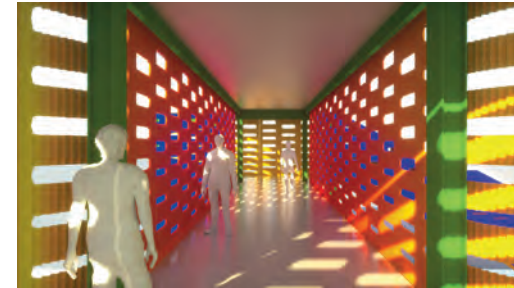
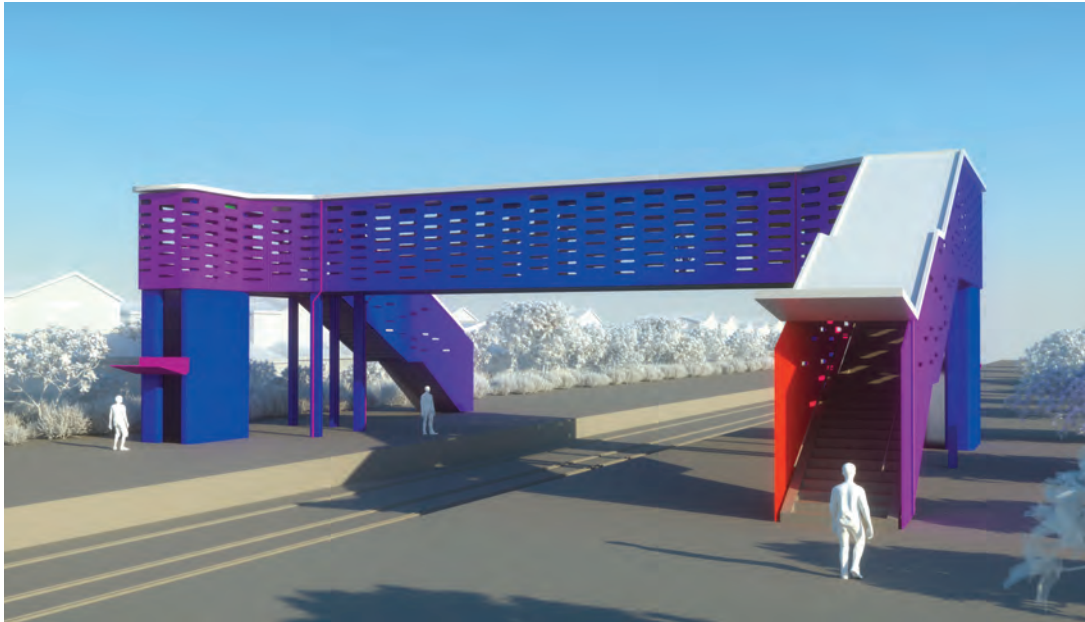
## YU Atelier, People's Republic of China

### The Time Tunnel

Formed as a series of arches, this design adapts to local weather conditions. The arched roof section has a sliding cover which can be adjusted to provide shade, fresh air or protection from wind, depending on the prevailing weather conditions. In cold weather the bridge can be completely enclosed to retain heat. Details of

local weather forecasts can be transmitted and projected onto an inner curtain, matched to the position of the sliding roof. At night, LEDs inset into the arches will form a continuous arcade of light. The repetition of the arches provides slices of space that the passenger moves through in this 'Time Tunnel'. ■





## Cook Robotham Architectural Bureau, UK

This design has a striking rippled surface which covers the main span and the staircases, made even more striking by use of bold colours which can be chosen by the local community (with the exception of red and green on the external section). Lozenge apertures are repeated along the powder coated panels of the bridge and the staircase. The panels are bolted to the structure

so they can be easily replaced. The aim of the design is for construction and maintenance to be as simple as possible while keeping the appearance of the footbridge consistent throughout and ensuring that people find it safe and enjoyable to use. The junction of both stair and lifts towards the main bridge deck is chamfered to assist with passenger flow. ■

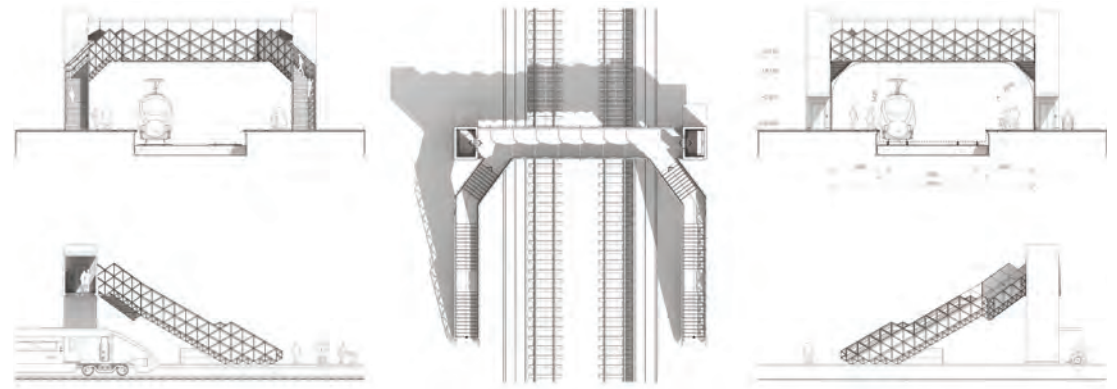






## Lacey & Saltykov Architects, UK with Arup

This design takes its cue from the traditional arched railway footbridge, combining that concept with elements of a more modern footbridge with a completely flat crossing, to focus on the most efficient route through the footbridge by passengers. An angled stair flight

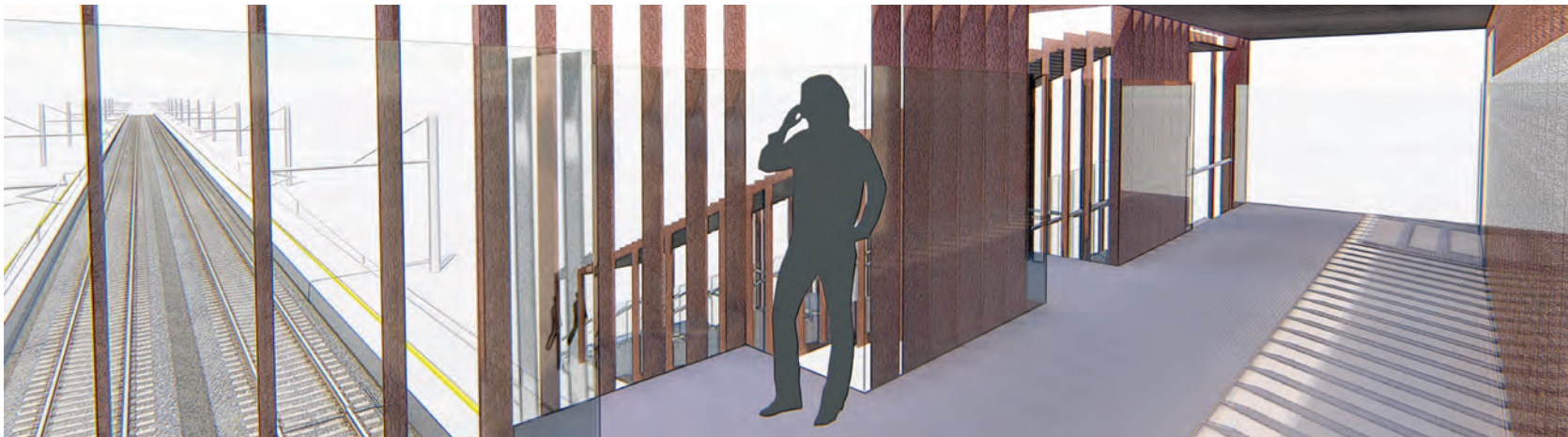


towards the top of the stairs minimises the distance through the footbridge for pedestrians, while an unusual lift car configuration with a side door means wheelchair users or those with buggies only have to turn to one side to exit the lift. Lift waiting areas on the bridge are

separated from the pedestrian flow. Plate girder finishes are reminiscent of traditional railway footbridges, as are the mesh staircase sides. LED lighting is integrated into the stair handrails. The finish of the lift towers and roof elements can be adapted according to local need. ■

## Aqua Architecture, UK with Inter Urban Studios and Engineeria

The industrial nature of rail infrastructure is referenced in both the design and the colour of this footbridge, the deep reddish texture of weathering steel. The design's simple and repeated 'rib' form emulates the repetition of railway sleepers whose shadows track gradually across the walkway as the sun passes overhead. Extruded sections each side of the walkway accommodate seating areas, creating extra interest in the design. Glazed panels topped with black powder coated handrails allow light to penetrate while protecting passengers. Carefully designed rubber bumpers concealed beneath the bridge span protect the steel structure from contact with the overhead electrical supply cables. The structure can be built quickly off site and in modular sections that can be fitted in a lorry and bolted or welded together on site. ■



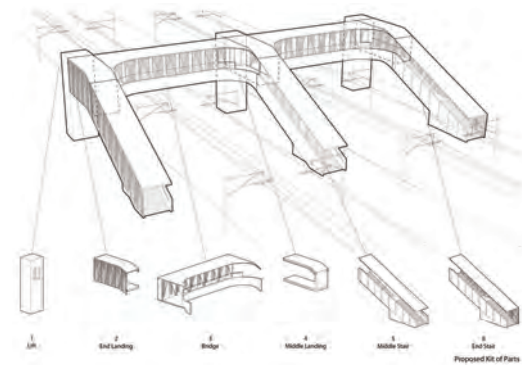




## Gollifer Langston Architects, UK with Michael Hadi Associates Engineers

The controlled curvature of a railway track is captured in the sweep of this bridge, its steel components acting together to create a single sculptural form rather than an assemblage of parts. Materials proposed draw on associations with railways and use a simple streamlined approach. Constructed from perforated metal the structure is lightweight and lets in light, but has an internal layer of glass to avoid direct

access to the perforated layer over the rail tracks. The deck ribs cantilever from a prismatic steel truss that forms the primary bridge structure. The steel structure can be painted in different colours or even patterns or stripes. Low output LED lighting housed in the leading edge of the bridge roof accentuates the flowing form and provides safety at night. ■





## Arcadis, UK



Weathering steel blades folded at different angles line the deck and the stairs of this structure, evoking the movement of a wave. With each step passengers see an altered view from the footbridge revealed by the different angles of the individual blades that they pass behind. The fixed part of the blades is pre-drilled with holes to accommodate the bolted roof connection, if required. Glass on two sides



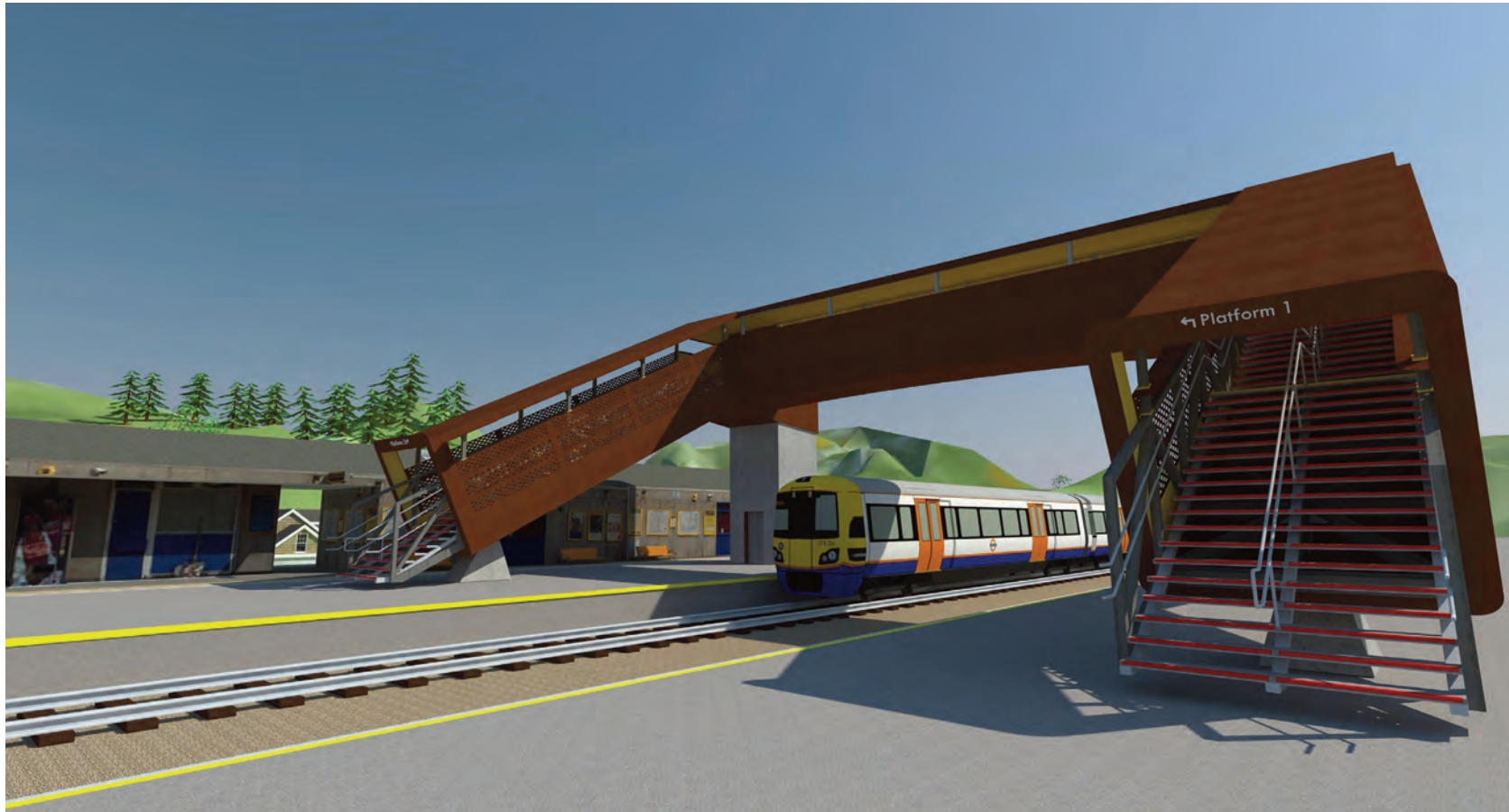
of the lift towers encourages users to look along the platform and into the landscape. Continuing the material theme of the main span, the remaining two sides of the lift towers are clad in weathering steel. So too are the staircases and their single cruciform supports, tapering down from deck level to draw the eye toward the main structure and minimising the footprint of the bridge. ■



## AwAwDe, Canada

This design proposes a two-layer cladding system; the exterior uses reclaimed and weathered metal plates from retired railway carriages, while the interior layer is made of smooth 1.8m high transparent plexi-glass which runs along both sides of the bridge span. The angular shape of the exterior cladding, which at points drops down to floor level, coupled with the transparency of the plexi-glass, provides opportunities to look out from the bridge. On the inside surface of the exterior cladding is an exhibition area, its contents curated to reflect the context and location of the bridge. As well as ensuring user safety the interior plexi-glass layer protects the exhibition material. The plexi-glass also diffuses upwards illumination from lights fitted at floor level to create a soft and warm ambience. ■



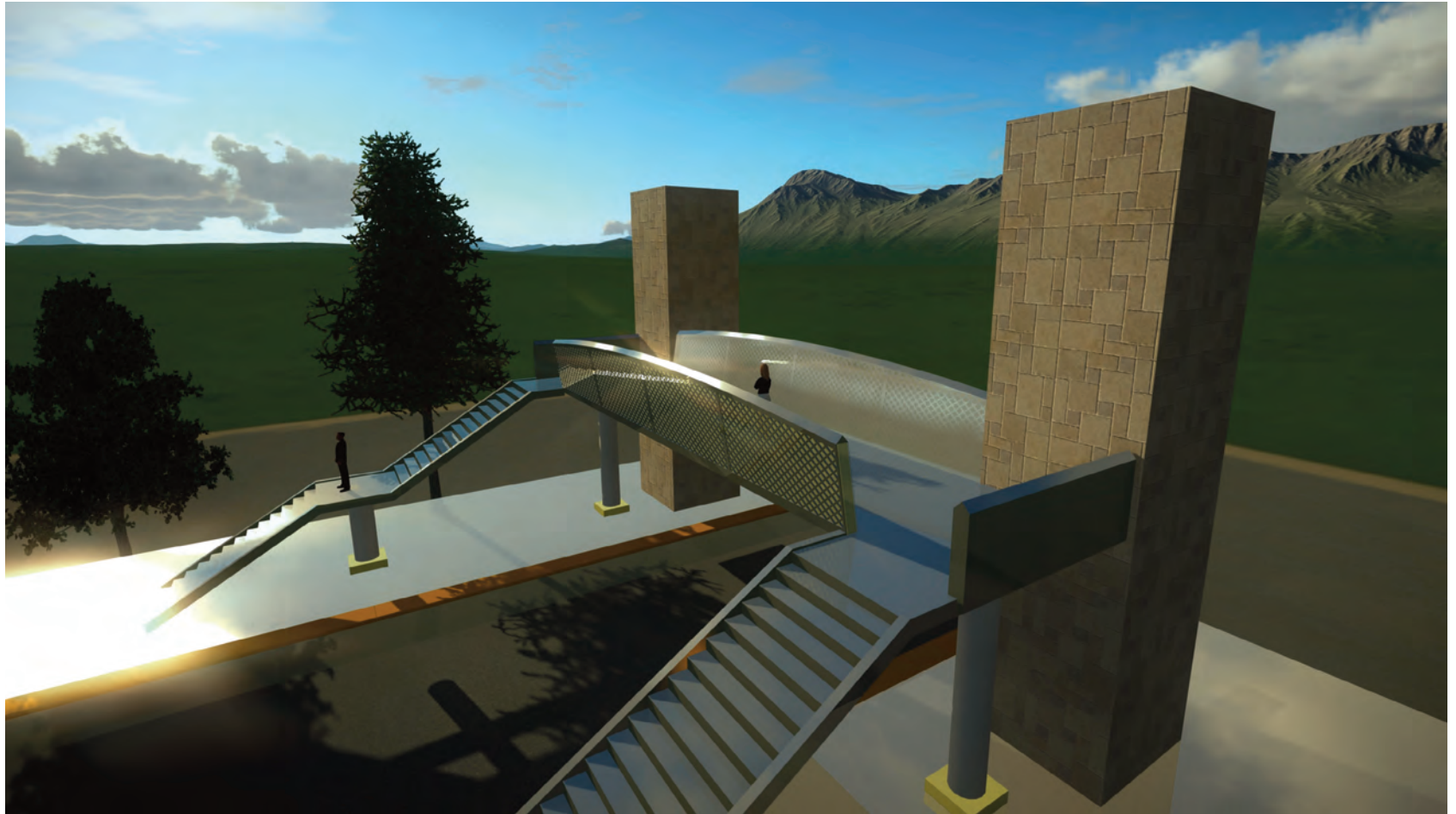


## Pro-Form Architects, UK

This proposal envisions a reinforced concrete lift tower anchored by a pad foundation as the primary structure for the bridge. A set of stairs made from a lightweight structure hangs off each lift tower terminating with a floating effect just short of the platform. The stairs are clad in Corten steel with the upper half

perforated in a pattern to resemble Victorian lattice styles used in old bridges. The perforations also allow for natural illumination of the footbridge's interior. All other structural and cladding elements are prefabricated and standardised. The main body of the bridge uses a double shell reinforced structure. ■



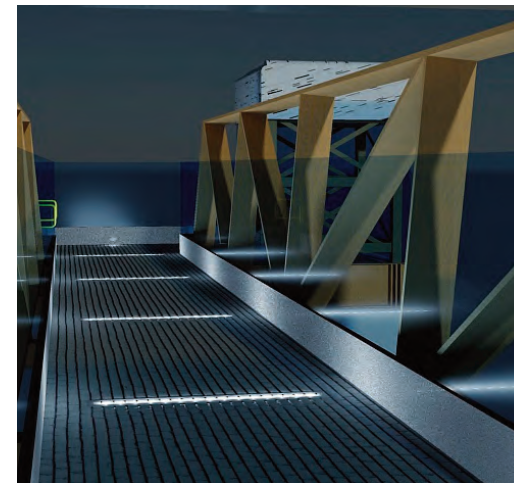
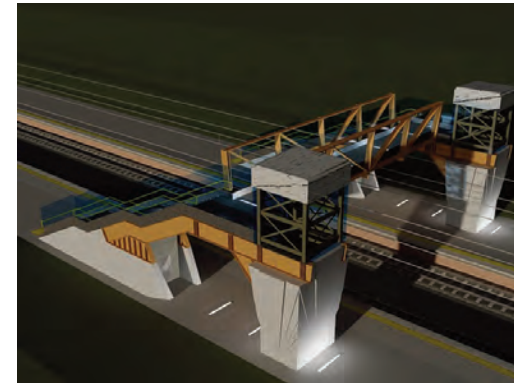
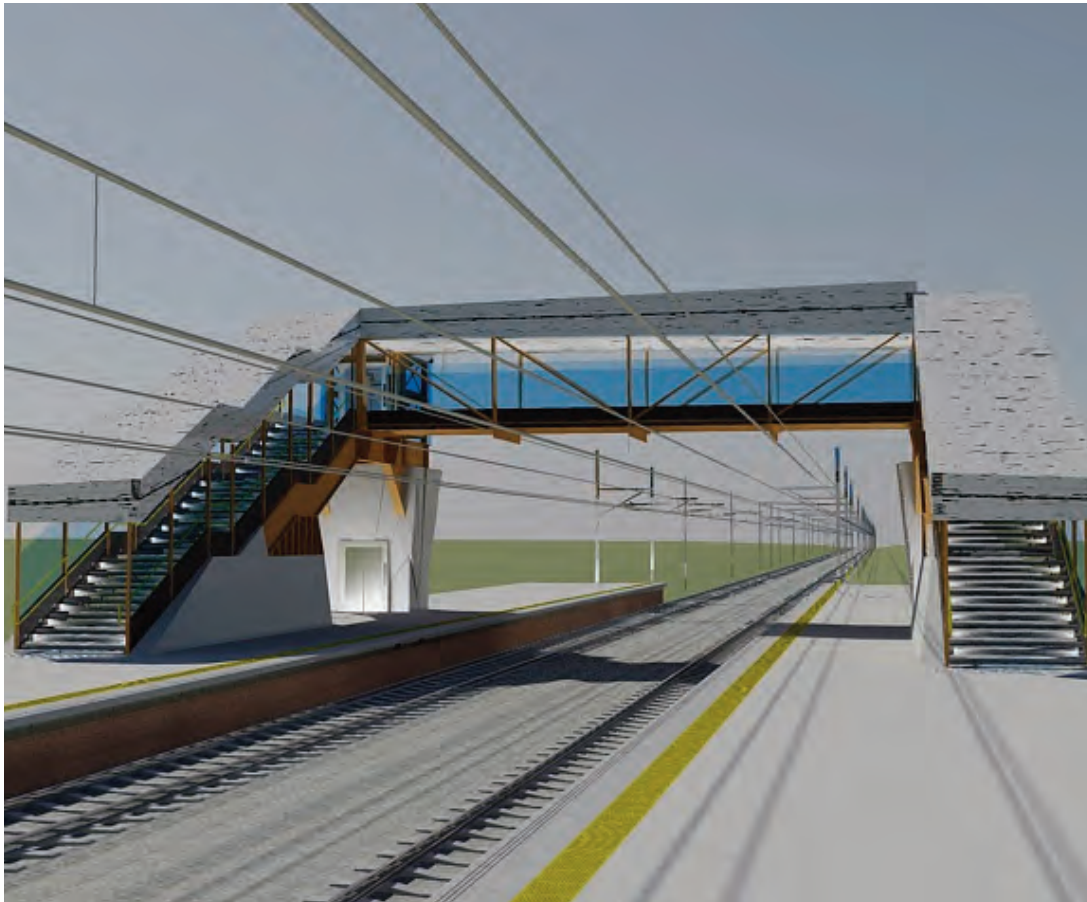


## Mott MacDonald, UK

Intended to evoke traditional railway footbridges through form and material, this design features a bridge span with hollow parapets containing a light source to highlight the exterior panel design. The panels themselves are fashioned to suit different

locations, with options including traditional lattice, contemporary patterns or pictures, or simply the name of the station where the footbridge is located. A solid transparent panel is provided on the interior of the parapet at the point where the footbridge crosses the railway

lines with overhead electrical supply wires. The roof is made of lightweight, self-cleaning ethylene tetrafluoroethylene (ETFE). Lift towers are constructed from stone or brick and feature a laser cut panel that reflects the design on the parapet panels. ■



## Stephen Walsh, UK

This design combines a historical structural form with modern features. The bridge span is constructed with a Pratt truss but with a trapezoid cross section. The buckle plate deck contrasts with the modern parapet glazing. The

main span support is integrated with the staircase and lift tower. Two parallel beams are cantilevered off an anchorage block to the lift tower supports. The main span walkway is made of segmented trays inset with paving and

transverse lighting. Each tray is easily removed to gain access to services within the void below. The lift towers have glazed parapets while the lower portions have a facade consisting of precast concrete panels, cast in a fan pattern. ■



## Ergotechnics, UK with enGauged Design & Consulting Engineers

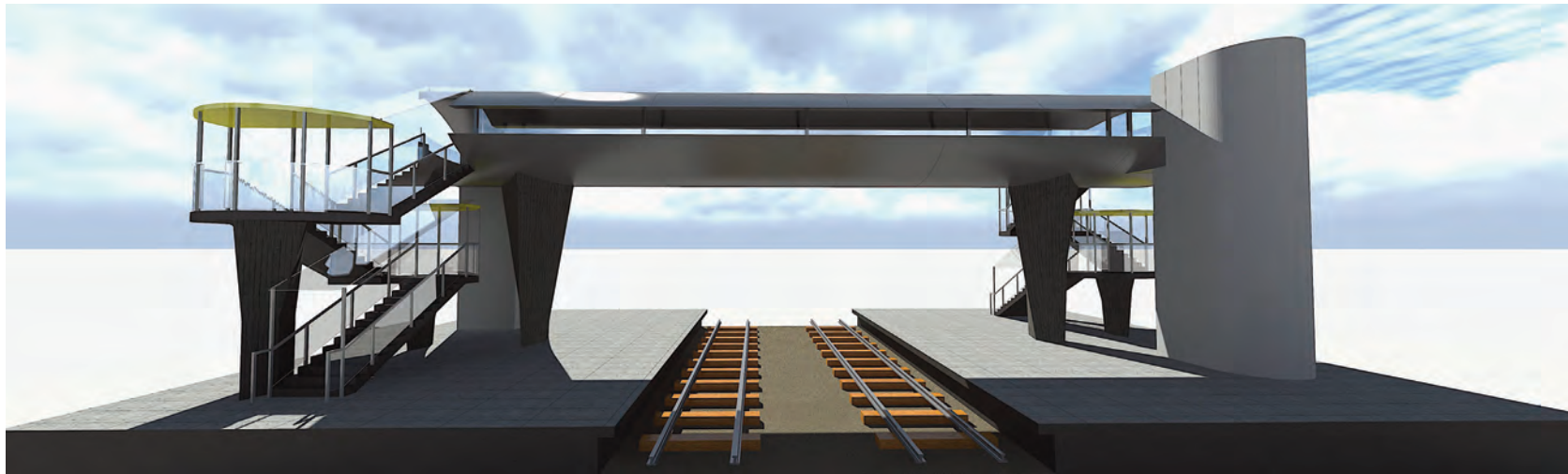
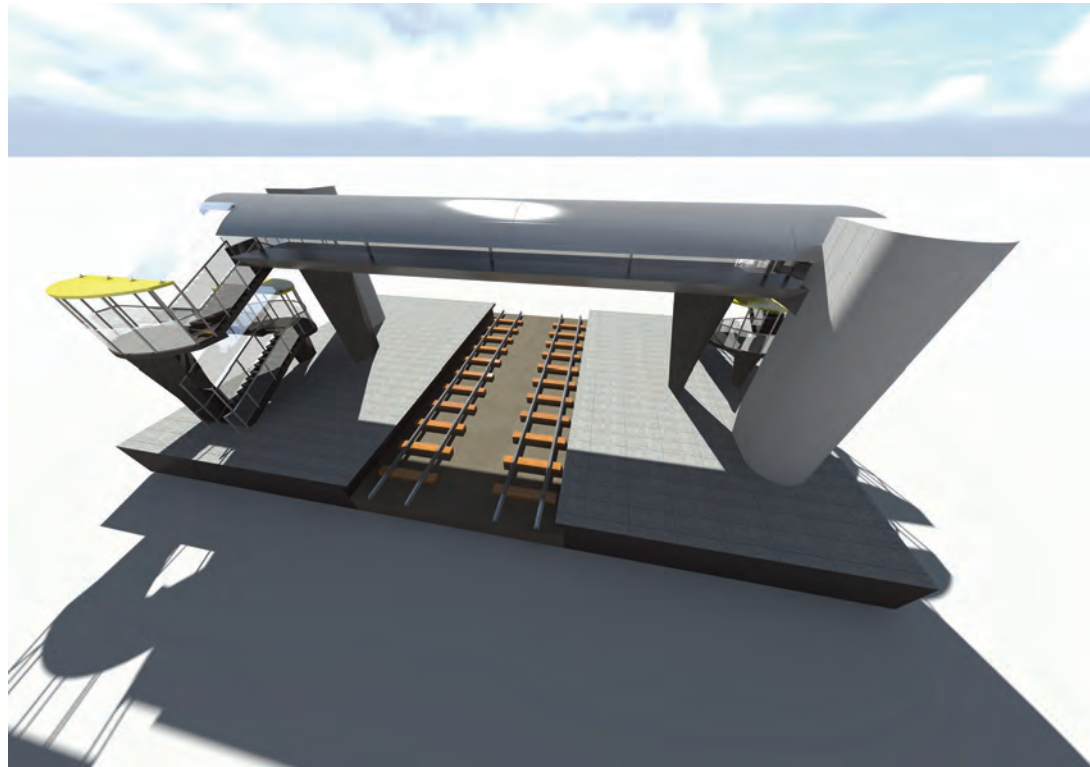
This footbridge is adaptable to three different scenarios of varying size and footfall; village, town and city. All three options include seating, ticket machines, CCTV and train information on the bridge span itself (if required). The 'village' option is the smallest, while the 'town' option is a larger, covered version. The 'city' design provides for retail and cafe outlets as well as additional seating along the span of the footbridge. This area could also be used as a substitute station where existing facilities either do not exist or are in the process of replacement or enhancement. The proposed structure utilises Corten steel trusses and associated framing externally. It combines this with a double-glazed curtain walling system to the bridge elements and lift towers, to maximise transparency and provide a light and bright environment. ■





## Beanland Associates, UK

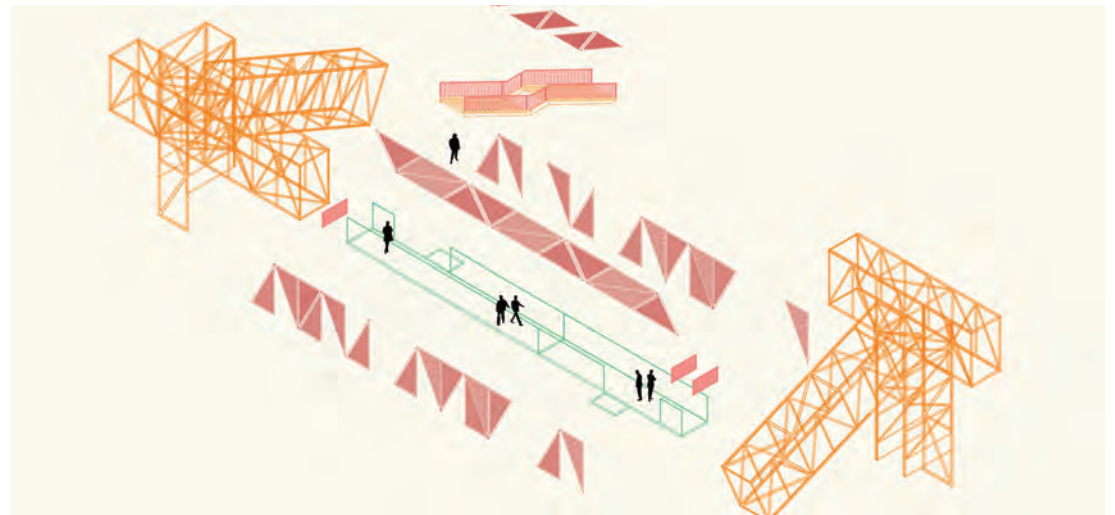
This footbridge's support structures have been designed to minimise heavy structural elements at platform level to allow passengers to move around the platforms more easily. The design itself is derived from a set of components: main bridge span, standard staircases with or without glazed covers, optional roof element, and lift towers. Stair and lift elements can be aligned parallel with the platform or rotated to achieve different spatial arrangements. The lift towers are designed to be clad with high-pressure laminates with artwork appropriate to the footbridge's location. The three-flight stairs are made of precast concrete, with toughened and laminated glass used for the balustrades and covering where desired. ■





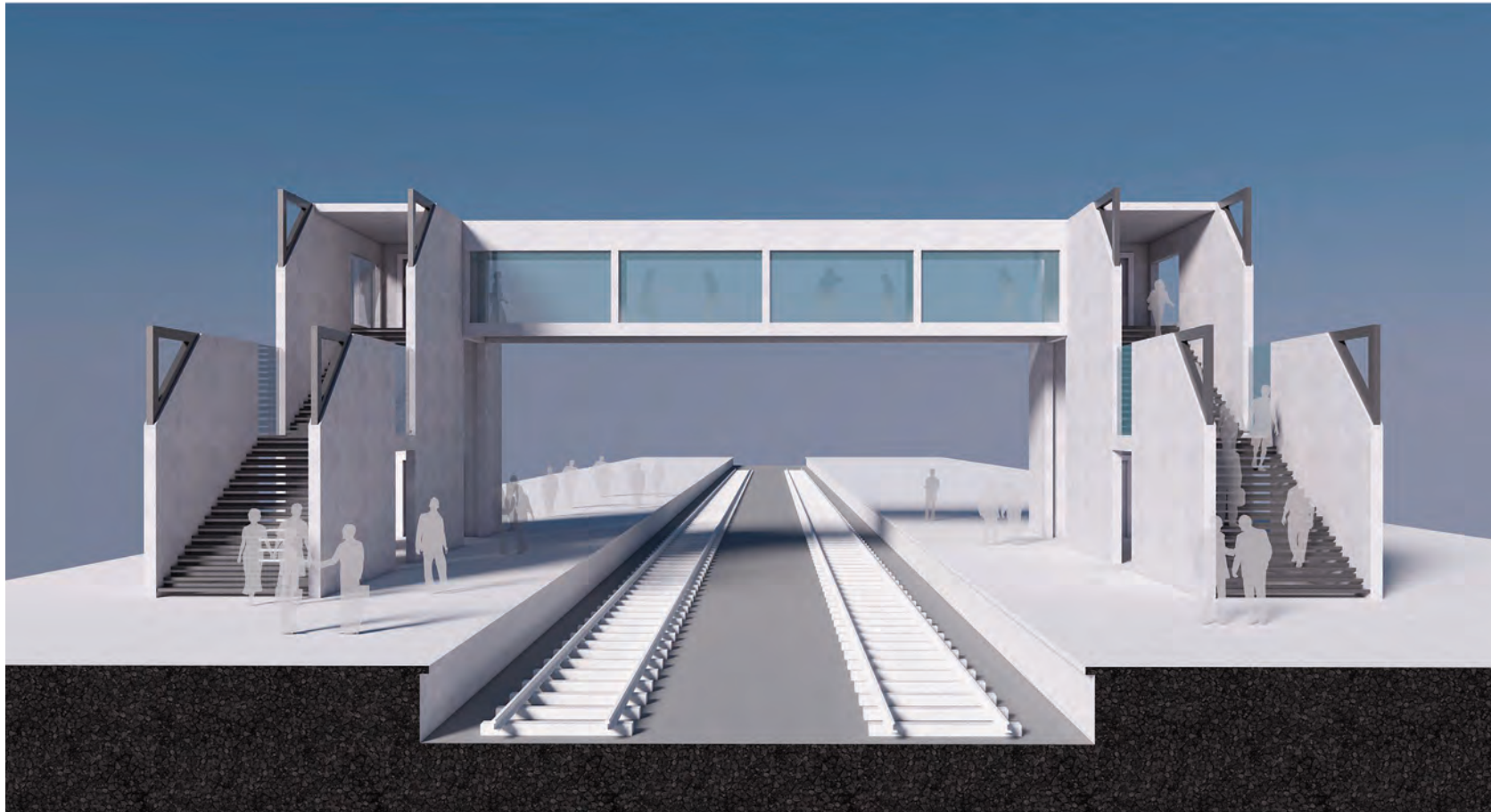
## NORR Consultants, UK

This footbridge is assembled from a kit-of-parts. The repeating elements of this kit can be put together in different formations to make the bridge span, the structure to house the stairs, and the lift towers. The stairs, lifts and bridge span are then inserted into the standard structural elements and any coverings are applied to the exterior of the structure. This layering process is intended to make the footbridge adaptable to a variety of environments and conditions to give a unique design and sense of identity to the railway station at which it is installed. ■



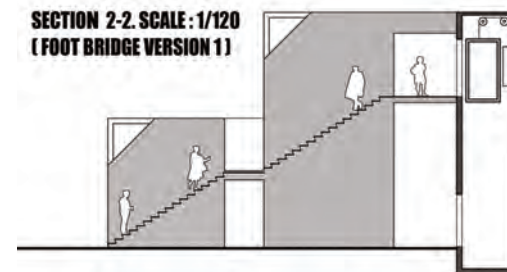


## Hoang Quang Huy, Vietnam



This footbridge is designed with the lesson of structures like the Sydney Opera House or Egyptian pyramids in mind; that the basic shape of a building - old or new - should make a positive impression and express a style that has longevity. The design prioritises easy maintenance with an underlying steel frame

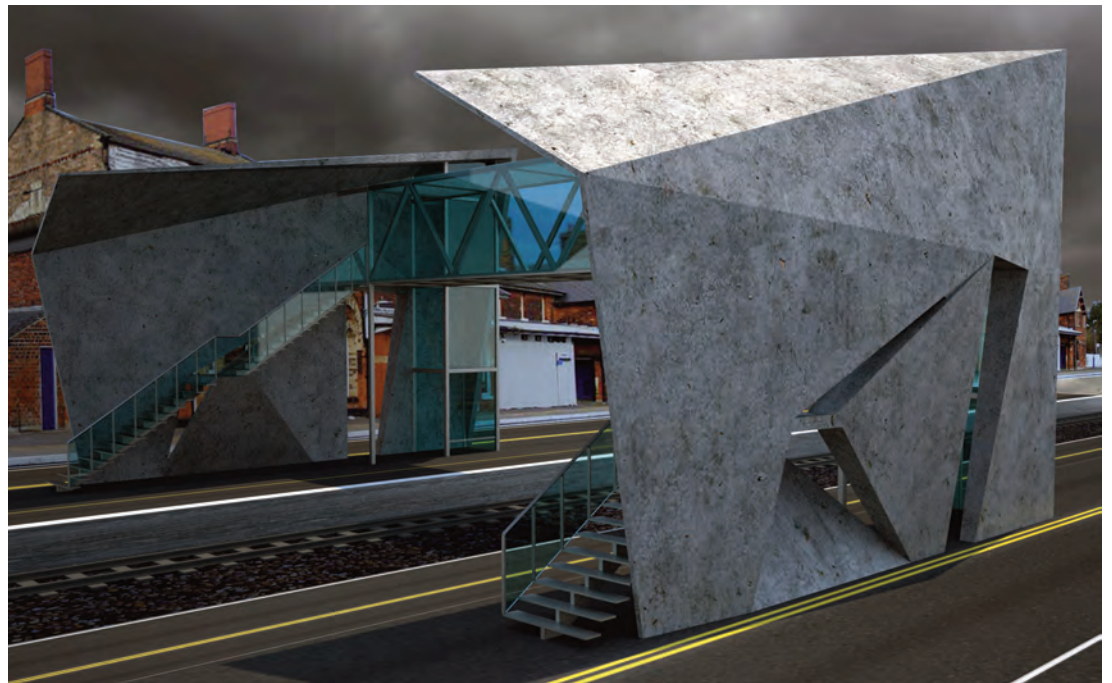
structure built up from repeated components, and the walls constructed from cement fibre board. The design of the structural steel frames means that the footbridge can be easily adapted into versions with or without lifts, and with single or double staircases. ■





## Anello Architetti Associati, Italy

Composed of a thin steel structure coated in aluminium, the bold geometric structures that make up the exterior staircase wall and roofs wrap around each end of the bridge. Despite their steel construction, these slender permeable shells with their angular cut-outs appear modern and contemporary, referencing the visual voids of landscape skylines in built environments. Glazed lift towers are located within the shelter provided by the thin steel geometric shells. As well as offering an aesthetic structural concept this footbridge has nevertheless been designed with manufacturing methods in mind. It incorporates simple load transfer mechanisms and through its use of materials takes into account life cycle costs. ■



**WilkinsonEyre Architects, UK with Eckersley O'Callaghan Engineers**

Utilising carbon fibre as the primary material, this design proposes a Vierendeel truss with compression members of varying widths, responding to structural demand along the bridge. With the structure becoming more open towards the midspan, passengers benefit from an open and light structure with good views up and down the railway tracks below. Concrete piers, stairs and lift towers are combined with an exposed, unpainted



carbon fibre finish for a modern appearance that requires only minimal maintenance over its lifespan. The designers note that carbon fibre is perceived as expensive to work with, but that much of the cost relates to the fabrication of the moulds for the production process. Using the same design for multiple footbridges would allow the moulds to be reused, reducing the unit cost of production significantly. ■



## VEDA Associates, UK with PEDELTA Structural Engineers

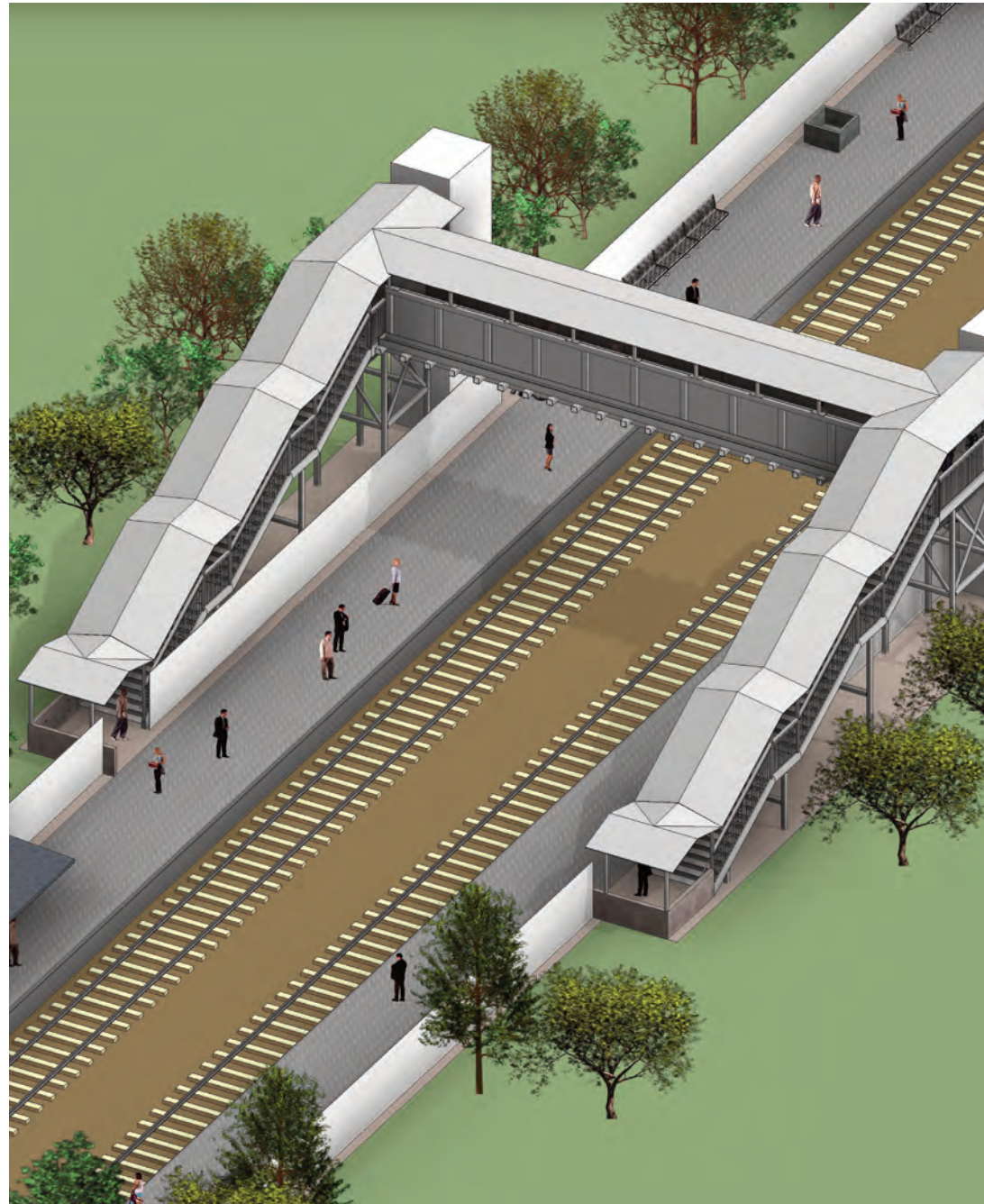
This concept incorporates a high-strength fibre reinforced polymer (FRP) bridge deck supported by lift cores that also hold wrap-around staircases, avoiding additional staircase supports. Relocating the lift machine room from its typical location on the platforms to the top of the lift towers reduces the footprint of the bridge. With the FRP deck expected to weigh just 25% of a steel equivalent, foundations can be reduced in size compared to footbridges made of more traditional materials. The FRP is expected to require minimal maintenance and last as long as steel. The design can be tailored through the use of colour, special coatings and illumination to create unique footbridges for individual locations. ■

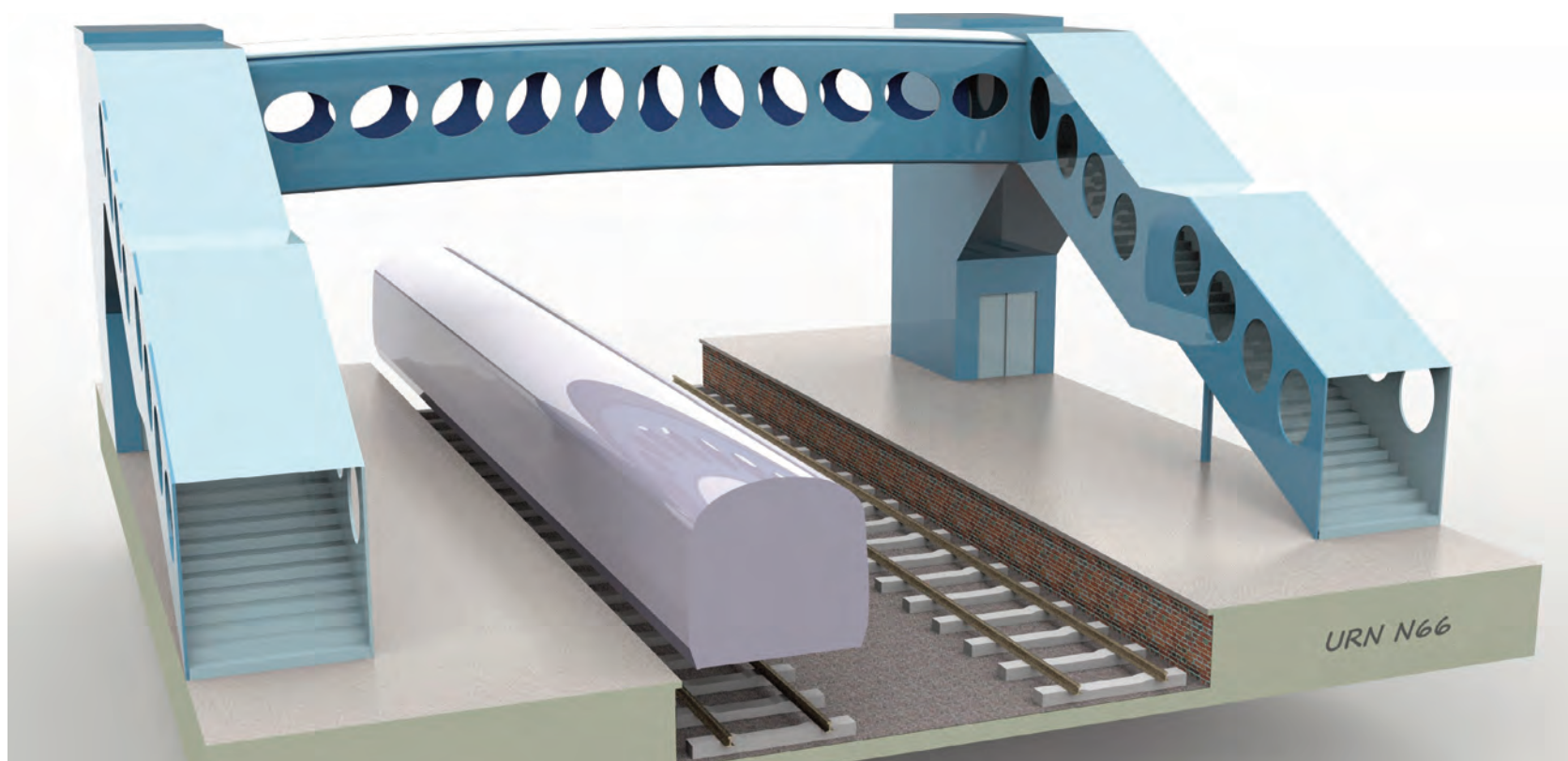




## EE Management, UK

This footbridge is designed to have minimal maintenance costs by using fibre reinforced polymer (FRP) in the bridge span, stairs and lift tower cladding. As the materials are lightweight the usual intensive foundation work is eliminated which means that the construction of stair and lift foundations can be undertaken during normal working hours behind hoardings next to the platform. Only a 12 hour installation window is needed and the footbridge is secured with a group of small helical screw piles installed using a small vibro hammer driving machine. The use of FRP and glass reinforced polymer (GRP) on the footbridge also eliminates the need for electrical bonding where tracks have overhead electrical supply wires. Additional LED lighting is installed within handrails. Costs would be controlled through a strict use of standard designs; only span length and stair heights would be customised. ■

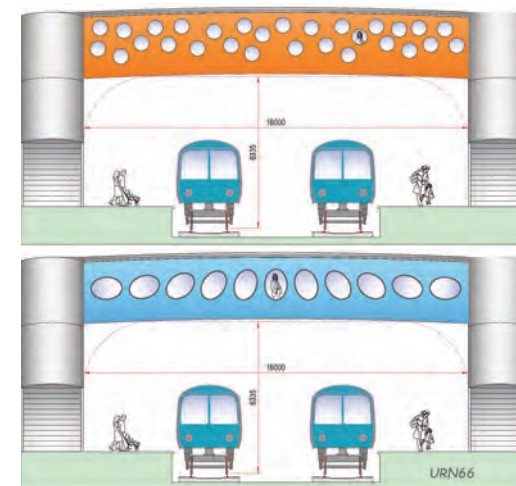




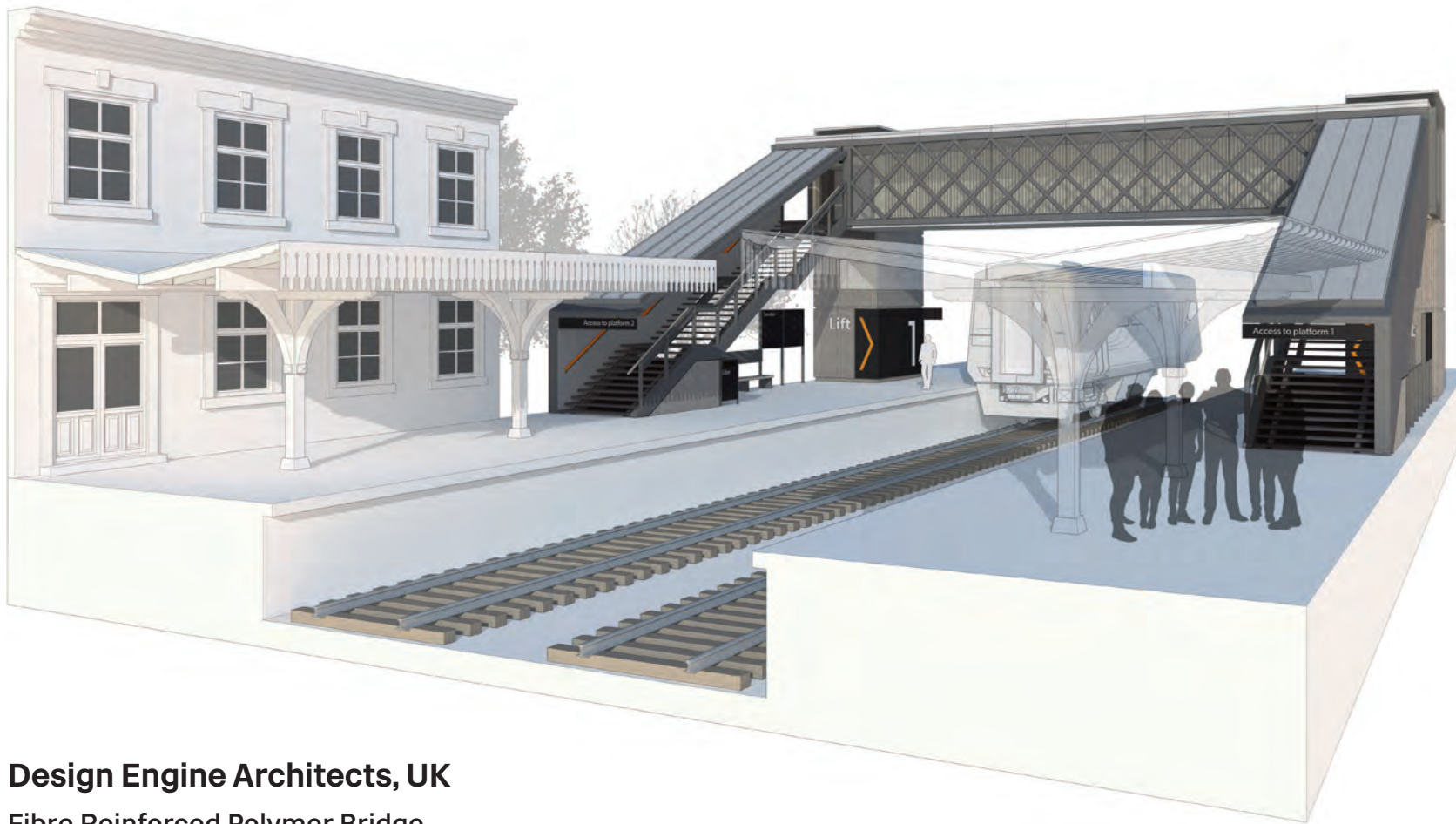
## Optima Projects, UK

The bridge span and staircases in this design are cast from fibre reinforced polymer (FRP) as single moulded elements. Using different inserts in the same mould, the window design can be modified to create oval, round, triangular or other window recess shapes. The same basic primary structure can be tailored to individual sites allowing for local creativity or artistic influences, without adding significant cost. The FRP mouldings can incorporate a wide range of integral surface

finishes, textures and materials that provide a stone, timber or metallic look. The lightweight nature of FRP compared to traditional materials reduces dead load on supporting structures and foundations, making installation easier and quicker. Casting the footbridge sections as single elements reduces the number of crevices that can trap dirt and provide bird nesting sites, while minimising the number of joints cuts down future maintenance and inspection requirements. ■







## Design Engine Architects, UK

### Fibre Reinforced Polymer Bridge

In this proposal fibre reinforced polymer (FRP) is used structurally for the deck, the side wall and soffit construction. On the main span, one side is clad with pressed aluminium panels on the outside, in a design which references traditional railway water tower tanks. Lightweight and durable thermally modified timber is used on the inside. The opposite side of the main span is a more open structure taking its inspiration from

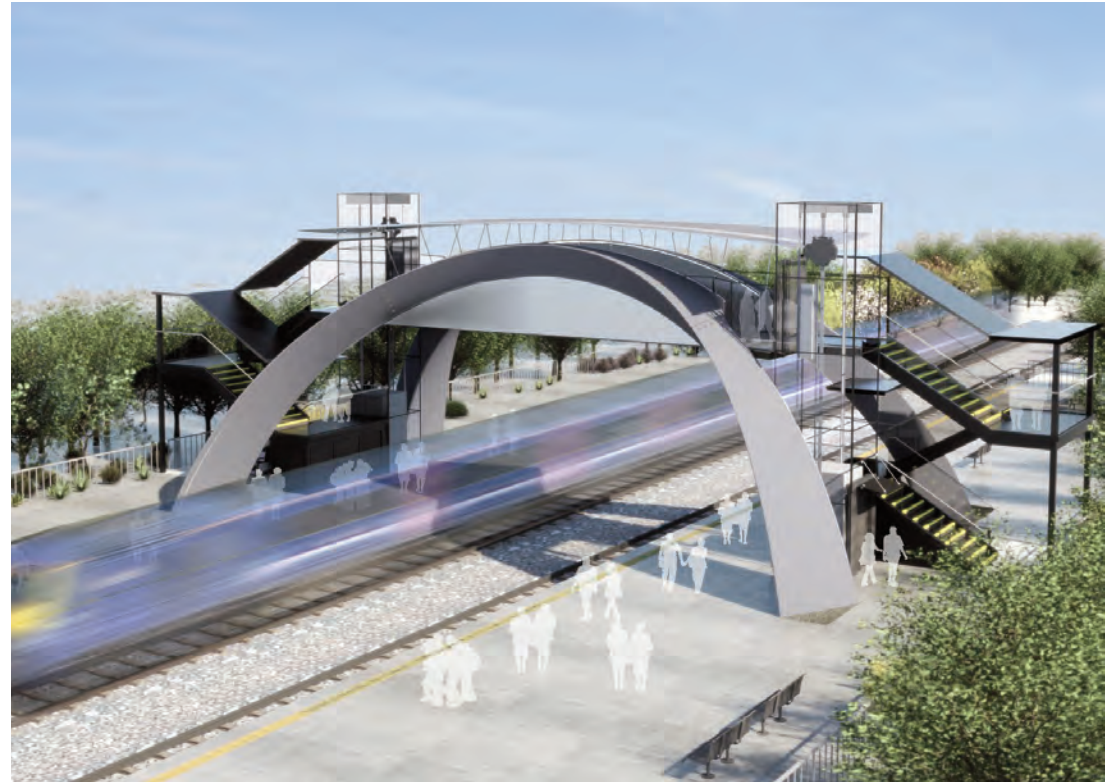


the lattice form particularly associated with traditional footbridge designs, to provide daylight and a view for passengers. Here the lattice form is reinterpreted as a carbon fibre truss in the spirit of an FRP solution but with a much higher quality of finish. Overall, this design exploits the advantages of FRP as a material while remaining within the tradition of railway architecture and engineering. ■



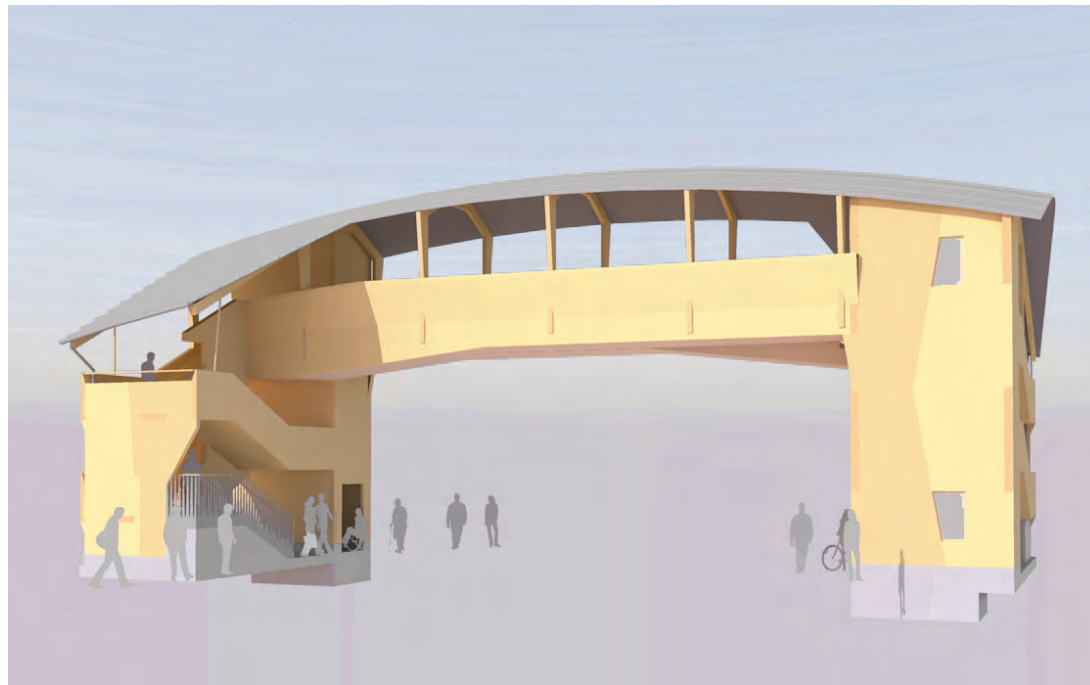
## JAIA Architects, UK

Glass reinforced polymer (GRP) is a major construction material of this lightweight and cost-effective footbridge. It is used boldly in the design, which is dominated by the two sweeping arches that span the railway lines and act as the main structural elements. Each arch is made up of three sections, assembled to form a single sweep. The springing points of the arches are anchored to the ground and are GRP, clad around structural steel tube sections; the centre sections are entirely GRP. The main bridge deck is also constructed entirely of GRP, making for a lightweight structure that can be crane-lifted and connected quickly to the arches. GRP's resistance to corrosion, lower cost compared with more traditional structure materials, combined with a high strength relative to its weight, makes it attractive for footbridge usage. Because it is lighter the bridge deck can be made thinner, so fewer steps are required to reach bridge level. ■



## McGarry Ní Éanaigh Architects, Republic of Ireland

The ultimate aim of this bridge is for travellers to be happy and calm because of this easy to use, visually engaging and reassuring design. The architects suggest that much as a railway footbridge provides safe access over railway tracks, a tree, felled by wind, can span a river, ravine or gap and provide safe passage. The theme of moving the 'everyday ordinary' passenger experience towards 'excellent ordinary' feeds into the choice of a natural raw material - timber, or more specifically acetylated radiata pine timber. Acetylated radiata pine comes from fast-growing sustainably managed forests. The timber structure creates a reassuring atmosphere reminiscent of a calm sturdy cradle. Additional visible materials are mainly metals; zinc is used for the footbridge's sweeping roof, which completes the bold physical presence of this structure. ■



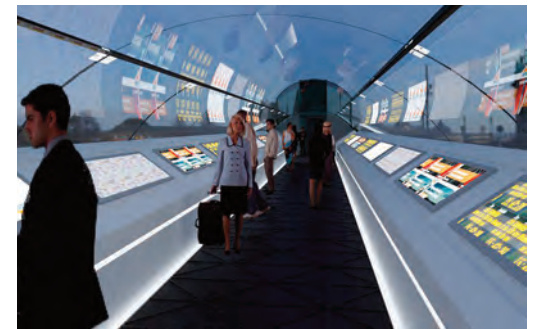




## Stanley Bragg Architects, UK with MLM Group

Kinetic energy recovered from pedestrian footfall and solar power help provide energy for the lifts and lights in this white glass reinforced polymer (GRP) bridge. Pavegen kinetic energy recovery system floor tiles harvest energy from foot traffic across the footbridge. The curve-sided main span's individual modules can be bolted together and post-tensioned on site or manufactured as half sections and craned into place. The bridge section is supported off the

lift/stair core structural columns on cantilever plates hidden within the base of the side modules. The stairs incorporate automated cycle wheel ramps. The shape of the modules provides display space for station information and advertising as the passengers cross the bridge. Photovoltaic cells are incorporated into the low maintenance multi-layered curved glass screens that form the bridge roof. This is finished with a track that can incorporate top lighting. ■



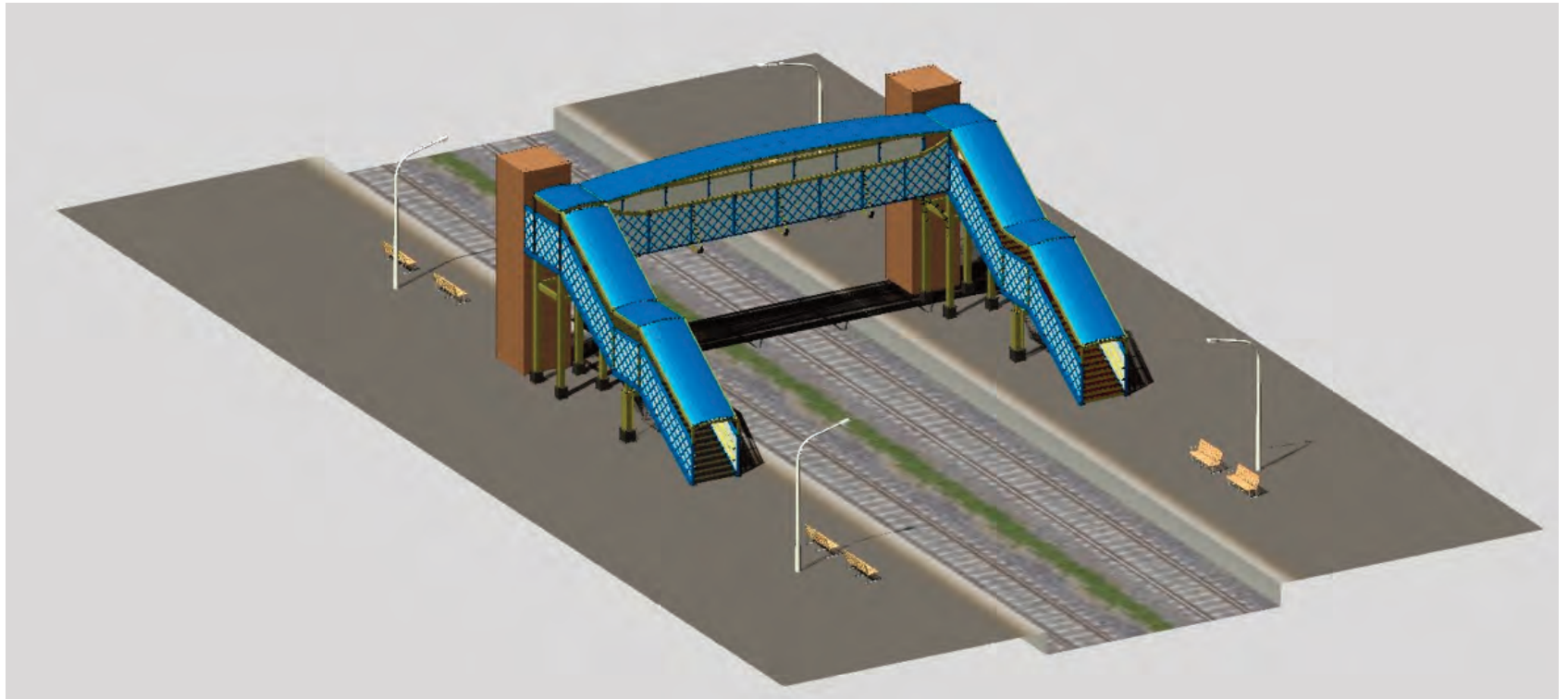


**del Renzio & del Renzio, UK with Considine**

Fibre reinforced polymer (FRP) construction technology is used in this footbridge, enabling a lightweight modular low maintenance accessible footbridge structure. The construction features a translucent inner FRP layer and an FRP exoskeleton allowing large

free spans. The diagrid structure references the Victorian cast iron lattice footbridges found at many smaller rural stations and is envisaged to be a sympathetic modern interpretation to complement old and new stations. An optional roof structure could be

installed in the form of an arched diagrid structure stretched over the bridge span and the stairway. Lighting is provided by uplighting to the side of stairs, creating visual interest with the shadows cast by both the grid and the pedestrians crossing. ■

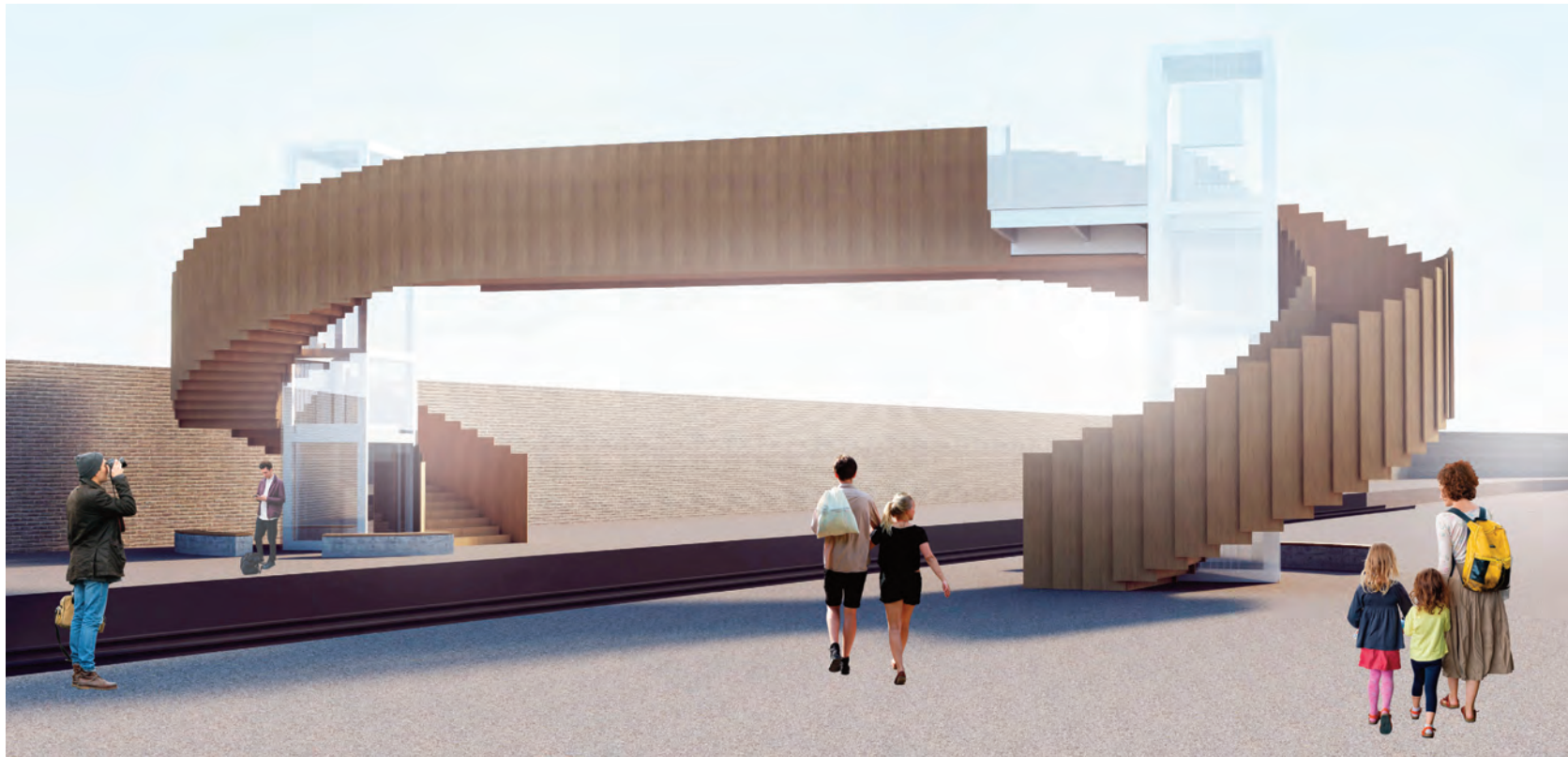


## Mott MacDonald, UK

Lattice-style railway footbridges provided the inspiration for this design and are recreated in glass reinforced polymer (GRP), providing a succinct mixture of old and new. The lattice truss form is intended to invoke the UK's industrial heritage within the rail network while the use of GRP allows for efficiencies to be found in construction, maintenance and the structure aesthetic. The GRP also makes significant weight savings, reducing material

transportation costs and allowing the use of smaller plant equipment for construction. As a result, the footbridge can be installed with reduced track possession time. This footbridge seeks to build upon the already established standard footbridge design by utilising many of the features seen in existing footbridges. In this way it achieves a new standard design without the need for significant adaptation. ■





## Philip Turner, UK

### The Winding Footbridge

A serpentine timber-clad deck winds around two lift structures in one continuous rotationally symmetric gesture in this design. The lifts are housed in steel towers which act as giant columns to support the bridge and stairs. This avoids the need for additional columns, and the underside provides a sheltered area where passengers can wait for their next train.



The tectonic pattern of the lightweight composite timber panels cladding the deck and balustrades references the timber station roofs that were common in the 19th Century. A translucent acrylic and steel roof can be added. The bridge aims to celebrate the movement of people and make the experience of crossing the tracks a joyful one. ■

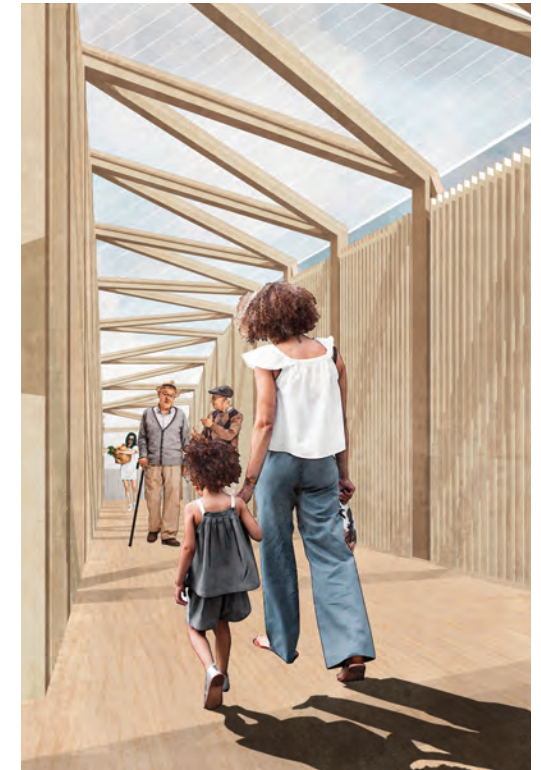


**Arthur Harmsworth and Isaac Cherian,  
University College London, UK**



The ethos of this design derives from five considerations: ease of production, reduction of cost, sustainability, human-centric design, and building a new icon for the British railway. A series of cross laminated silver fir asymmetric box frames make up the structure of the span, the lift towers and the stairs, with pine fins used

for balustrades and cladding. Both of these timber materials are relatively lightweight and easy to work with, and obtainable from sustainably grown forests, meaning that both construction and environmental costs are kept to a minimum. Recycled polycarbonate sheets are an inexpensive material used in the roof to



produce a comforting quality of light due to its semi-transparency. The roof of the span takes the form of an asymmetrical arc resulting in a twisting plane that is easily recognisable from outside the station and which produces a dynamic interior space that changes along the length of the bridge. ■

## Afterexit Workshop, UK & Italy

This footbridge does away with conventional flat walls and floor in favour of a curved internal surface. Instead of purely facilitating passenger movement, its unconventional shape and surface provides a versatile and enjoyable space for people of all ages to enjoy. Within the curved design there is still a flat path for pedestrians to follow which generates energy from their movement. On either side of the path, relaxation areas that slope up to 40 degrees allow people to sit down, work, charge their phone, look at interactive screens or connect to the Wi-Fi, while waiting for a train. An anodised aluminium roof can be added to this stainless steel and glass footbridge to provide what the designers describe as a “playful landmark”. ■



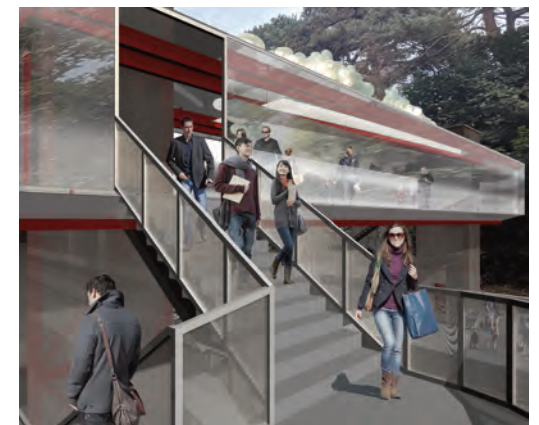




## Vita Architecture, UK with ECHRO Project

Utilising a modular construction for the main elements, this wider than usual footbridge has semi-circular glazed ends as well as glazed sides. The semi-circular elements improve circulation by facilitating a one-way system across the bridge at rush hour, with the curved glass ends feeding passengers onto the correct side of the bridge. The lift towers are also clad in glass. The design is intended to represent the

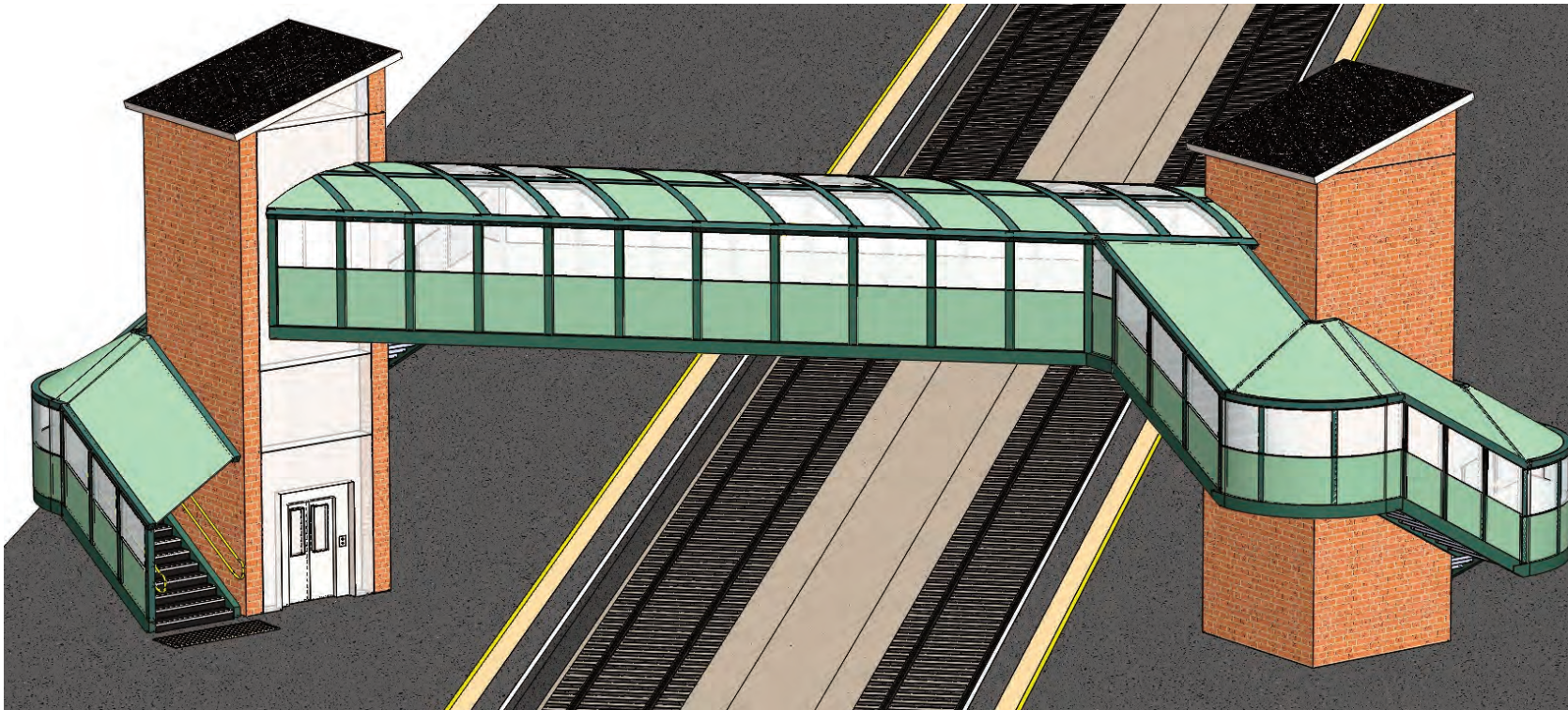
identity of individual stations through customisable elements which could change and develop over time, allowing the aesthetics of the bridge to adapt to suit the changing context. Communities and residents would be encouraged to select via mobile voting the graphics to be used on the footbridge. The space available within this footbridge would enable it to accommodate additional artworks. ■





## Nicholas Humphries, UK

### Mental Health Footbridge



The Mental Health Footbridge creates a positive, safe, and accessible space, benefiting the well-being of people using it. One contributing element is the use of calming blue lighting installed in the handrails - use of blue lighting at stations in Japan is reported to have reduced suicides by 80%. A seating area on the bridge promotes social interaction and offers a quieter, less stressful place to wait than the platform. Improved access to green



spaces is linked to good mental health so the seating area includes small indoor trees or shrubs, while the main span also features artworks and inspirational quotes. Further greenery is found in the form of a green wall beneath the stairs. The footbridge is wider than it is tall, creating a free and open space, and each lift tower has one elevation of glass, to help reduce feelings of anxiety or claustrophobia. ■



## Takahiro Watanabe, Japan

### Link footBridge

This design does away with the traditional linear bridge span - replacing it with a circular "sky garden". The footbridge would be located in positions where people using the footbridge can see the town that might be divided by the railway lines. The wood decked sky garden itself is a place that provides rest for residents

and visiting travellers as well as enabling them to cross the railway lines. The side facade of the sky garden and the sides of the stairs are made up of wires stretched vertically from the floor to the roof. Using vertically tensioned wires in this way enhances the visibility of the inside and the outside of this footbridge. ■





**Dan Bergsagel, Liam  
Ashmore, Philip Isaac and  
Jonathan Hawkshaw, UK**  
**Timber Framework Footbridge**

Inspired by the railway signal box as a house above the tracks, this footbridge is conceived more as a settlement than a bridge. Its conception embodies the idea of the crossing as a place to be or a place to view; the footbridge could be a simple covered walkway, a gallery for countryside ramblers, a waiting room at a hectic station or a food market at a city centre crossing. The footbridge brings together different historical forms and constructions. Masonry-clad piers, each with an arch, support the deep engineered timber trusses of the main span, the stairs and the lifts. They generate the appearance of the footbridge as a construction site, full of potential and change, as each one is inhabited to suit its own particular setting. The use of a timber through-truss for the primary bridge span is born from the bridge-building traditions that started in Europe in the 18th Century and flourished across North America in the 19th. ■





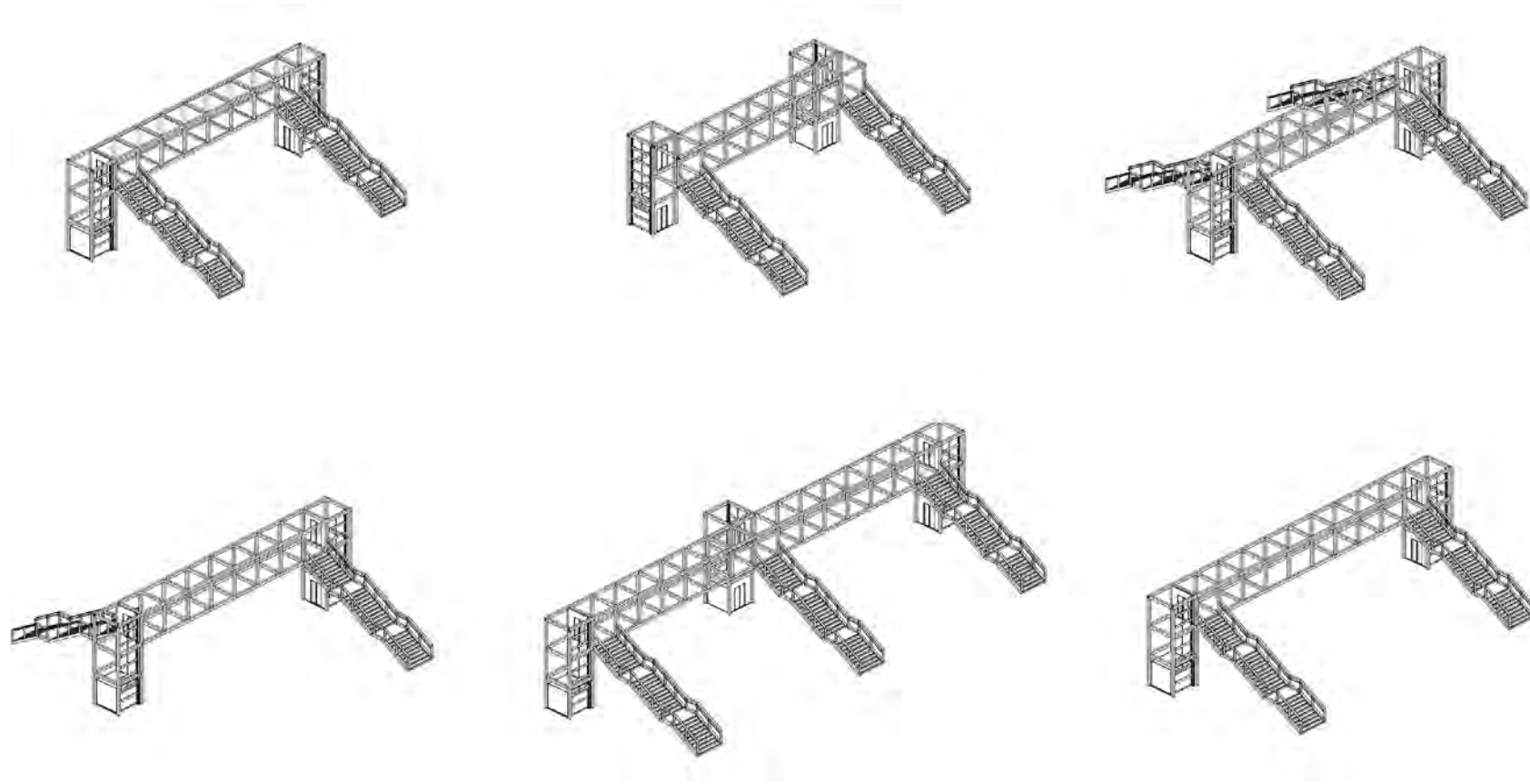
## Corstorphine + Wright, UK

A limited and consistent palette of components is proposed for all of the potential enclosures in this footbridge design, making the system adaptable, reusable and cost effective. The main span, lift and stair enclosures are essentially constructed with minimal modification from the same kit-of-parts rendered in cobalt blue. Two large steel 'H' frames (one for each platform) act

as the structural connecting element for all three, while also serving as the footbridge's recognisable architectural icon. The component 'order book' methodology uses the minimum number of required components, reducing wastage and potentially allowing the bridge, lift and stair structures to be dismantled and reused in other locations, if required. ■

## Ian Ritchie Architects, UK with Atelier One

### Modular Railway Bridge System

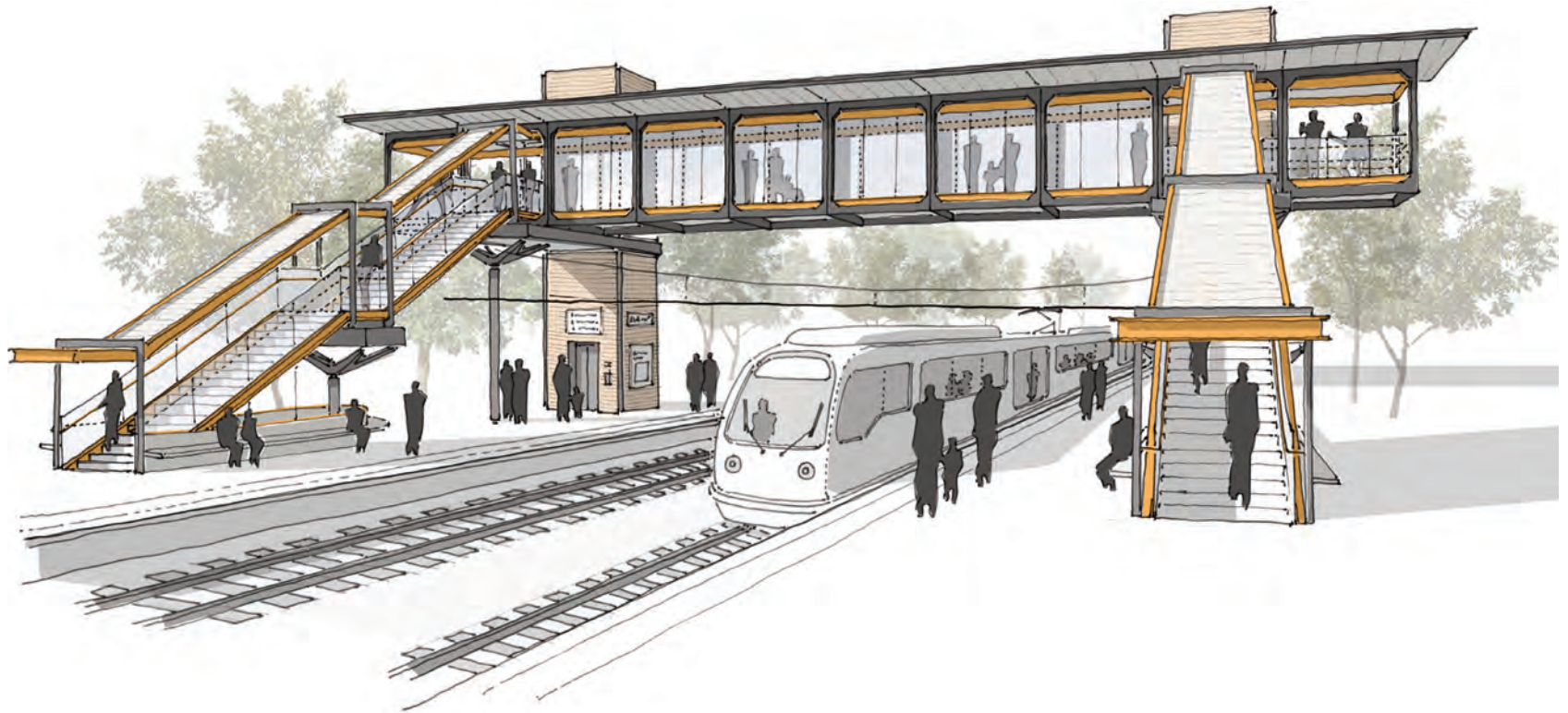


Using a single steel square hollow section size for all the primary structural elements in this bridge provides simplicity and efficiency, as well as elegance of design. This footbridge consists of a kit of three parts: a structural lift core, an enclosed walkway, and a staircase,

each one based on a standard module size to allow for variations in height and length. Corten steel grillage on the exterior of the modules acts as additional bracing as well as providing an enclosure. Each element is sized for easy transport by rail or road and arrives on site with

all fixtures and fittings pre-installed. Work on site is a matter of assembly, rather than construction. The straightforward structure, formed from industrial metal materials reduces maintenance while also building on the existing vernacular of railway infrastructure. ■

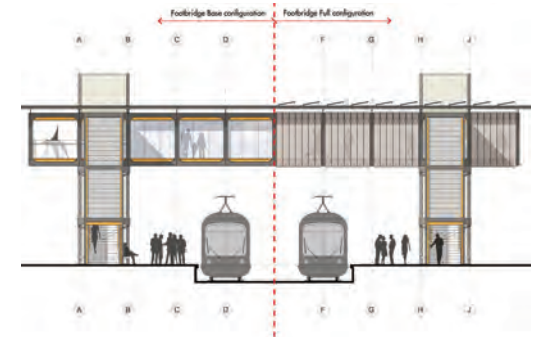




## Fabrizio Primavera, UK

The design uses a 2.7m tall x 2.7m deep modular unit with the width left flexible to create a footbridge that meets local requirements. When combined, the modular frames act as a Vierendeel truss spanning the railway tracks below. The lift towers provide the main vertical supports while the footbridge roof is directly supported off the primary steel framing. The walkway is contained and supported off the main frame. Each 2.7m side

section has glass walls, in front of which art panels or information displays can be installed. Perforated anodised aluminium panels can be added to the exterior of the main frame. The floor sections comprise solid timber while the roof elements can be fitted with solar photovoltaic panels to provide sustainable energy. Optional modules at the ends of the bridge span allow space for sculptures, installations or performers. ■





## Nicolau Faria, Germany with Azhar Architecture



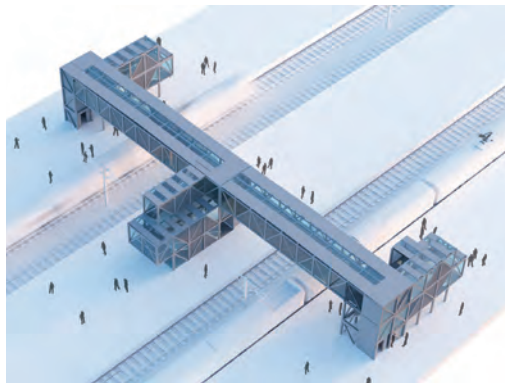
This modular footbridge uses a 900mm grid in all three axes that allows the overall dimensions to be adjusted in small increments, making it adaptable to any number of platforms, lifts and stairs, and also usable for other means of access such as ramps. The design breaks down the brief into the three basic bridge elements of

lifts, stairs and main span, all of which are treated with a similar material approach. Each has solid lateral planes, a translucent or transparent enclosure and metal connections that fix each element to the next. In turn, these three components correspond to the three material families of the palette: stone, glass and

metal. The truss is made of steel, prefabricated in large sections to which folded metal stairs are fixed. A low maintenance approach includes being able to clean the roof by accessing it from within the footbridge, using an angled pole directed through an opening above the vertical glass screens. ■



## Purcell, UK with Conisbee Bridge Building



The module for this design is an ISO 668 standard intermodal freight container of various lengths, in a Pratt or Howe trussed structure. As such, the modules can be constructed off site and then transported by rail to the site. Modules are fitted together with bespoke structural fixings. Cladding options range from plexi-glass to metal mesh, to cross-laminated timber verticals replicating the patterns of the shipping container. Hydraulic or traction lifts can easily be

accommodated, with the lift tower constructed off site as part of the module design. Making each lift tower and car transparent provides users with visibility to aid security. Flanking staircases are also constructed off site within each bespoke module and share the same transparent design as the lift tower and car. Each module is fully serviced with inbuilt trunking and light fittings and can be “plugged” into the adjacent module. ■





## Aidan Hermans and Helen Siu, University of Bath, UK

### Adapt-a-Bridge

The patterns and colours of the railway footbridge at Settle station provide one inspiration for this playful and colourful design. Adapt-a-Bridge uses a triangulated pattern to articulate the glass balustrade and the ETFE (ethylene tetrafluoroethylene) canopy and it is this triangulated geometry that allows the proposal to be divided into modules. Each bridge module is mirrored on two planes with the intention of minimising the number of panel types. This means greater flexibility, ease of fabrication and delivery, reduction in on-site construction time, adaptability for use in different sites and the potential for multiple configurations. The use of colour in the proposal is an important and sympathetic nod to the historic 19th Century railway bridges. The coloured glass balustrades catch the attention of passengers on the platform, while those crossing the bridge experience the reflection of these colours on the surfaces of the bridge. ■



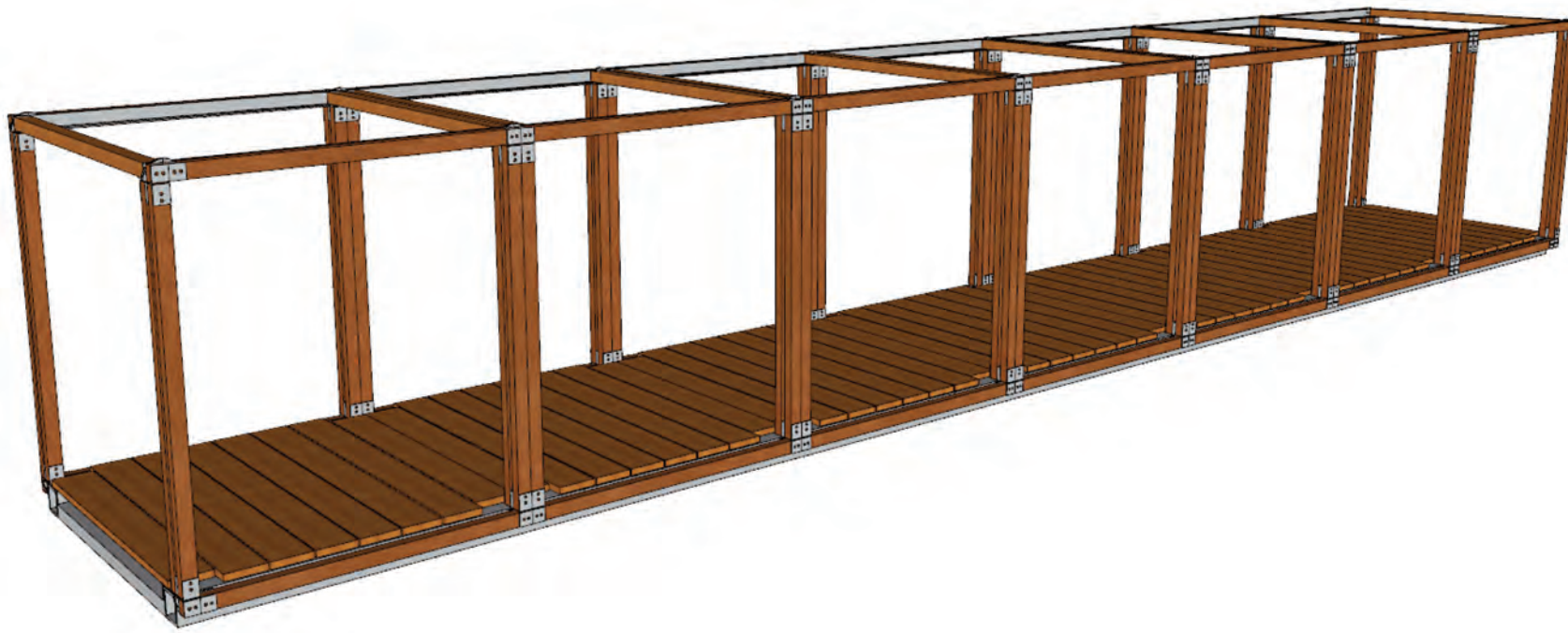


## Craig More Architect, UK

### Folded Bridge

Folded Bridge is a straightforward minimal structure which seeks to avoid detracting from historical surroundings. Each modular component comes complete with its own handrail sections, resin flooring, LED strip lighting, glazing and powdered aluminium cladding. As such, these lightweight, insulated, waterproof modular components can be quickly attached to a steel box frame on site. Folded Bridge's design ensures easy adaptation to both covered and uncovered options, as well as different numbers and configurations of staircases. With large glazed panels on the modules, the interior of the covered version of the bridge is light-filled, robust and low maintenance. Tinted or acid etched lower glazed panels minimise vertigo and can be used to showcase artworks. The stairs are supported by precast base modules craned onto pre-prepared foundations. ■

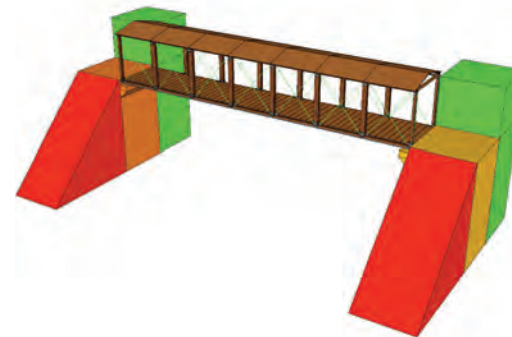




## Robert Bird Group, UK

Prefabricated composite timber and steel modules with parallel steel channels on their base sit on a steel track. This makes up the bridge span. The lightweight nature of the track and modules means that the main span can be constructed on a station platform and then craned into position. Where crane options are limited the steel track can be installed first with the modules then slid into position along the

track. Once all modules are in position, they are connected by post-tensioned stressing cables acting as both tension bracing members in the structure and also giving the structure strength by providing longitudinal pre-stress. Member redundancy in the modules means that each module can be replaced one at a time as necessary, making maintenance of the structure easy over its design life. ■







## Y design workshop, Republic of Ireland

### The 50/50

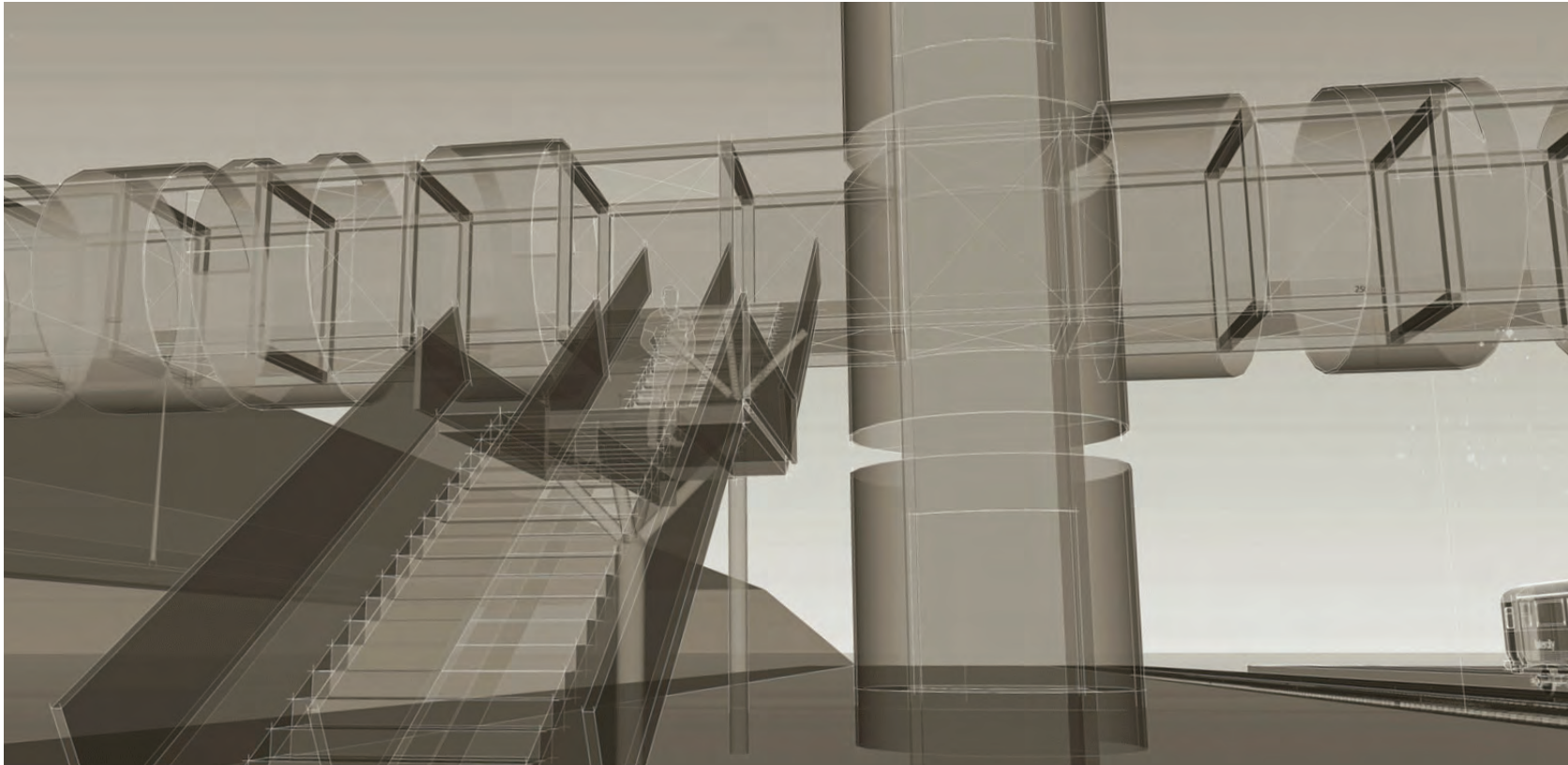
The 50/50 addresses the dilemma of whether a structure's envelope should be solid with only necessary glazing, or fully glazed with only necessary solids, by proposing a 50/50 solution of alternating solid and glazed panels, extending even into the roof section. Based on a flexible and fully buildable modular system, the configuration of elements can be adapted for various locations and upgraded to larger spans and various lift/stair configurations.

Structurally, the footbridge uses a 250mmx250mm square hollow steel section, but rotated through 45 degrees, with 10mm vertical plate steel panels / stiffeners welded onto it, also at an angle. This twist gives better light penetration across the angled interior edges of the footbridge and easier viewing through glazing. These structural elements also form the external skin of the footbridge giving it a clean and sleek appearance. ■

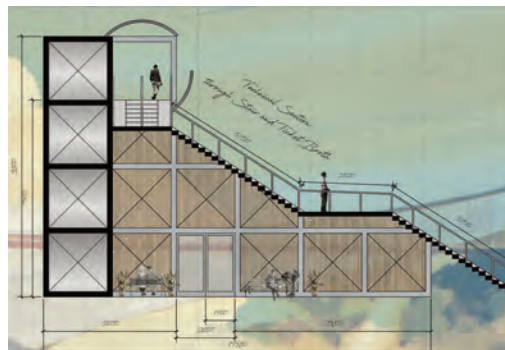




## David Brain Partnership, UK



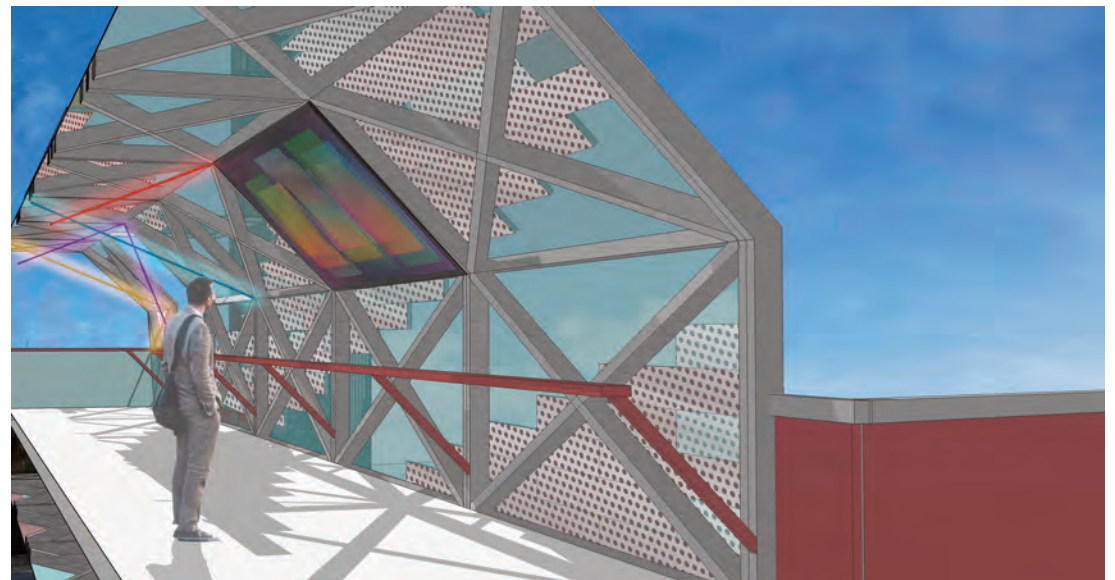
David Brain Partnership was inspired by Isambard Kingdom Brunel's work on the railway network when designing this bridge, the modular construction of which makes it adaptable for use at any station. Meanwhile, the circular tube-like elements along the bridge, referencing la Passerelle Arganzuela in Madrid and the pedestrian bridge at La Roche-sur-Yon, provide for a striking appearance. They are designed to appear as though they



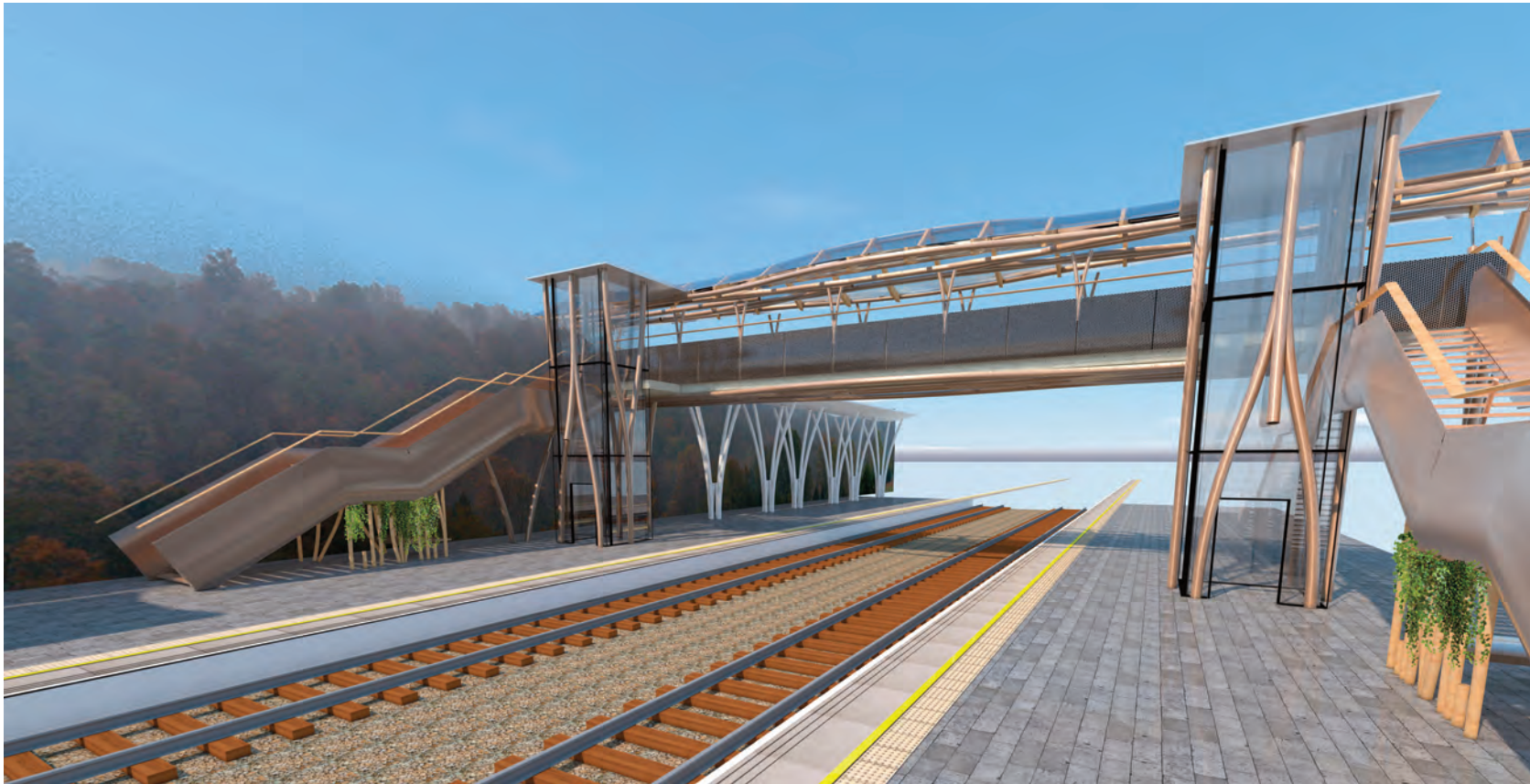
are rotating - creating interesting visual corridors and vistas from within. This is further enhanced by the way natural light interacts with the space at different times of day. Externally, they offer a stimulating visual impact despite the use of simple geometric forms. The circular modules are interspersed with repeating cuboid elements to build up the bridge. Different materials can be used to suit the local context. ■

## Mackay & Partners, UK with Design 4 Structures

With an unusual octagonal form, this footbridge is designed to have a complex interior to provide an interesting experience for the user. The tubular structure allows for open-end windows, enhancing views to the surroundings. The structural exoskeleton, made of steel, can be clad in different materials to respond to different contexts, for instance wood at rural stations or metal at urban locations, with a contrasting interior colour palette. Despite the apparent complexity of the structure, a modular approach to its components facilitates easy transport and construction on site. ■







## BPR Architects, UK

### 2Trees

Inspired by the idea of the branches of two trees connecting with each other to form a bridge, and proposed as a way of bridging the division between communities which railways can create, the 2Trees footbridge is an adaptable, organic design. Composed of modular elements which recall the trunks and branches of trees, the system is intended to

adapt to local constraints and local contexts. Standard cladding panels can be made of glass fibre reinforced concrete, or ornamental cast iron - perhaps cast from scrap iron recycled from elsewhere on the railway - when installed near heritage assets. A decorative version of the cladding panel could be selected and designed by the local community. ■





## Vine Architecture Studio, UK with Arup (London)

The curved shape of this footbridge's main span is created through the use of diagonal elements which are all the same length, but whose vertical angles vary towards each end to follow the bridge's shear force diagram. The struts are much more evenly loaded along the length of the bridge so can be made using the same sized section with less wastage of material at the midspan. Minimising the number of different lengths of steel elements and using the same section

for all of them will lead to a fast and economical manufacturing process, while a simple construction method using pin joints will minimise assembly time. The bridge element spans between the two lift towers as a single deep steel truss. Local lateral stability comes from the concrete deck working as a diaphragm coupled with cables that form a lightweight bracing at roof level. The stairs use full height trusses to match the bridge and provide additional lateral stiffness. ■





## Salvador Rivas Architects, Mexico

### Net-Walk-Rail

Net-Walk-Rail is a flexible kit-of-parts system, which can be adapted to different settings across the network. Structure, circulation and services are brought together in a single, integrated 'tube' designed to be easy to maintain and reconfigure. The exterior of the tube has a net-like frame, into which can

be inserted prefabricated panels made of recycled plastic. Its curved walls provide a safe, sheltered passageway with a high degree of visibility, and can be easily scaled according to the needs of each location: the minimum diameter of the vertical pillars is dictated by the width of the lift, while the 'tubes' can be

stretched horizontally to create more space for passengers. The round pillars are based on a rotating structure, so that the N-form plan can be adjusted to shorten the walking route or to connect to secondary bridges from above, while the N itself has the potential to become a new 'Network' symbol. ■

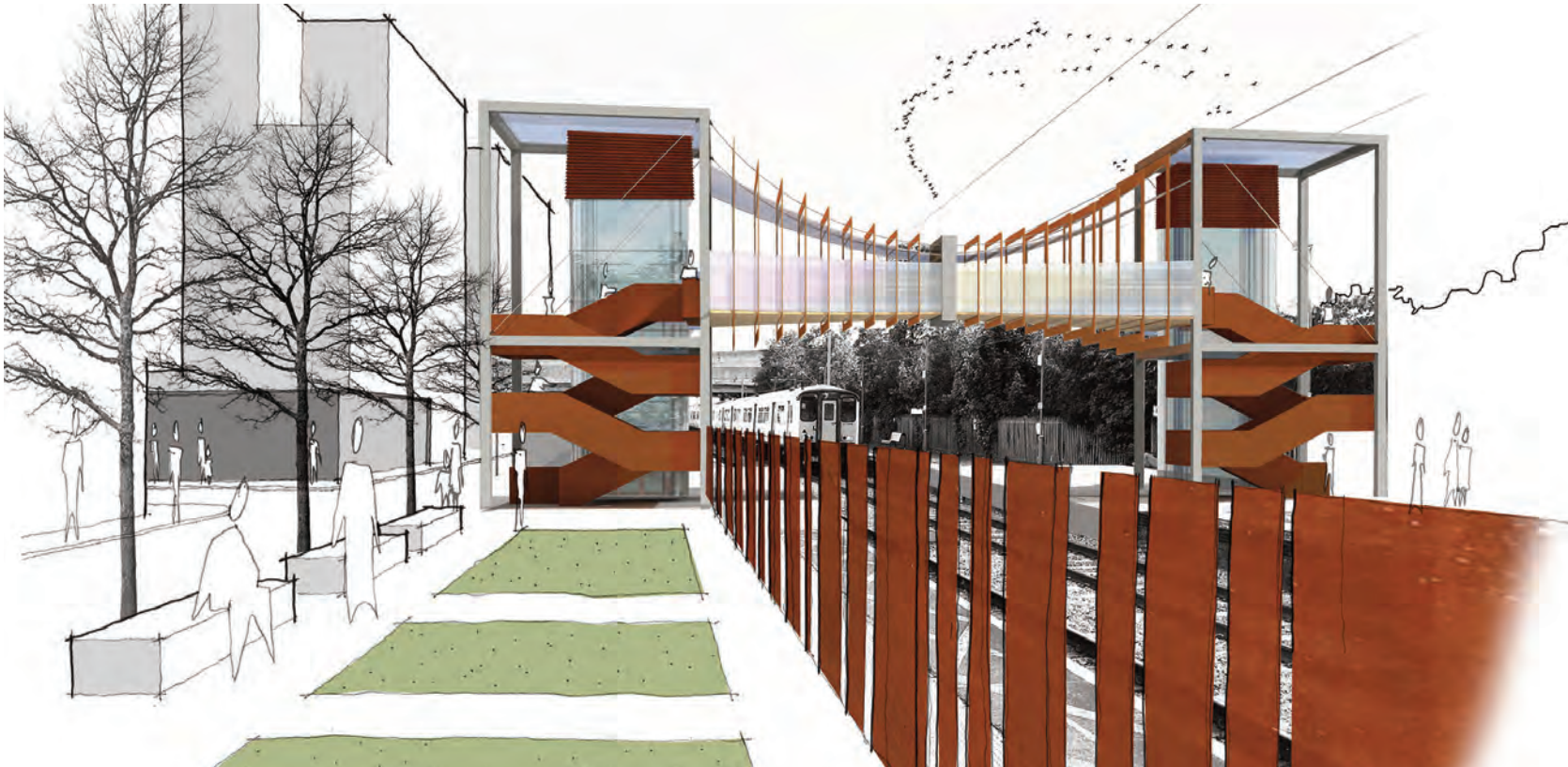




**Goodrich Cutler Associates,  
UK with Arup  
BroSektioner**

This footbridge has a modular approach; structural 'pods' with circular or oval cross-sections, available in three different sizes, are combined and assembled to form a continuous span to achieve the width and layout required. The modular nature of the structural components allows adaptation, for instance the incorporation of a mid-span access point. The

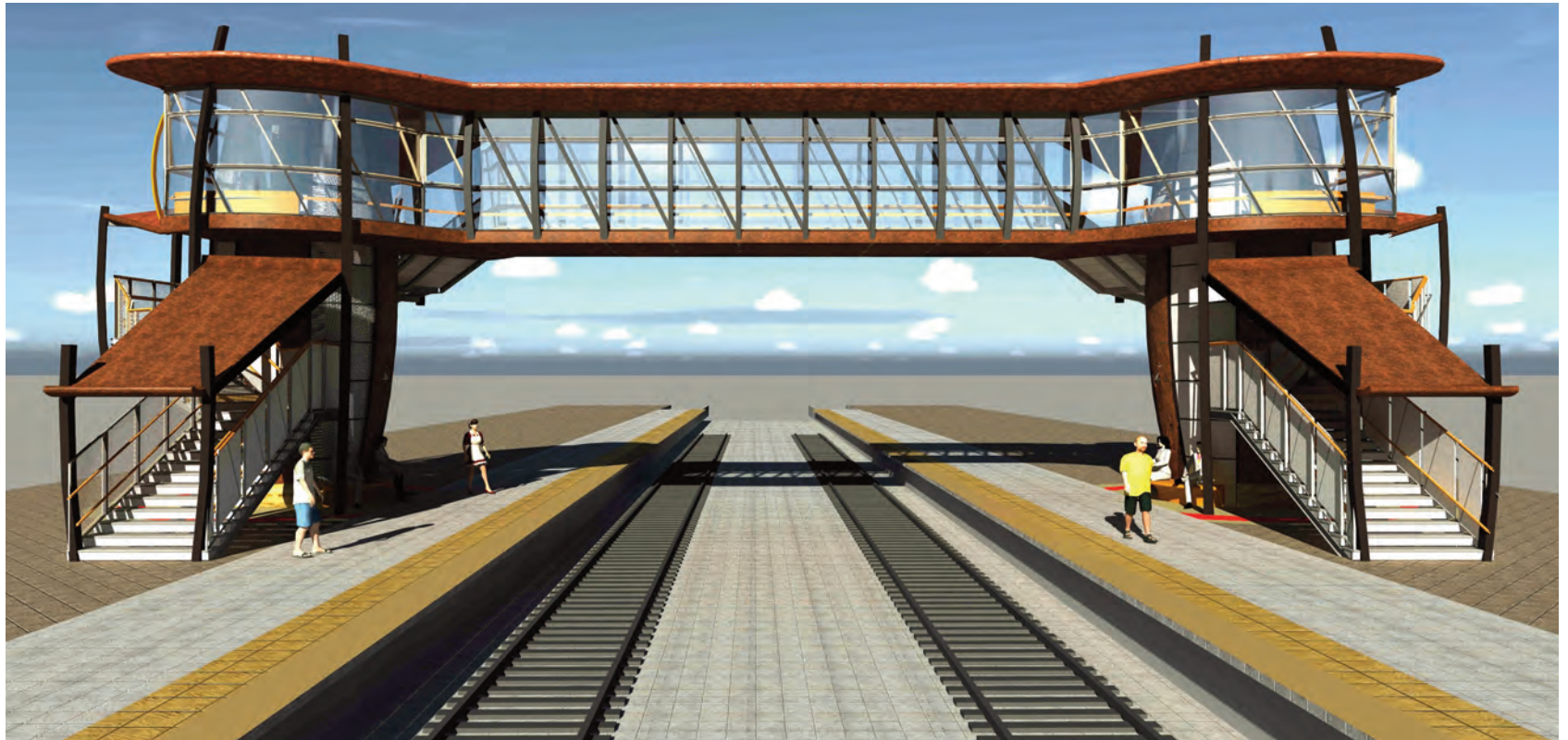
larger pods accommodate dwell and seating space for passengers. Stair access routes repeat the same structural language, while the stairs themselves feature cycle channels. The adaptive modules of the main bridge have the potential to offer secure cycle parking. External cladding can be varied depending on location, weather protection and purpose. ■

**Owen Architects, UK with Rodrigues Associates****Concertina Crossing**

Imagined initially as a new footbridge for the site of the recently closed Angel Road station in north-east London, Concertina Crossing is a suspension bridge designed for harmonious integration into urban or rural settings. Repeating structural elements can easily be reduced or increased, accommodating varying spans. The footbridge has a minimal profile at its midpoint, shaped to reduce visual impact. Corten / weathering steel plate frames support

the deck, balustrade and roof panels. The steel lift towers symbolise the firm anchoring of the suspended crossing and provide a sympathetic contrast to the weathering steel stair balustrade. Translucent, pigmented polycarbonate panels form the balustrades and optional roof panels, providing shelter but allowing passengers a blurred visual connection to their surroundings while preventing undesirable glare. ■

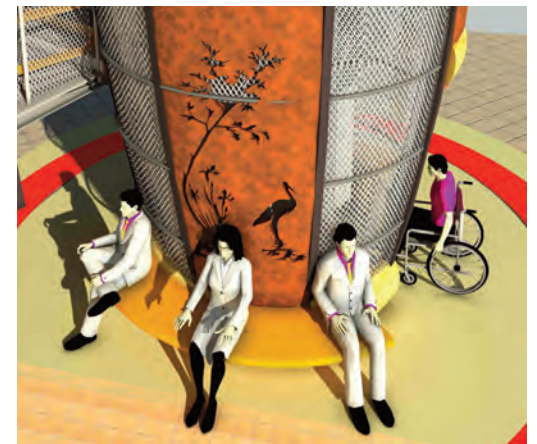




### Pádraig McCarron and Henok Belachew, Ethiopia

A key feature of this design is the reimagining of traditional lift towers as 'barrels' at either end of the footbridge, drawing inspiration from the form of steam engines. They provide a focal point for passengers with the incorporation of seating around their bases. The barrels are clad with alternating vertical runs of stainless steel mesh and interchangeable artworks on Corten steel panels. Around the base of the barrels engraved stone features quotes from famous

Victorian railway engineers such as Brunel or Stephenson. Depending on available space, the staircases can spiral around the barrel lift towers, or run parallel to the platforms. The hydraulic lift cars will be partially glazed and in remote locations they will be powered by solar panels and batteries. The bridge framework has curved vertical members which complement the shape of the barrels, and features full height glazing within. ■

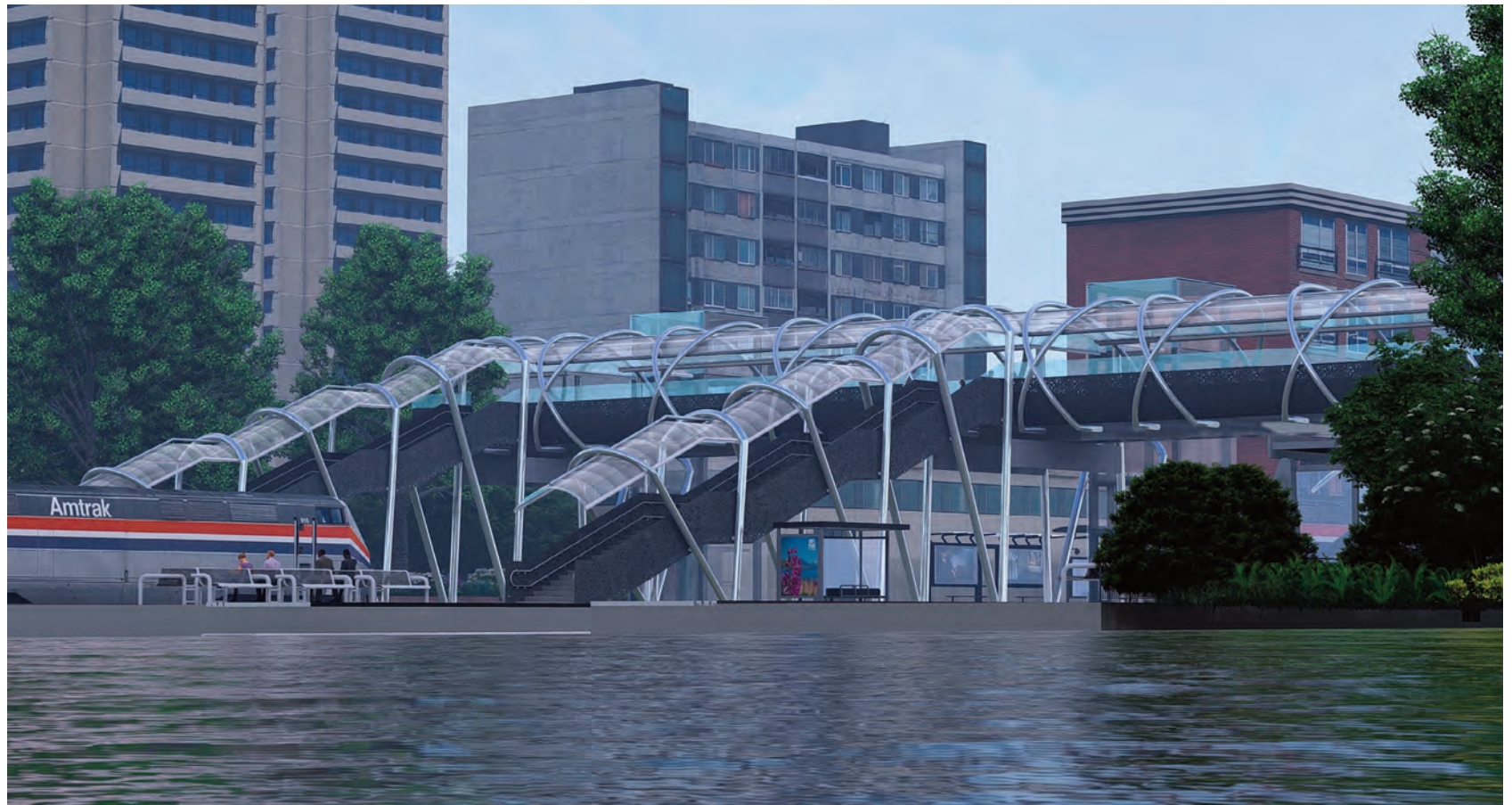


## MDG Architects, UK

Paying homage to expressive railway structures such as the Forth Bridge is a key driver in this design. The organic, skeletal hoops not only make the form distinctive but create a dynamic language that flows over the track and between the lift cores at each end. The structure can easily be erected off the pedestrian walkway from which they take support. The hoops can also carry services and lighting between platforms, but their primary function is to support a roof covering both walkway and stairs. If erected without the roof, the architectural language provided by the hoops remains. The lift cores are clad with open mesh, lit from within, illuminating the open staircases and adding to the artistic expression of the bridge. Additional artworks can be applied to the walkway glazing in the form of etchings drawing inspiration from the local area, landmarks or history. ■





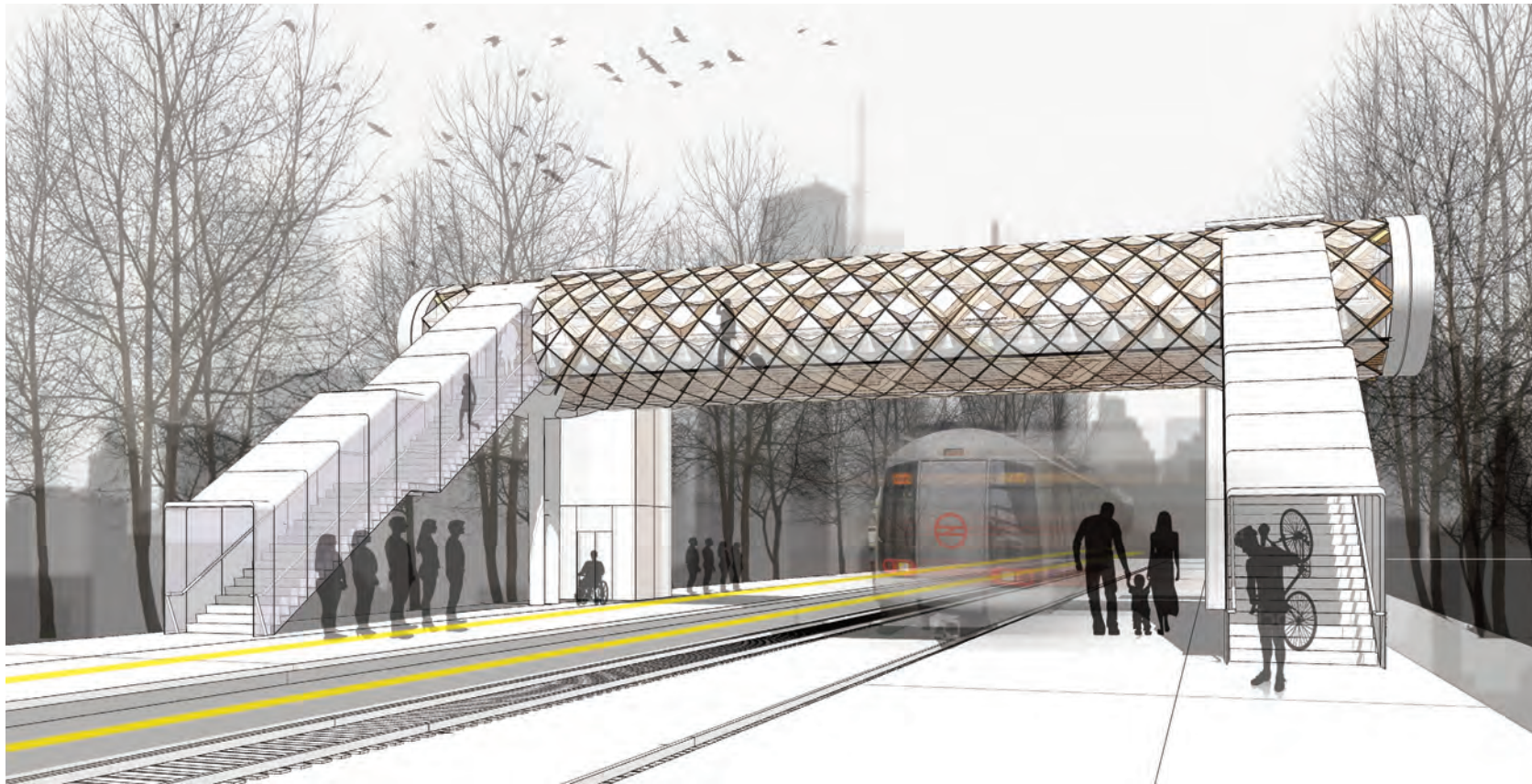


**Nabil Zohdy, Romita  
Shrestha and Romit  
Shrestha, Australia**

This design aims to be flexible, easily installed and attractive for busy environments. Taking

into account the needs of passengers catching trains, often with little time to spare, it adopts a traditional layout with straight movement flows and aims to minimise distractions by avoiding unnecessary pillars or supports. It balances this passenger need with inspiration from bridges used in more relaxing settings such as over rivers with a curved form which decreases wind resistance and offers an attractive

appearance. Recent improvements in laser cutting allow for a customisable perforated finish to the balustrade panels, to provide a distinctive but cost-effective identity at each location where the footbridge is installed. Natural lighting is optimised with the top half of the footbridge made of transparent materials, while the ends of the main span provide locations for art, advertising, or digital signs. ■



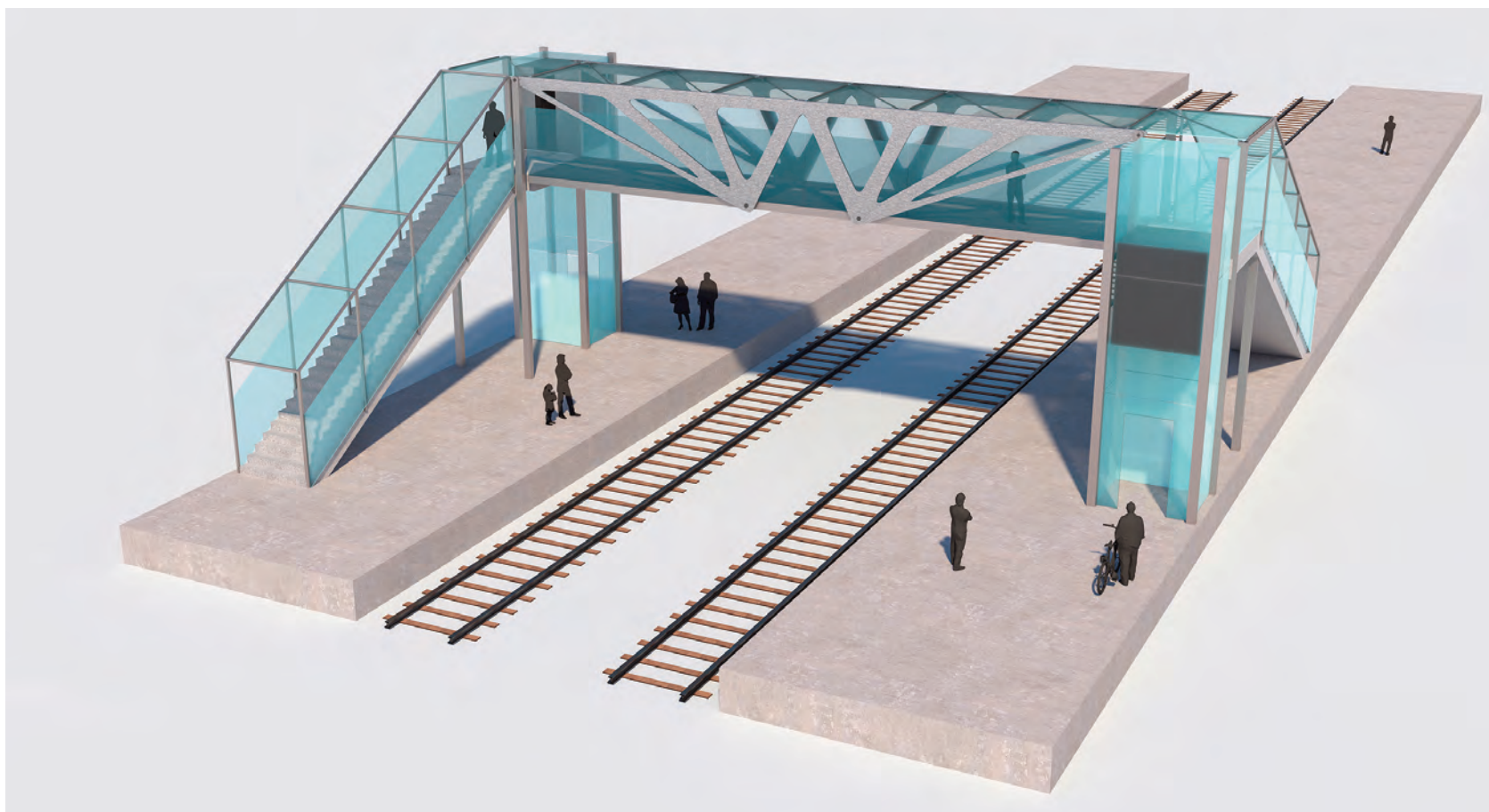
## Brian Gasmena and Mihail Vulov, UK

### Chameleon

The tubular bridge span in this design is based around a glulam (glued laminated timber) gridshell structure. Glass panel elements on the bridge are shielded by aluminium visors, shaped to allow air to flow into the bridge. The bridge span element is built out of modular sections four metres long, making for a design that is flexible in length and which can be assembled

on site. The staircases are formed from folded steel plates and have glass enclosures. This design aims to balance elegance with simplicity of form and structure. The footbridge's exterior is described as a neutral skin which would blend into its surroundings by changing the materials on its outer surfaces in response to different local contexts. ■





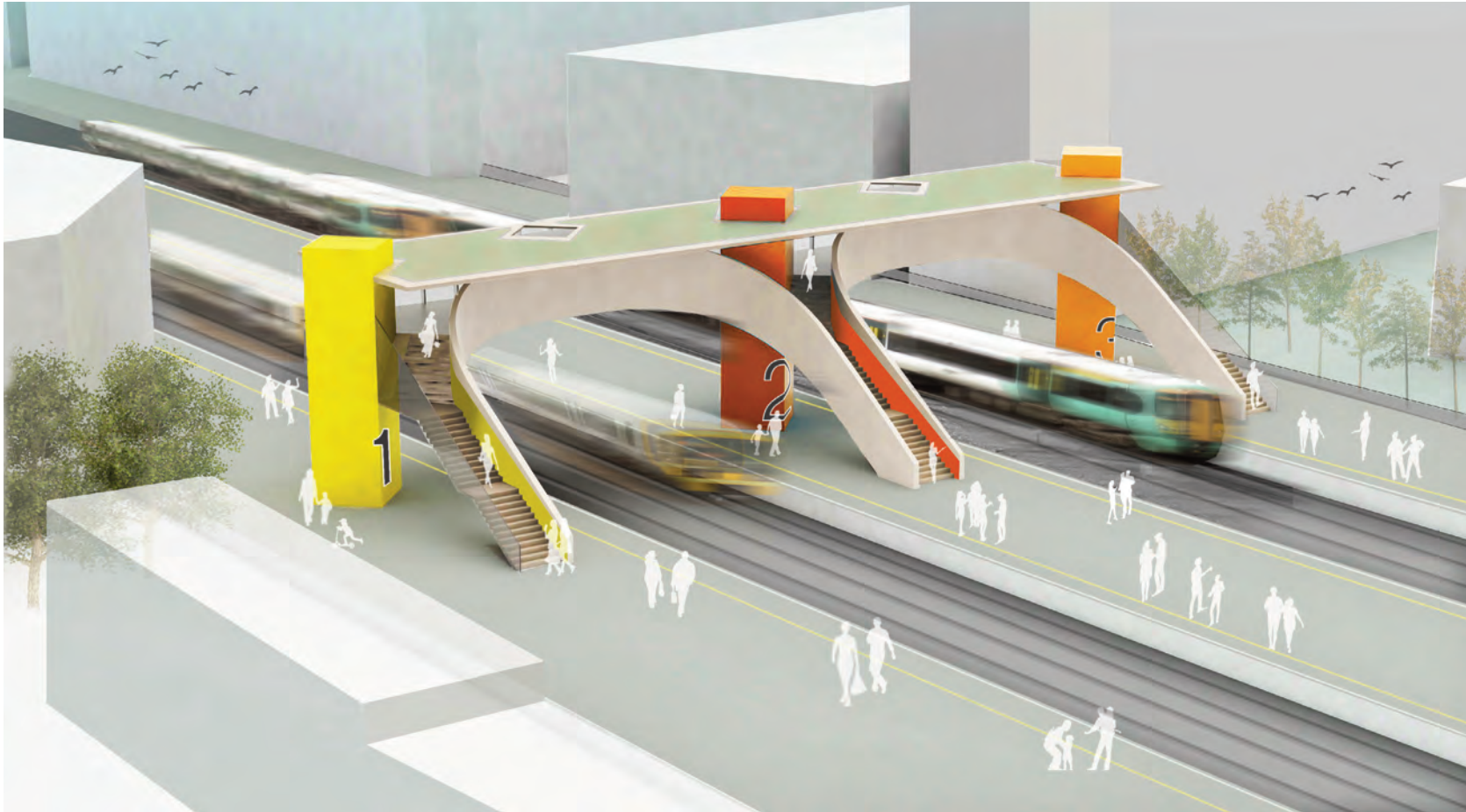
## Sophia Williams, Michael Herrick and Lisa Ramburg, Germany

### Slice, Skew & Ship

This footbridge reinterprets the truss system prevalent in railway design. Here, the steel plates that form the truss are fabricated with 21st century water jet cutting technology, allowing for a wide variation in the form of the cut-outs. Glass railings and side panels are used throughout, allowing light

and visibility and accentuating the shape of the truss design. The result is an efficient and practical footbridge, with a recognisable design identity. The bridge's main elements are prefabricated and delivered via the rail network in one piece. To fit into a standard freight car the bridge is skewed about the pin

connections in the roof and deck. Upon arrival, the system is rotated, straightened, lifted and placed into its final position using mobile cranes. Concrete deck pavers and diagonal bracing elements in the roof and deck are added on site, along with glass panels in the covered version. ■



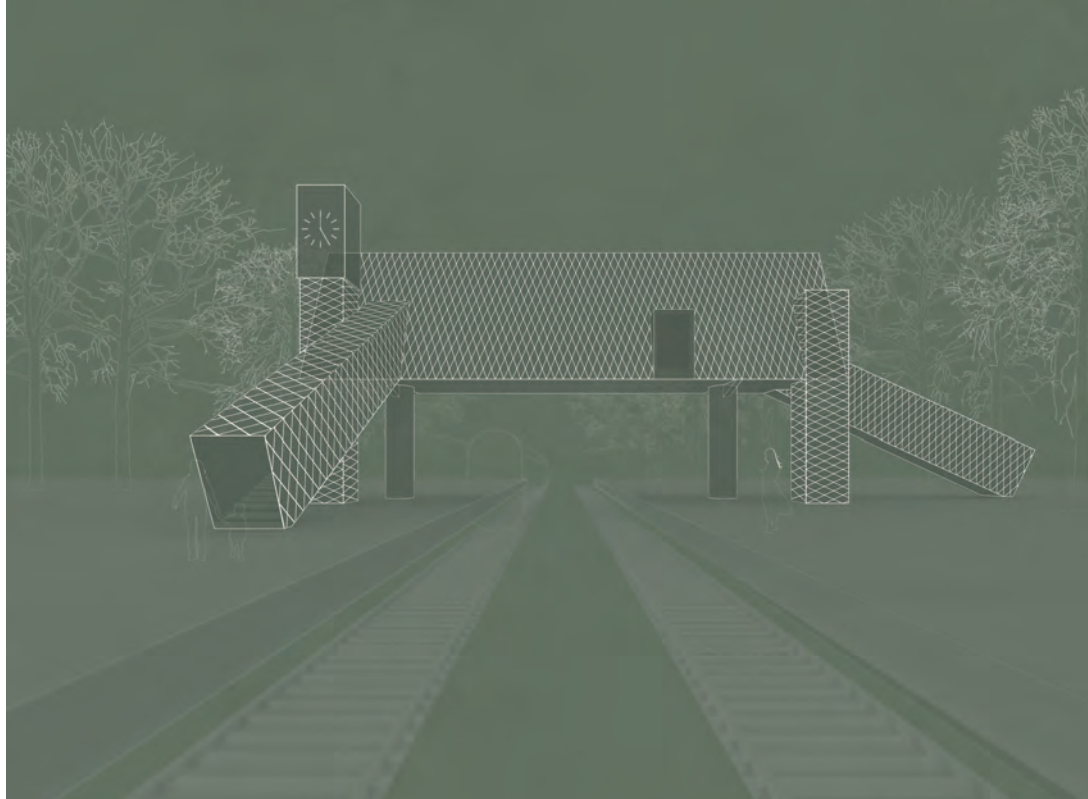
## AHMM, UK with Meinhardt

The structure of an arch has a long heritage within design and on the railway. This footbridge takes the arch shape and tilts it to form a sweeping continuous handrail to one side of the stairs, up and over the footbridge in one movement. The lift towers are positioned at a 45-degree angle and work with the

handrail to provide the structure for the footbridge. The angled lift towers give easier wheelchair access, reducing the necessary width of the bridge. The fully glazed elevation allows passengers and enthusiasts alike to enjoy views of the station and beyond, and helps a first-time visitor to find their way

around the station and the surrounding locale. Signage is provided in bold colours and floor to ceiling numerals indicate the platform numbers. Small gardens can be included to instil local pride in the station, and the community can also be involved in choosing the colours for the bridge. ■





## Bauen, Denmark

This design is based on an adaptable kit-of-parts that is neither a one-off nor one-size-fits-all solution; a sculptural ensemble, recognisable in its playful language of primary forms. The clock tower is an everyday vertical landmark, anchoring the horizontal bridge element, which has a distinctive triangular cross section. Protection from the weather throughout the full length of the crossing is an

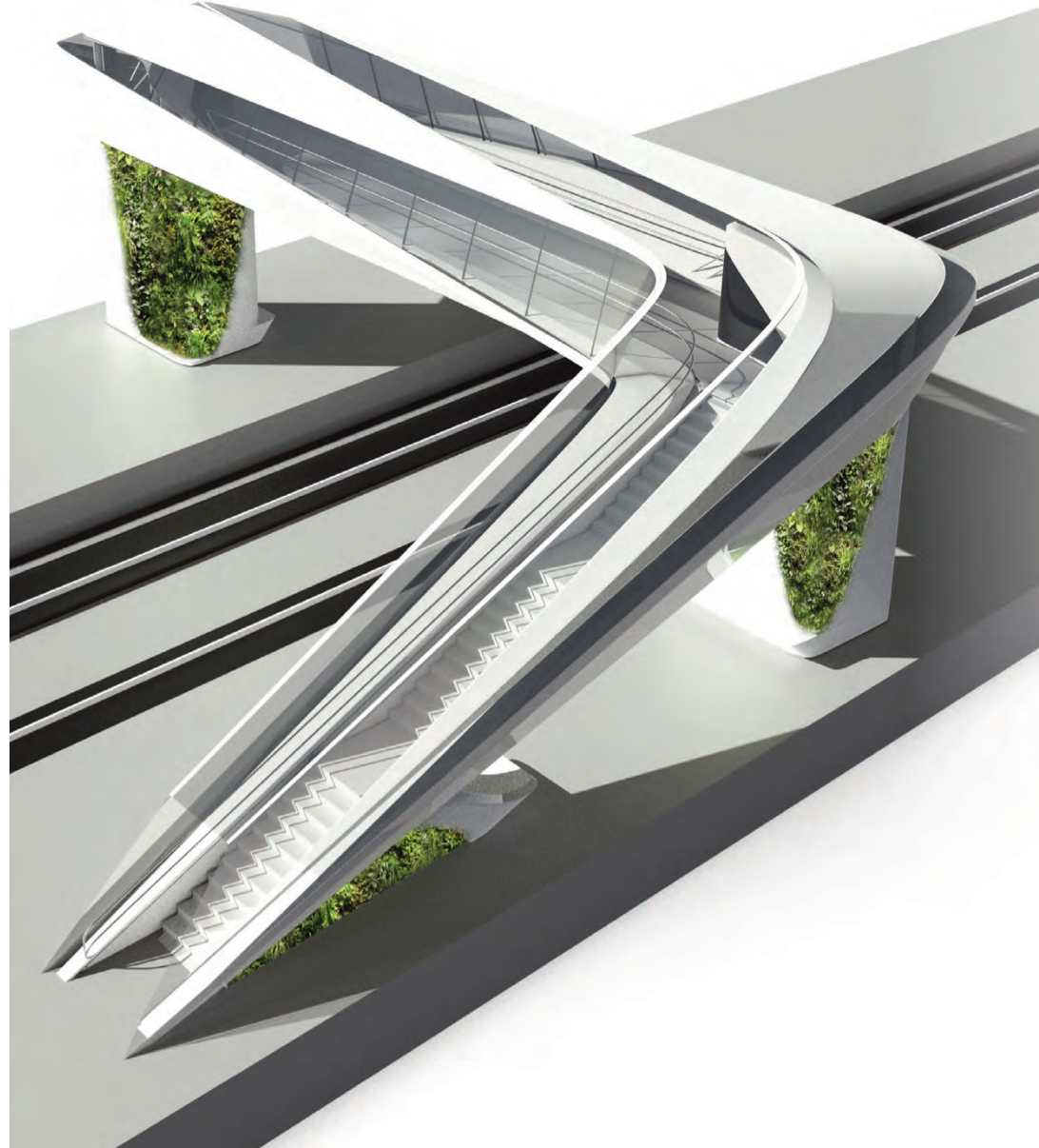
integral part of the footbridge design. Each primary element has a structural steel frame and girder covered in a metal wrap of copper alloy or painted aluminium, referencing traditional roofing. The surfaces are smooth and even with no perforation or gaps, which eases cleaning and maintenance. Openings for skylights and views at eye level and integrated benches can be added. ■



## Lianou Chalvatzis Architects, UK with Buro Happold Engineering

### The Whoosh

True to its name, the Whoosh footbridge provides a smooth sweeping connection over the railway, that also minimises the impact on the platform area. The lift towers are reinforced to allow the bridge span to connect directly into them, making the lift towers and footbridge supports a single structure. The area beneath the staircases is turned into a functional space with a simple seating arrangement, enhanced by the presence of planting. The lift towers are also covered with vegetation, providing a fresh and exciting space for passengers. The asymmetrical aluminium composite panelling on the footbridge is self-cleaning and fire-resistant. Alongside the glazing, it gives the crossing a vibrant appearance. Timber cladding is an alternative option. ■





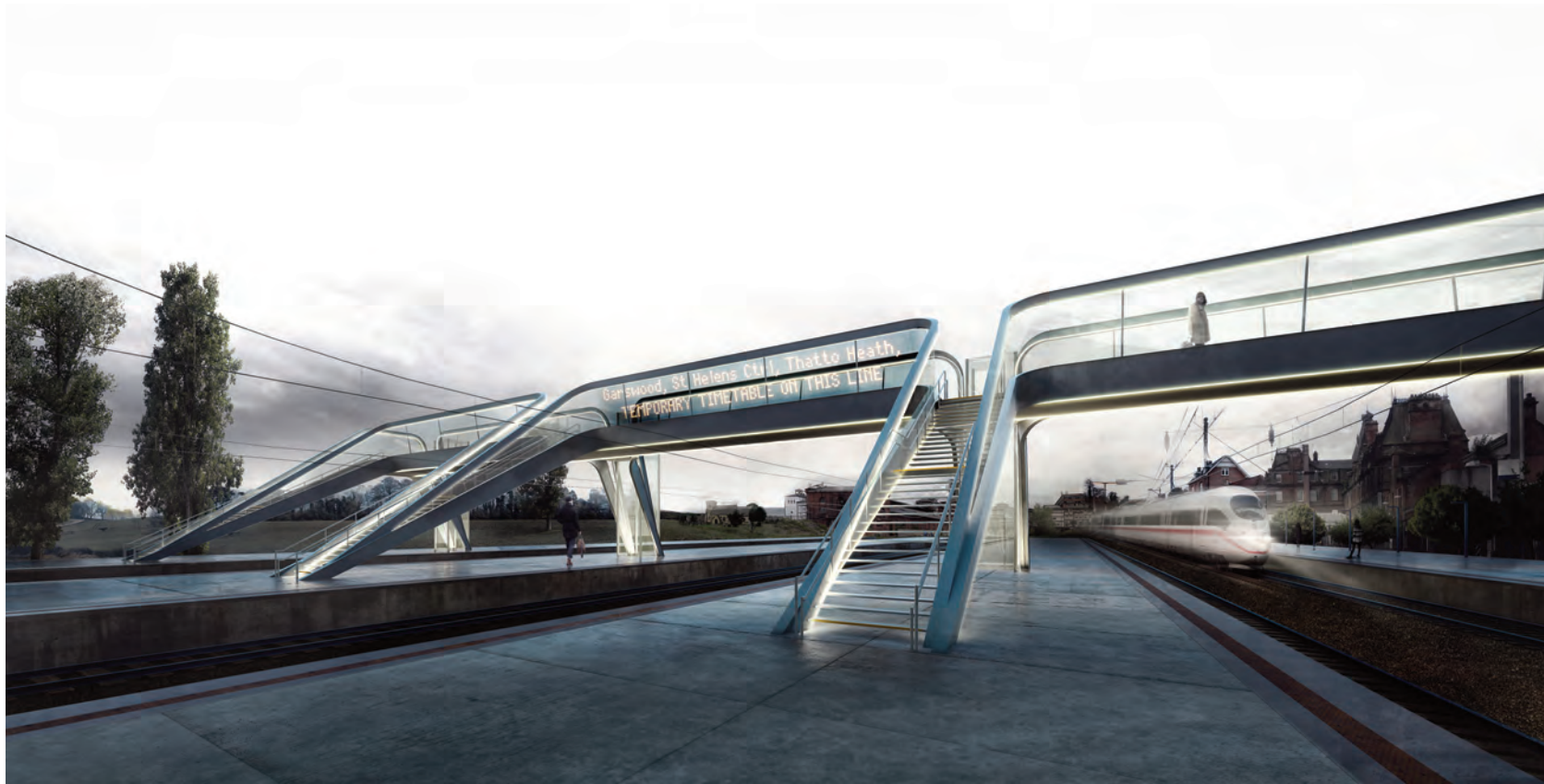


## Ting Xu, People's Republic of China

The form of the main structural element of this footbridge originates from a standard train tunnel, composed of a simple precast concrete arch, creating a dialogue between the footbridge and the trains passing through it. The original tunnel form of the arch is transformed by scooping and cutting out part of it, opening up the space over the railway tracks as much as possible. The main span rests on hollowed out sections of the walls of

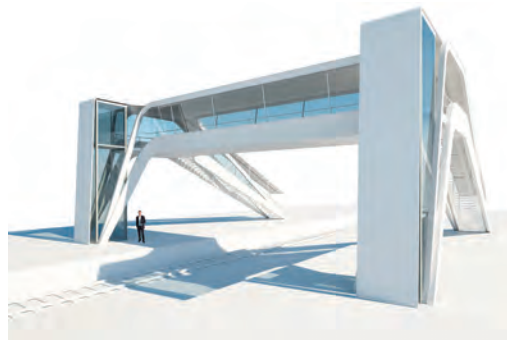
the arch which in turn support the stairs. The stairs and the main span are attached to the main structure without any extra support. As well as fulfilling all of the necessary structural requirements to support the crossing elements the concrete arch also provides covered areas at platform level for those waiting for a train or lift. The main arch is constructed from a set of precast pieces embedded with a steel cable structure, which are then assembled on site. ■





## FVAI Structures Architectures, Spain

Two solid bands on each side of a user's route are the main visual element of this footbridge; both bands emerge from the base of the stairs and flow up and through the space above the track, then down again. The lower band, attached to the main box girder structure of the span, creates a visual separation between the railway tracks and the walkway interior. The slimmer, upper band supports a glass enclosure reaching the full height of the



footbridge along the way. The upper band also holds lighting ducts, carries the drainage system and supports the roof. The continuous lines and smooth shapes of the footbridge relate to the appearance of the railway tracks below. This footbridge can be adapted to allow any number of platforms to be linked, while maintaining a recognisable, elegant and consistent theme, for both covered and uncovered versions. ■



## WSP, UK

### BRItEDGE Crossing

The weathering steel box girders on this footbridge's main span vary in height, echoing the flow of forces in the structure. Combined with glass balustrades, this design provides an open and bright crossing space. Weathering steel is also used in the main span, staircase and other supports. Glued laminated timber provides a lightweight material for the roof and the handrails on the stairs and at either end of the main span. The design is intended to embody the principles of lightweight design and modular construction of elements. The bottom tray of the deck will allow utilities to be installed off site. No formwork is needed for the lightweight concrete footbridge deck, poured in-situ in a quick single pour. A parametric design approach is used to tune the structure's main geometrical features to suit different local requirements while still allowing the same construction techniques to be used at each location. ■





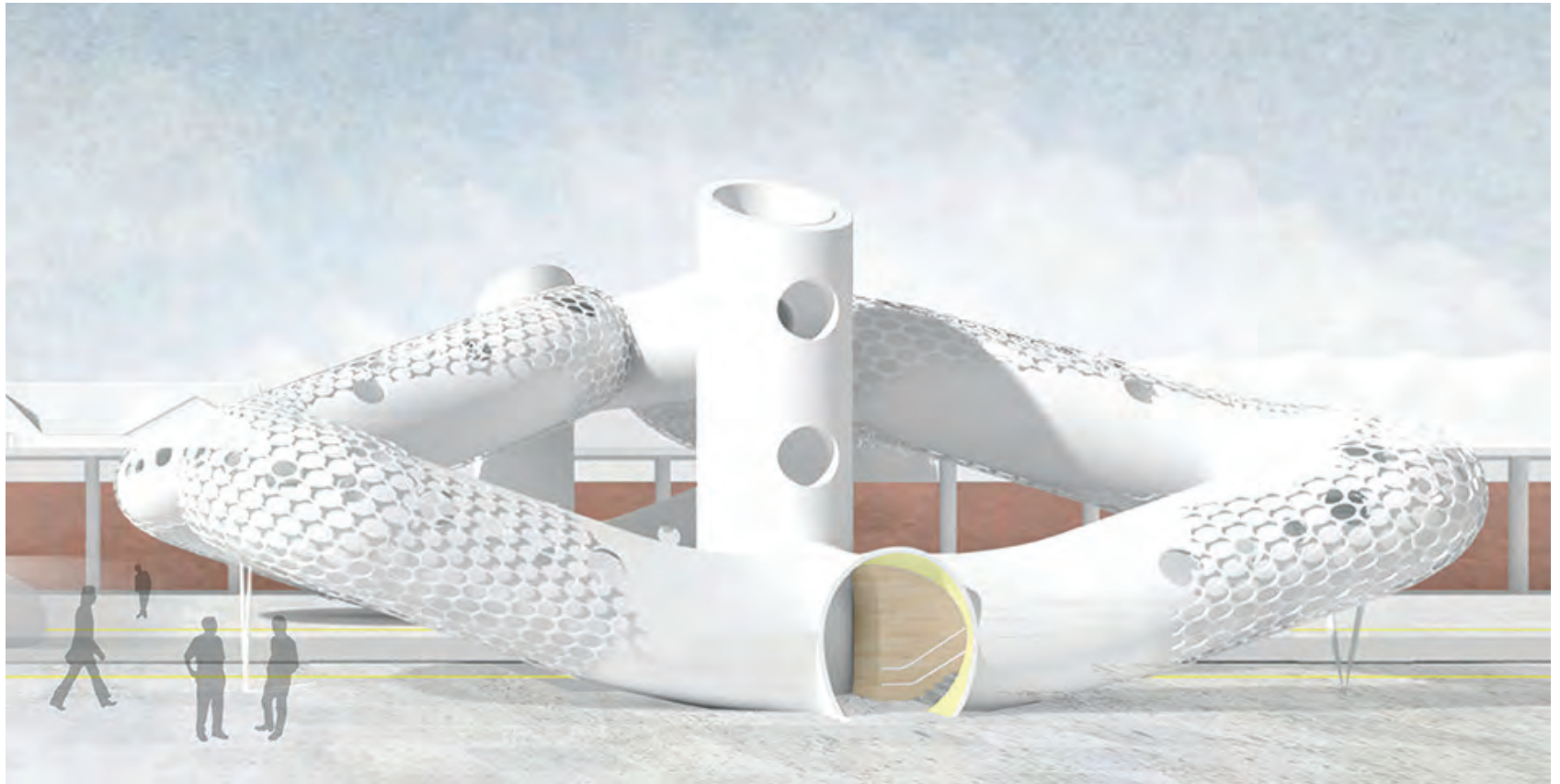
## Entuitive, UK with Houchell Studio

Adaptability is at the core of this design, achieved through the use of a unifying geometric system, based on a space frame. The modularity of the space frame - and the triangular shape of the modules - enables the structural system to respond to different bridge requirements whether used as a vertical

element in the lift towers, the cantilevered lift platform at deck level, part of the stair, or the main span itself. The stair flights and bridge deck are aligned at a 45-degree angle rather than the usual 90 degrees, to improve circulation, particularly for those carrying luggage or wheeling a bicycle. A more typical

90-degree change of direction can be accommodated where platform space is more constrained. The generous landing area at the head of the stairs allows space for people with rolling luggage or bicycles to reorganise their luggage while standing away from the main flow of pedestrian traffic. ■



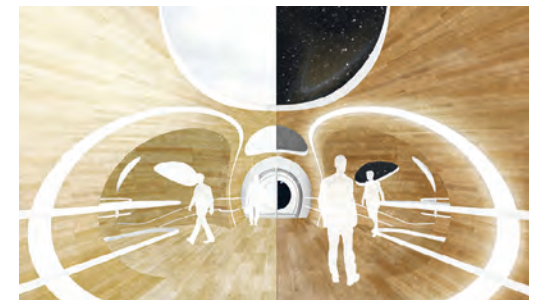


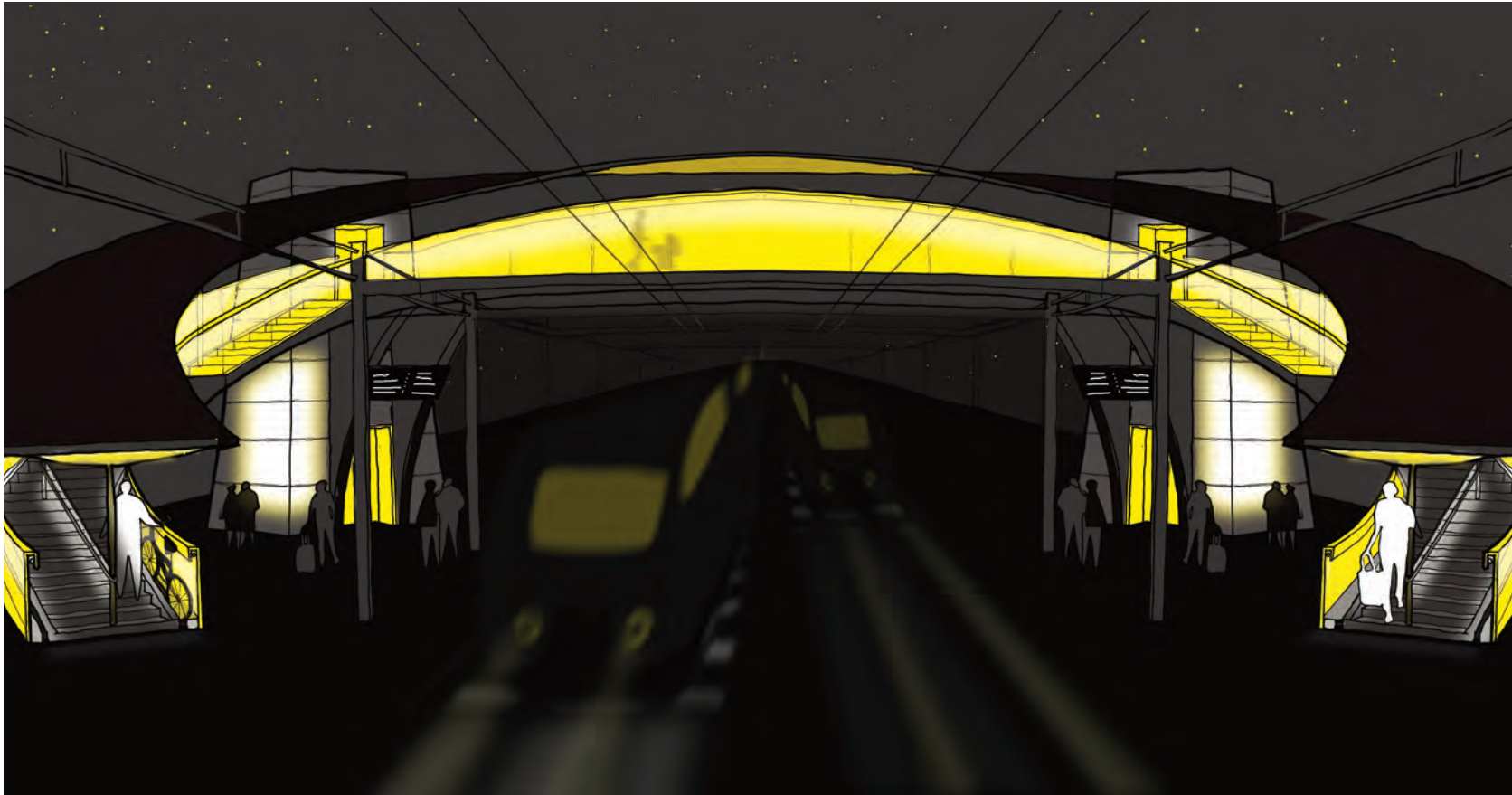
## Domenico Perrone Architetto & Partners, Italy

### TubesBridge

TubesBridge offers a bold new identity for footbridge design, expressing dynamism and fluidity through a simple, high-tech and light form. This white structure consists of three main monolithic tube-shaped components, branching apart from a common access point at ground level, with two outer staircase tubes following a sinuous trajectory, before meeting again at the upper level, where they combine

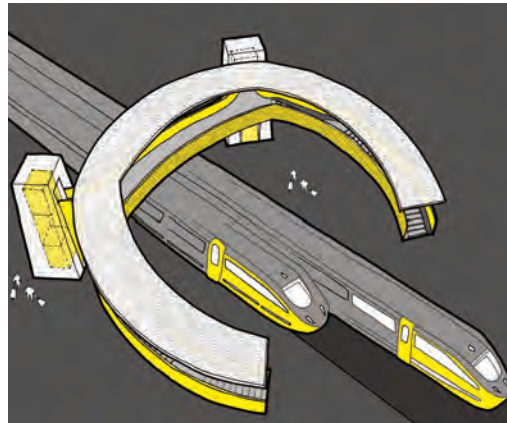
with the central element to form the main span of the footbridge. The vertical tube at each end of the central element houses lifts for step-free access. All the tubes are self-supporting structures composed of two external layers with an internal rib framework. The interior of the footbridge is lined with wood strips, punctuated by circular windows. Flowing strips of LED lighting guide users through. ■





## Meshworks, UK

This design references the early architecture of the railway with punctured steel and expressive engineering. The curve, the key design element of the bridge, aims to improve the flow of passengers and wayfinding around the station by eliminating corners. The lifts and stairs both face the rails at the same angle and join the bridge deck at the same point, which increases their visibility and makes it easy for users to see how to reach the crossing point.



Perforated, yellow-painted steel provides the required protection on the bridge. The same steel forms the curving stairs so the bridge reads as one clear route. If a roof is required, it is also supported from the centre of the stairs, leaving users with an unobstructed view from either side. The tapering lift cores echo Egyptian Revival bridges of the early railway. At night, these cores are lit, so the position of each lift and its entrance is obvious. ■



## Arup, UK

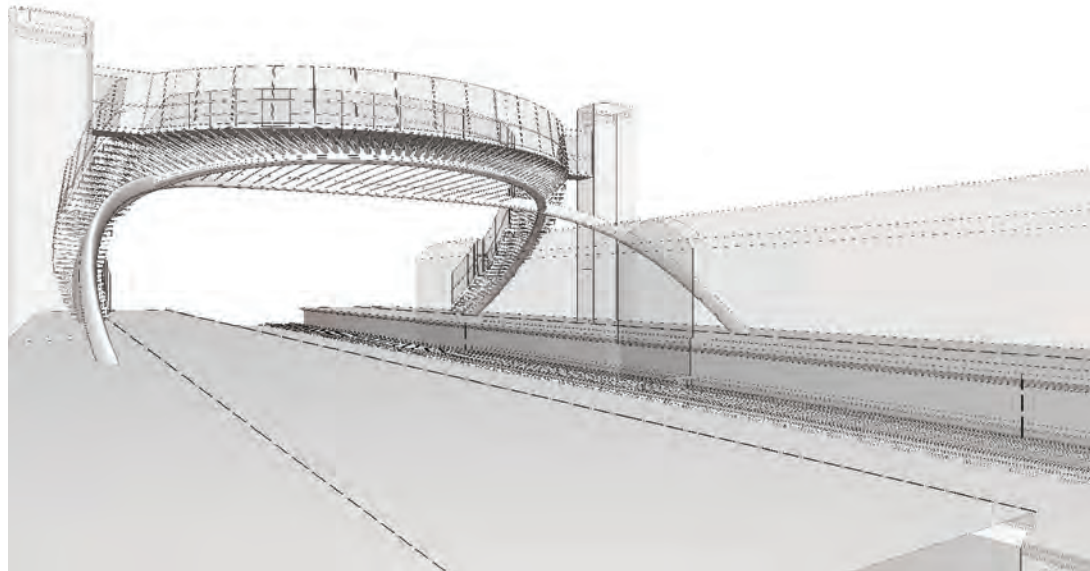
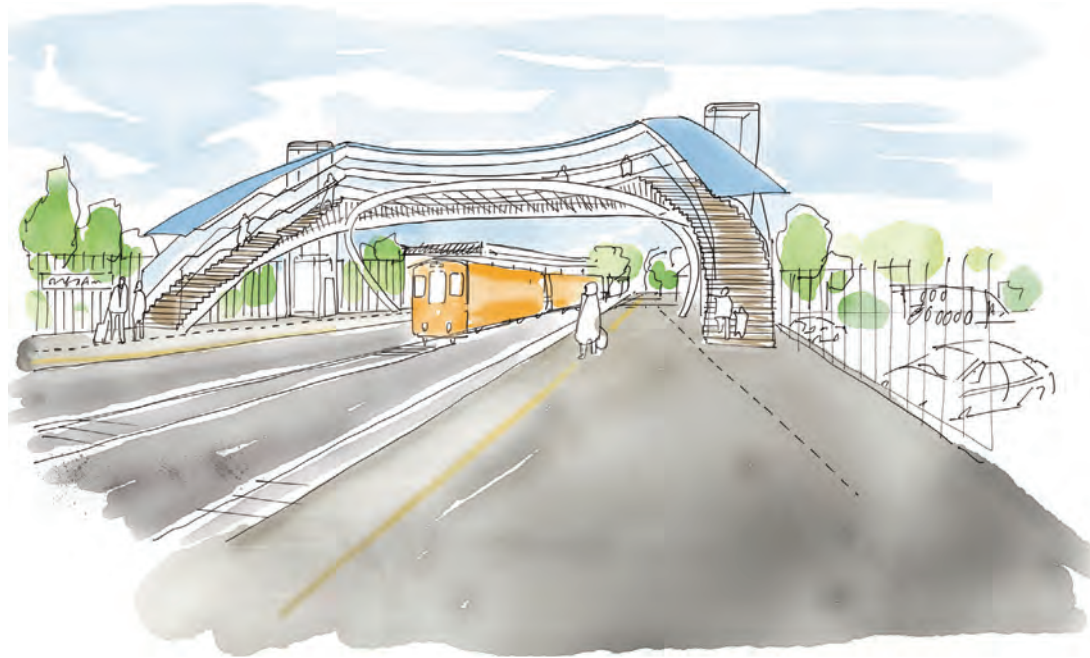
### Clock Bridge

The design for this footbridge addresses three issues: the need for different layouts of spans and stairs to suit different locations; that lifts for accessibility often appear as afterthoughts or bulky additions to the side of a structure; and that most 'standard' designs use sets of drawings which have to be redrawn for each site. A clock face concept is offered as a solution. The lift, and therefore the needs of users with restricted mobility, is placed at the heart of the design, with the lift tower acting as both the centre of the clock and the main vertical structural element. The footbridge spans and stairs can be rotated about the shaft to give a range of possibilities for the layout of the structure, allowing ultimate flexibility across different sites. The lift can be rotated within the shaft and the design provides flexibility for the lift doors to be installed to face the most appropriate direction for users. ■

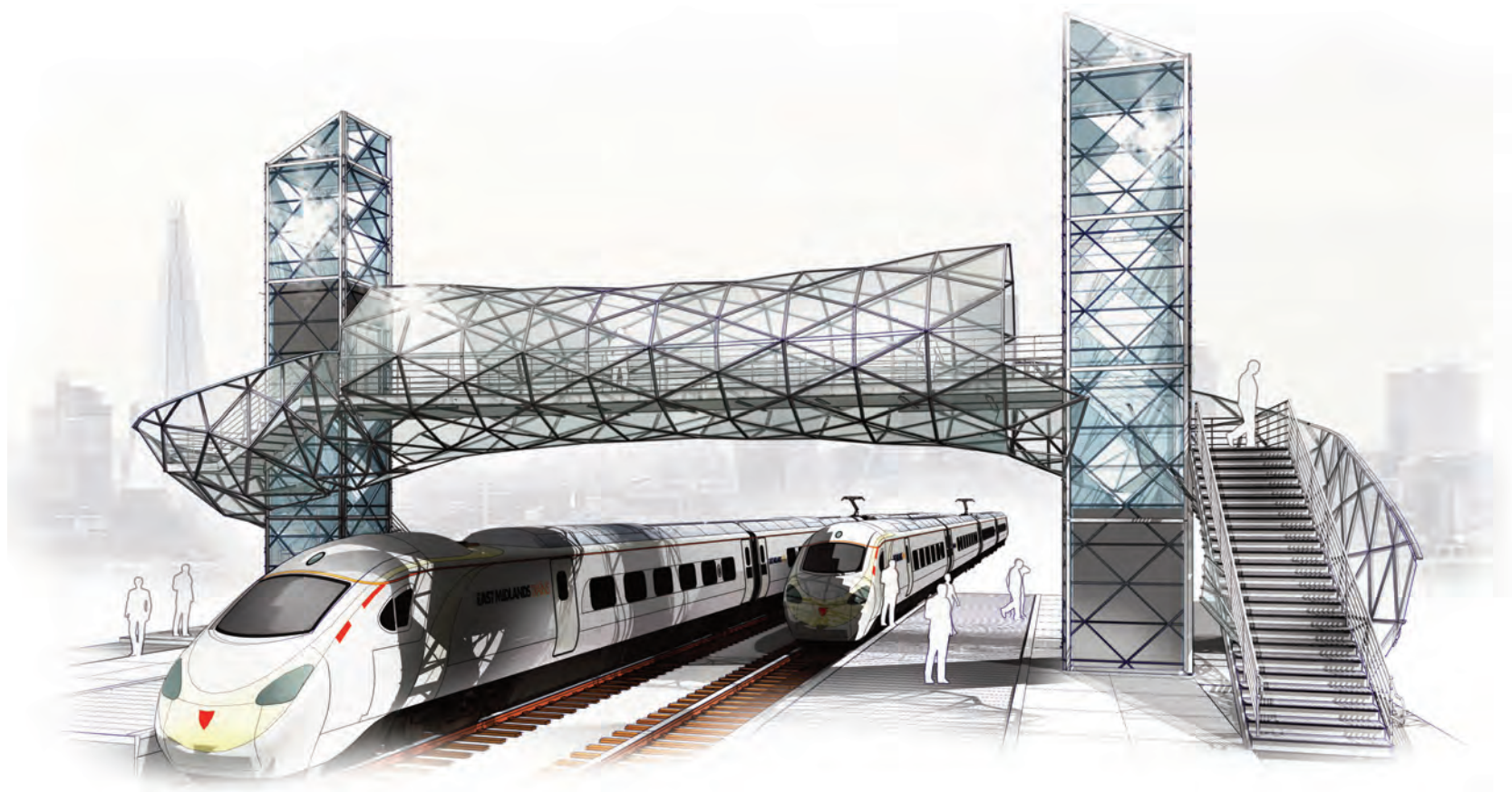


## Yui Fan Law and Nicolas Villegas Giorgi, UK

This footbridge structure comprises a pair of leaning arches, with branches to pick up the stairs and the bridge platform configured in the shape of a horseshoe. People, structure and views flow fluidly and naturally through this curved structure, without abrupt changes in direction. The structure has the potential to be more than just a passage or a passing point; as footbridges often command an excellent view of the location in which they are sited, they can act as the perfect place for a “third platform”. Despite this ambition, this footbridge is conceived as a modest intervention, keeping its height as low as possible and utilising horizontal tension cables to introduce additional stiffness. ■







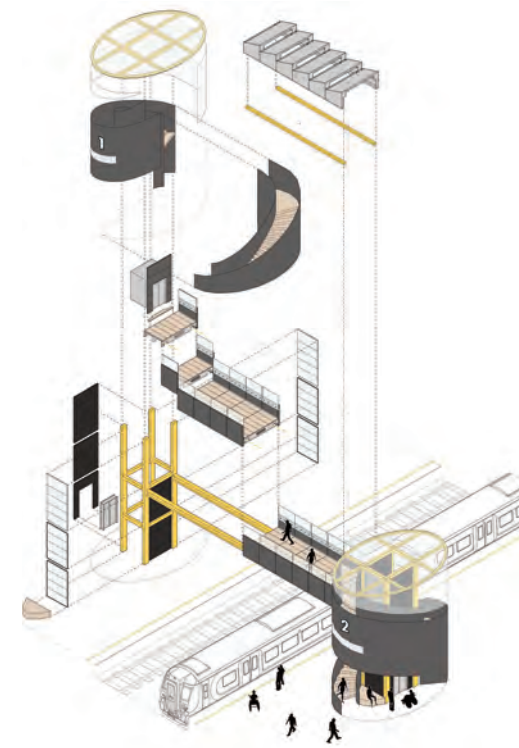
## MRA, Israel with Labaton Civil Engineers

### KitBridge

KitBridge is a standardised kit of mass produced parts, allowing a consistent and identifiable architectural language, while encouraging diverse and varied forms. The footbridge structure, lift tower framing, stair coverings and canopies all use the same standard set of elements. The structural

system is based on a tubular form constructed from repeating triangular modules, made of steel tube sections and linked by ball node connectors. Using a space frame structure allows the construction of long or short spans, which can accommodate irregular, orthogonal, circular or elliptical cross-sections - to create

local landmarks or make space for higher footfall. Cladding panels, walking surfaces, infrastructure-housing systems, lighting and signage are connected to the primary structural systems at the ball nodes. Standardised cladding panels can be made of glass, polycarbonate or aluminium. ■



## Alexander Flint and Ella Louise Flint, UK

The use of helical stairs, wound around each lift tower, minimises the platform space required for this footbridge, at the same time providing access to the lifts and stairs side by side. This gives an equality of experience to people using the footbridge, whether they access it via the stairs or the lifts. The staircase typology also provides natural shelter and surveillance for those waiting for the lift. This approach allows for the expression of a single stair and

lift volume, simplifying the access solution and drawing focus to the station. The design itself is driven by off-site manufacturing methods to generate a base module which can be lifted into place and installed in situ onto pre-assembled beams spanning the railway lines. A combination of translucent and solid materials is used to provide visual amenity to the users of the footbridge and those passing through by train. ■





## SWAP Architects, UK

The simple concept of an elegant rope bridge is transformed into a tensioned footbridge in this design. Structural steel sections infilled with translucent concrete hang off steel cables that span from the footbridge's four anchor points. The lines of the tension cables provide splayed moments across the bridge which promote the

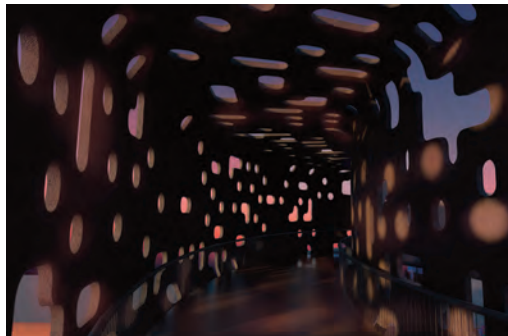
flow and movement of pedestrians - widening at each end of the bridge span by the lift tower and at the top of the stairs. This design approach can be easily manipulated to change the shape of the footbridge, provide cover and adapt to different spans and requirements at different sites. ■

## Web Structures, Singapore

### Form Follows Flow

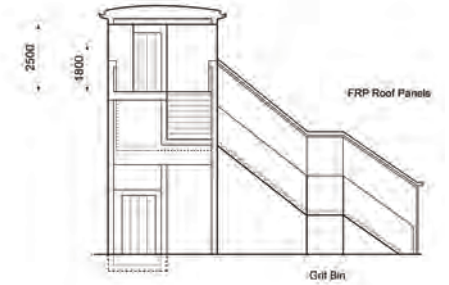
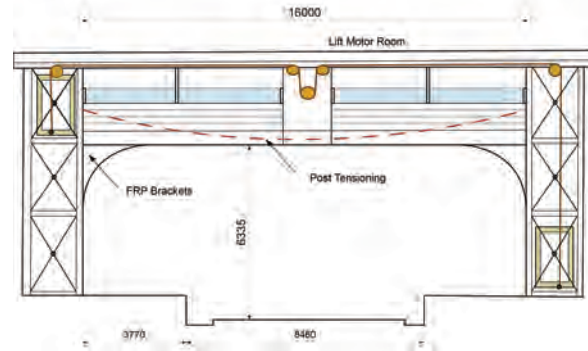
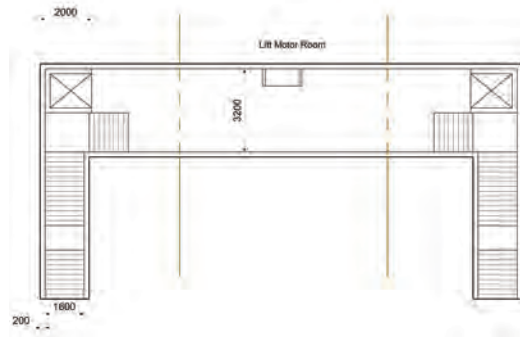


This proposal considers the idea of 'flow' in terms of people, materials, air and light. Perforations within the structure provide the flow of air and light. As a generic concept without a specific site to inform the positioning of the perforations, these are instead based on structural utilisation; where the structure is doing less work, more and larger holes are placed. The resultant pattern of perforations allows for cross-ventilation and natural



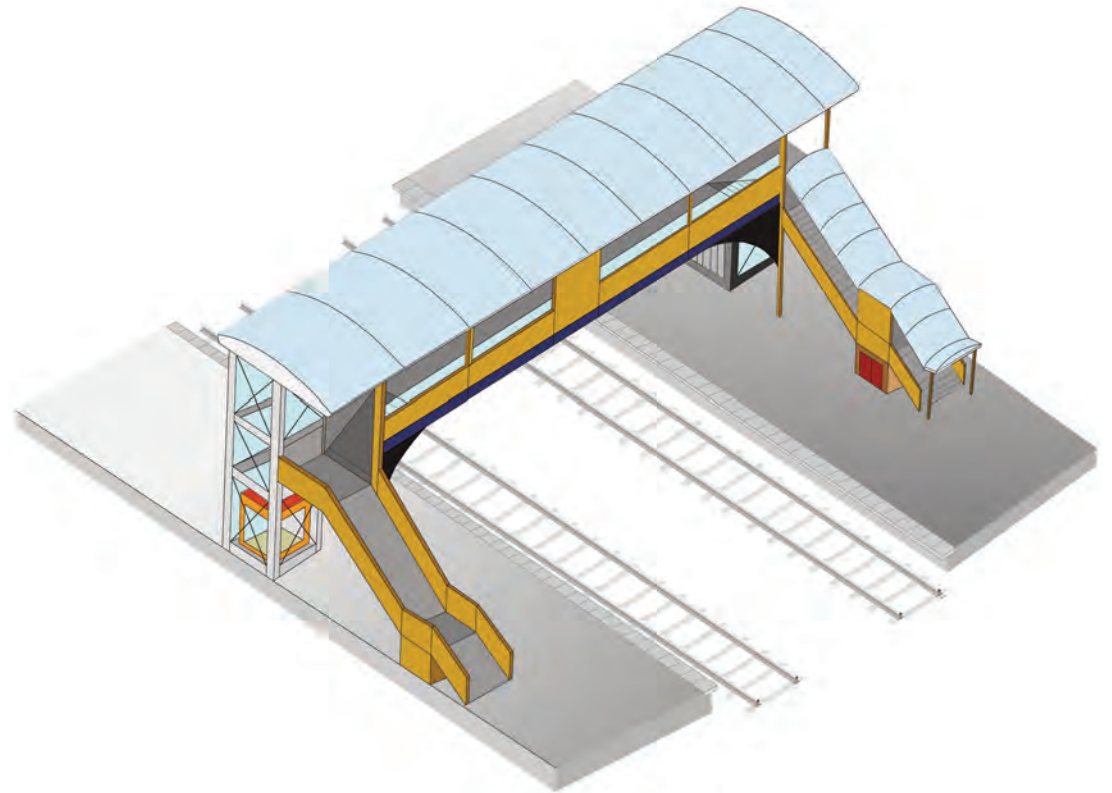
daylighting, minimising lighting costs and increasing user comfort. In colder locations, the perforations can be glazed. Due to its lightweight design, the bridge only requires two slender columns as supports. This keeps the platform visually uncluttered and makes circulation easier. The design is made of pre-fabricated elements which can be assembled in different configurations such as a C-shape or S-Shape according to site contexts and constraints. ■





## Grahame Herbert, UK

A key feature of this design is the use of a balanced lift system, similar to arrangements used in a funicular railway. This eliminates the need for a lift motor room on each platform, creating a more compact design at platform level. Instead, the lift cabling extends across the bridge, with just one lift motor room needed at the midway point. Balancing the two lifts reduces power needs. Both staircases have a final quarter landing allowing the final steps to be aligned with the bridge span, avoiding a clash between stair users and lift access. The footbridge is made up of fibre reinforced polymer elements that are strong, light and simple to assemble and can be manufactured in any colour or texture to simulate timber or steel to match existing station structures. ■





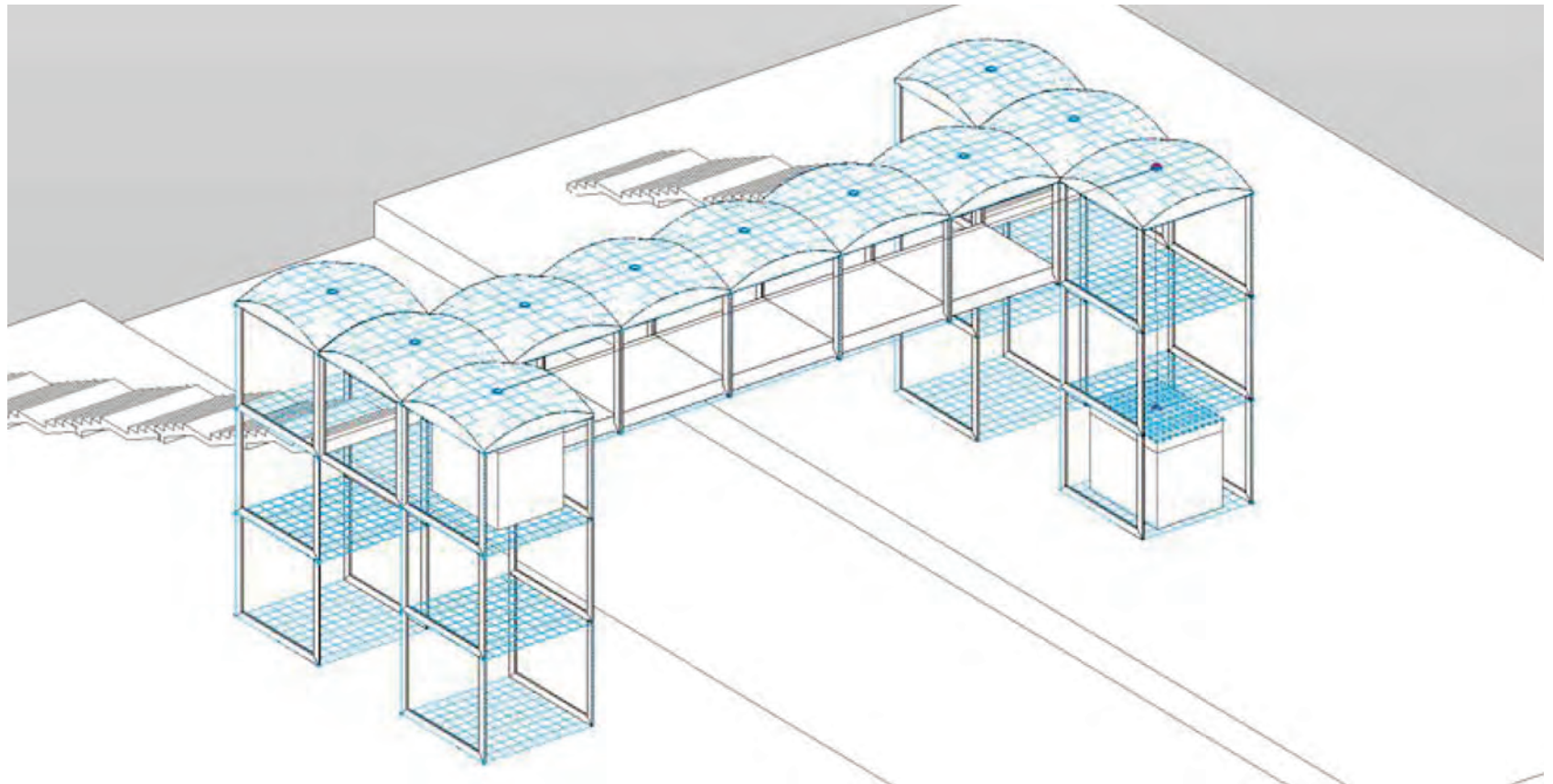
## Contour Architecture, UK

This light, modern design features an 'Orbital Lift', taking inspiration from paternoster style systems, allowing for two cars to rotate around a wall mounted track arrangement. Unlike other paternoster lifts, this system does not continually rotate, but is activated by users. This system reduces waiting times; because two separate cars operate on alternate levels

on each platform even if one has just departed for the bridge level its counterpart will be on its way to the platform. The main span is designed as an 'I' beam, built off site and craned into place. This shape has a strong central core, with minimal structural elements at the edge providing clear views out for those using the footbridge. ■







## Love Architecture, UK

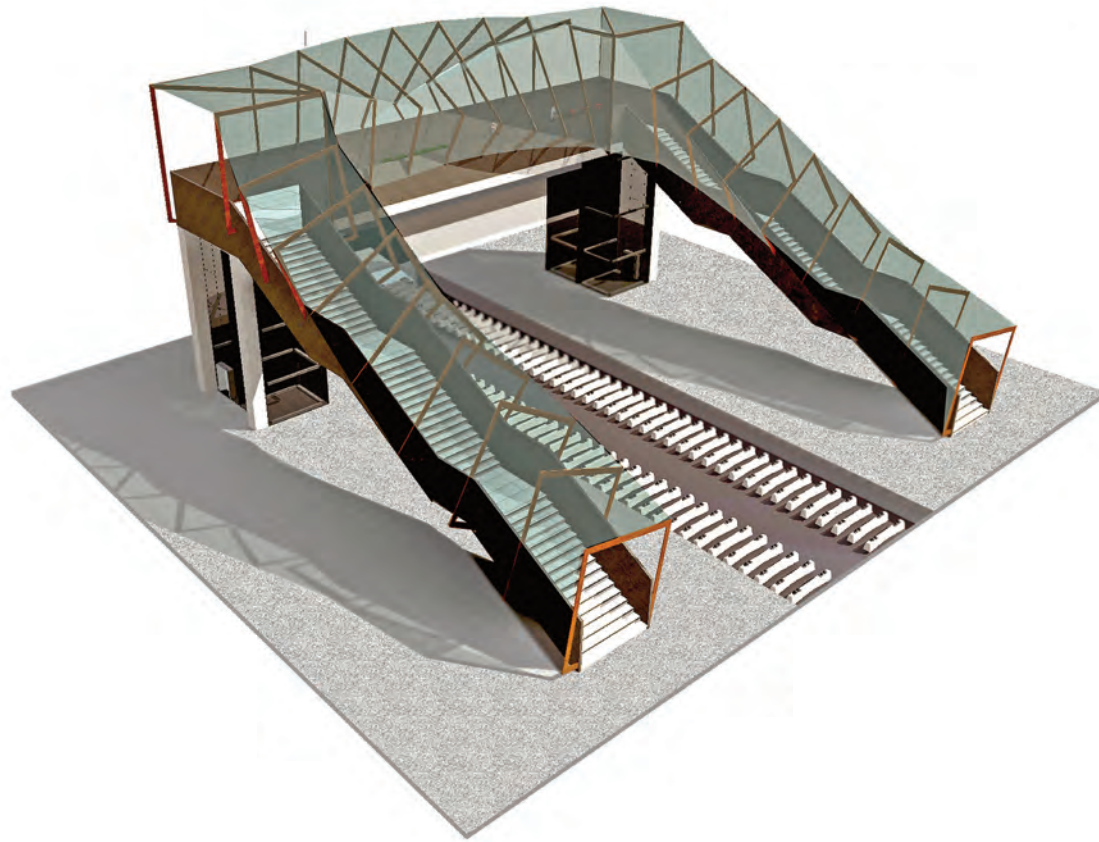
### Water Powered Rail Crossing

This design consists of a footbridge of modular construction combined with a pair of water powered lifts. Water stored in a reservoir on the top of the footbridge fills a tank on the roof of the lift car at bridge level. Then, water in the tank on the roof of the lift car at platform level is discharged. The lift cars are linked by a cable and pulleys; when the lighter car ascends, the other car

descends. The water eventually ends up at the lower level, but is pumped up again with electricity generated by photovoltaic (PV) panels. Rainwater is also collected to replenish the reservoir. Depending on the efficiency of the PV and the pump, water for a pair of journeys can be pumped in an hour. The PV panels also recharge batteries which operate the controls and valve mechanisms. ■

## Simone de Gale Architects, UK

A key feature of this design is its vertical-to-horizontal lift system, which takes users up and over the tracks and down to the other platform. There is space for multiple cars to operate side by side in the lift shaft as well as horizontally across the bridge span, providing a shuttle system and optimising traffic across the footbridge. This design also focuses on environmental considerations, with power generating flooring activated by the passage of pedestrians used to power LED lighting on the bridge. Recycled concrete used to construct the stairs and the bridge span is estimated to reduce CO2 emissions by 20% compared to virgin concrete. Long-life glued laminated timber frames support a photovoltaic glass roof. ■







## NJBA A+U, Republic of Ireland

### Landbridge

Addressing the impact new infrastructure has on wildlife movement, Landbridge features a green roof and sides that serve as a connection or wildlife corridor across the railway tracks. Modular galvanised/stainless steel trays are attached to the top and to each side of a standardised timber framed lattice which forms the main structure of the bridge element. These

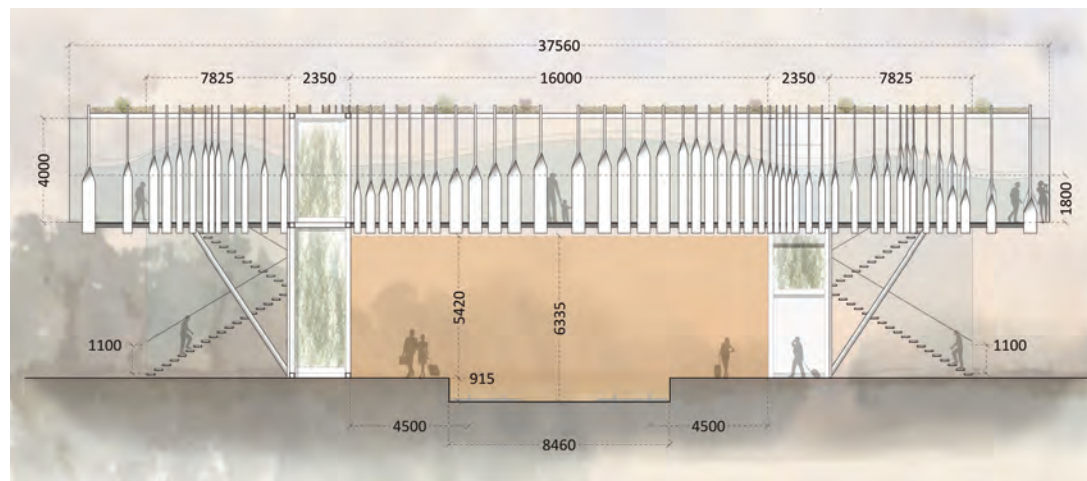
trays are planted with wildflower meadow plants that not only contribute to biodiversity on the rail network, but also reduce the drainage infrastructure required. The footbridge is supported by steel legs, which are attached to the main span via a rail, allowing their positioning to be altered to take account of varying platform arrangements. ■



## Waddington Architects, Jersey with WSP

F 1:1

This design proposes an understated solution which is engineering-inspired, referencing the industrial heritage of Britain's railways. The Corten steel structural frame comprises two lightweight Vierendeel trusses spanning the tracks, connected by a series of vertical plates with twists at varying heights. 1:1 aspect ratio picture windows at each end of the bridge offer contemplative views to users with time, while those in a hurry experience glimpses through the twisted plates along the bridge. A low maintenance, extensive green roof, an ivy curtain wall and bat-boxes enhance biodiversity, reduce rainwater run-off, provide shading and cooling and can be tailored to reflect the local ecosystem. Rainwater is harvested to irrigate the ivy wall and photovoltaic panels can be installed to provide power for low energy lighting and irrigation pumps. ■

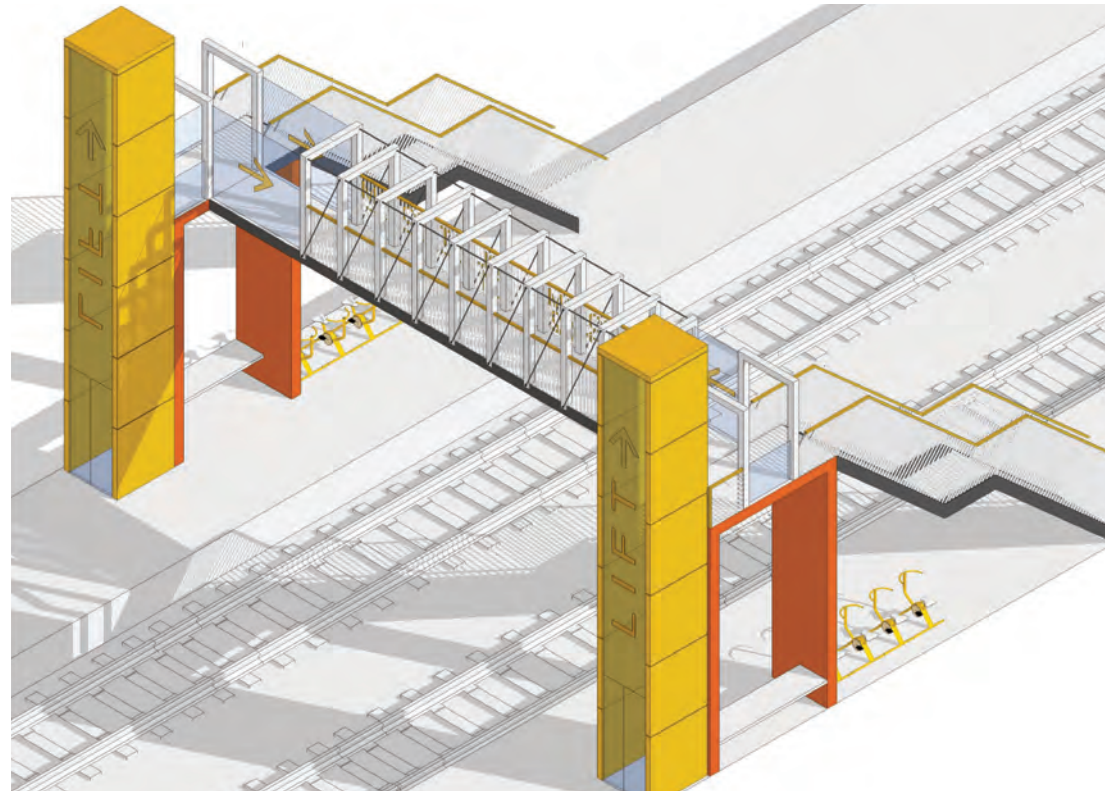




## Shape Architecture, UK and Diana Hare

### The Active Bridge

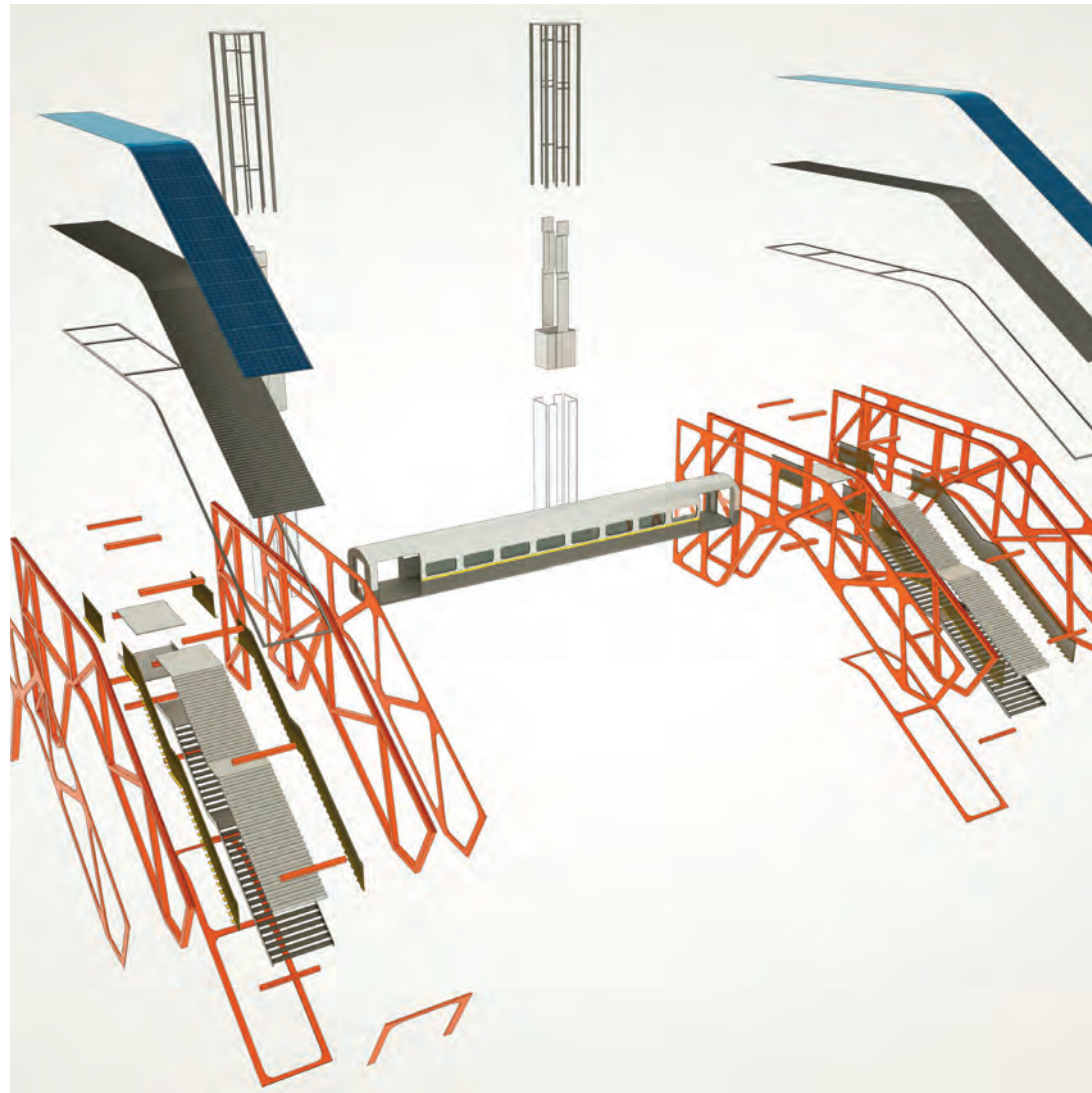
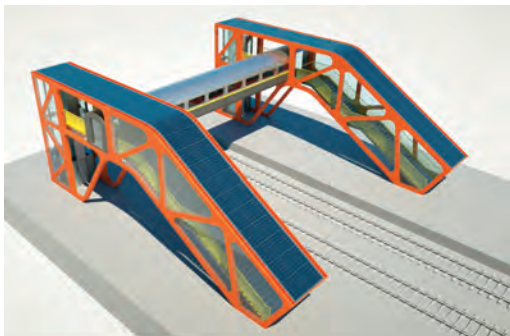
The Active Bridge is powered by the natural energy generated by the passengers who use it. Each footstep taken by a passenger is a source of energy that can be captured using foot plates. More energetic users of the bridge are also encouraged to generate additional energy by pedalling energy-capturing bicycles on the platform, while they wait for their trains. By drawing on these two sources of power, such a bridge at a medium sized station could generate more electricity than is consumed by the lift motors. The Active Bridge is a kit-of-parts with a core design that responds to a variety of locations and contexts. As such, the elements forming the footbridge can be easily removed for replacement/maintenance. Any of the cladding panels that need replacing can be removed while standing inside. ■



## Fereday Pollard Architects, UK

### Mark 3 Eco-Footbridge

A dramatic proposal for reusing railway assets is at the heart of the Mark 3 Eco-Footbridge. Its main bridge span is formed from a withdrawn Mark 3 carriage, originally developed in the 1960s. Structurally, the carriage is a simple tubular monocoque designed to span 16 metres between the bogies - matching the span of a typical footbridge. The carriage is ideally suited to provide the main span of the footbridge without significant structural adaptation, while the reuse of an existing structure for the entire span significantly reduces the embodied carbon in the footbridge's manufacture. The stairs and lift structures are built from a kit of laminated timber frames, again providing low embodied carbon. These are part-assembled off site and pre-finished to suit the location, and can be fully clad or open, with the option of electricity generating solar cells on the roof. ■







## Harris McMillan, UK

This design uses a geodesic construction to provide both the supporting structure and the cladding surface. Adjustable nodes are used to connect universal frame members, easing repair and deconstruction of the grid at the end of its life. This type of geodesic structure can also be increased or decreased in size depending on expected usage. The design lends itself to a fully enclosed structure

keeping all users safe within the footbridge. Notably, the cladding of this footbridge is made from recycled plastic formed into large sheets and wrapped around the structure. The minimal processing of the cladding materials helps reduce the embodied energy in this footbridge, while retaining the colours from the recycled plastic adds a unique character to each footbridge. ■

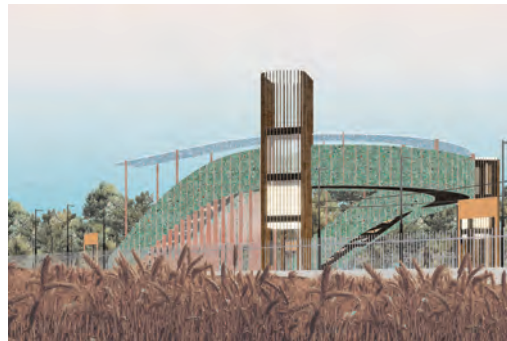




## Chun Ting Ki, UK



Noting Network Rail's endeavours to reduce waste from the railway system, this footbridge design showcases the sustainable narrative behind the UK railway system and focuses on the reuse of materials in particular. Recycled plastic panels, used to clad the roof soffit and parapet, are manufactured in different colours with a unique 'camouflage' pattern which would allow the footbridge to blend in with its surroundings. The individual



panels are robust, lightweight and easy to replace. Reclaimed sleepers are used to clad the parapet structure and the lift tower, while the primary structure is made of recycled steel. The circular arrangement of the footbridge challenges the orthogonal approach of typical designs - avoiding dead-ends and quick-turns and favouring cyclists, wheelchair users and passengers with luggage. ■





### Pat O'Mahoney and Kamil Broneski, Cork School of Architecture, Republic of Ireland

This footbridge celebrates the identity of the railway system by embodying its history and interest in architecture and technology; it is intended to be an art piece in itself. The overall curved form references railway tunnels, while the component glued laminated timber (glulam)

pieces used on the span combine to evoke the shapes created by railway track switches and crossings; shapes into which glazing can be inserted. Concrete lift towers with steel facades reference the engineering history of the railways, while lights at the top take their form from the

shape of the DC motor found in the traction drives of powered rolling stock. The materials employed - glulam, steel, aluminium and glass - have a reduced need for maintenance and are adaptable, ensuring longevity and ease of maintenance and cleaning. ■



## AA Architecture, UK

This footbridge draws its design inspiration from the triangular logo of Network Rail itself. A braced steel footbridge core supports triangular modules at each end, with steel sandwiched cross laminated timber providing slender structural wood panels for these modules. The longest edges of these triangular elements hug the staircases which have internal ramps for dismounted cyclists, to promote

orderly circulation. At platform level, seating areas are housed within the triangular modules while lifts are positioned at their vertical edges. The bridge element is protected with full height inwardly inclined acrylic glazing, while the bridge roof fascia features abstract art unique to local culture. The sides of the glazed stair cover can be adapted to support electronic advert platforms for revenue generation. ■





## TSP Projects, UK

### The Swing Bridge

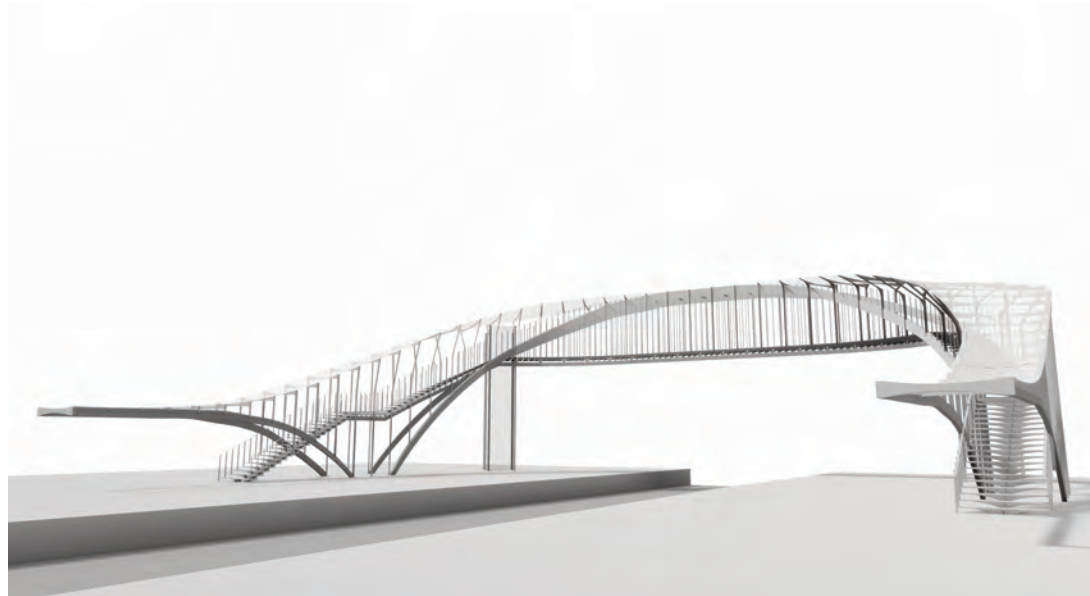
Influenced by Dutch graphic artist M C Escher's impossible cube, the main bridge element of The Swing Bridge is made up of two parts, fastened to hinges supported off two contorted angular piers. It is designed to be eye-catching and innovative, but also takes into account construction and maintenance within the railway environment; as the bridge can swing open and closed, it can be constructed and maintained away from the railway tracks. The two parts of the footbridge are cantilevered when rotating, and simply supported when fixed into position. Lightweight materials such as glass reinforced polymer are used for the bridge deck and trusses. Cladding on the piers can be chosen to suit the footbridge's local environment. ■



## Jing Qiao, Yi Weng and Xiang Ren, UK

### The Hug

Inspired by the weaving form of railway tracks, this design conceives the footbridge as a continuous three-dimensional ribbon. The footbridge is supported by a spine-like twin-structure in weathering steel and with two main anchor points, one on each platform. All elements are arranged around the pedestrian stairway as a central heart which not only makes wayfinding clear and circulation convenient, but also provides users with a pleasant experience. The footbridge form resembles a gateway portal, signalling a welcoming gesture to one's destination. Stair treads are made of perforated steel, the balustrades are steel with timber strip cladding and the flooring throughout the footbridge evokes railway sleepers. ■







## Kendall McGrath, UK

### Kinesis

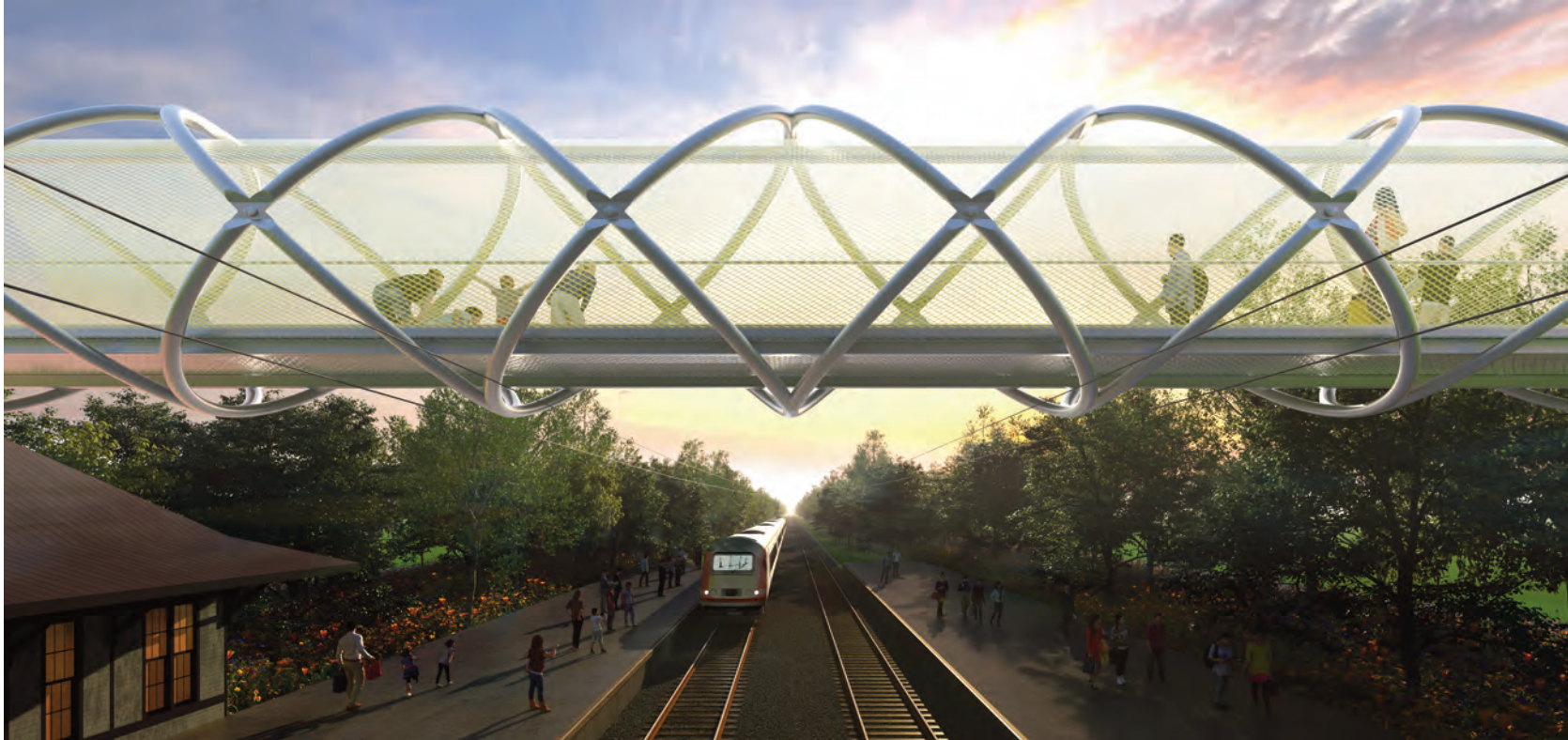
The Kinesis footbridge merges two contrasting concepts: a train's linear motion, speeding along a pre-ordained path, and the less predictable movement or pattern of people or of life itself. The footbridge achieves this by playing with the form of a traditional bridge. The twisting movement of the steel cables and tessellation of the steel pentagonal frames brings life to the design. It acts as a

'flipbook' animation viewed by someone passing through. While the lighting design highlights the tessellating form of the bridge, it also illuminates materials that reflect the legacy of the railways: rusticated steel portal frames, steel cables, glass and elements in suspension. The footbridge also features an inclined lift running parallel to the stair on each platform. ■



## Nikken Sekkei, Japan

### One Night, One Bridge



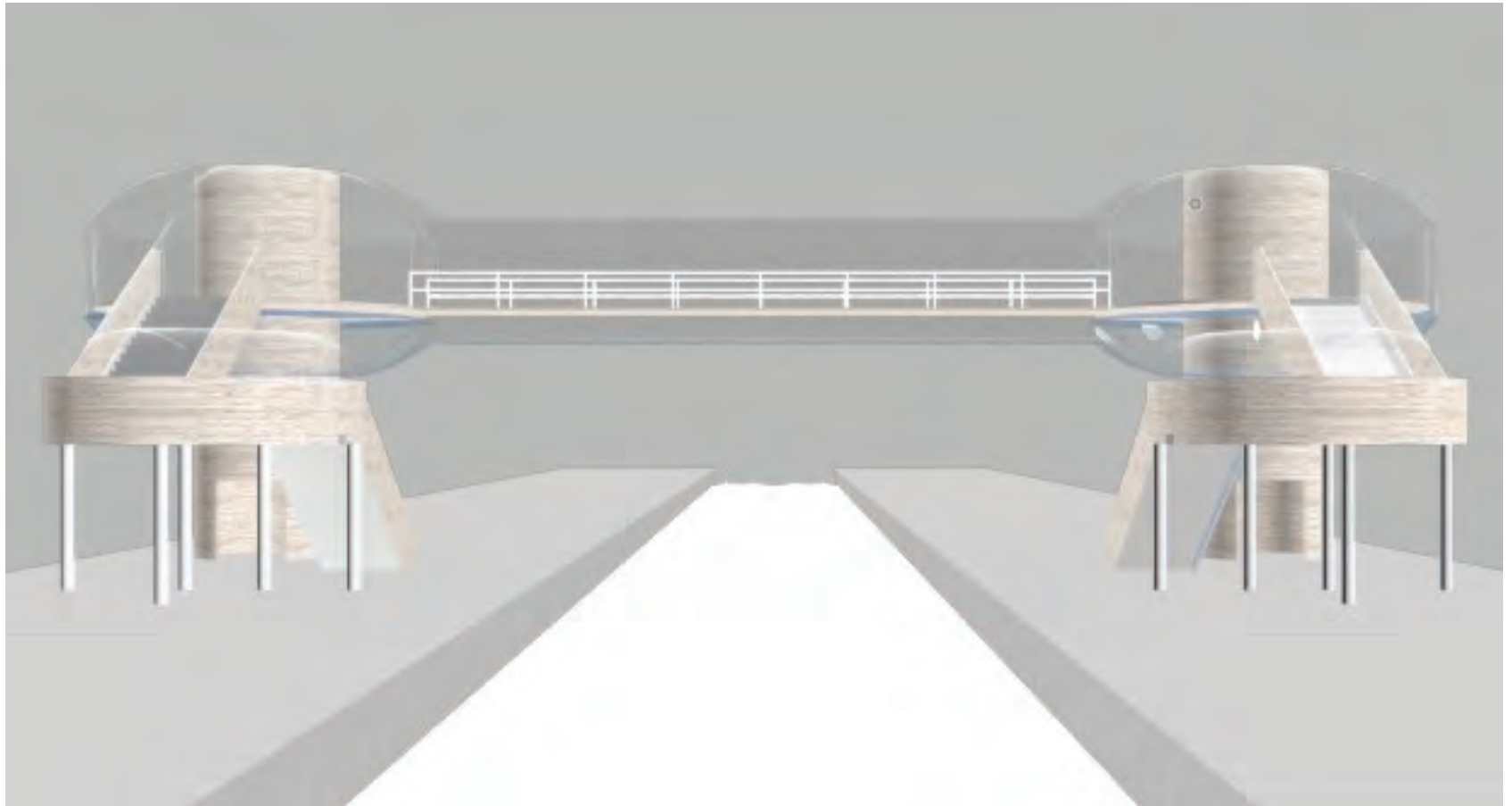
This footbridge has an expandable structure fabricated off site, so that it can be installed over the railway in the short period between the last train at night and the first one next morning. Folded scissor-like frames are transported by train from a factory to the construction site where they are craned on to the top of launch decks. The folded frames are gradually expanded from the platform sides with the help of hydraulic jacks, and are then connected at the footbridge mid-



point where they meet. An ETFE (ethylene tetrafluoroethylene) roof, steel floor, metal mesh sides, and handrails are installed from the inside of the footbridge so that it requires no scaffolding for its construction.

The scissor-like expandable nature of the frames means they can fit to various spans by adjusting their length. They can be mass produced in different shapes - rectangle, triangle and U-shapes, and stored easily until needed on site. ■





## Arup, UK

### The Transparent Bridge

Inspired by iconic footbridges The Transparent Bridge has a light and open design; a glass reinforced polymer exterior tube encloses the footbridge span with its timber deck. One of the main goals of the bridge is to remove the risk of working at height above overhead electrical power supplies. This is achieved by

assembling the deck section at platform level, rotating it around one of the lift towers and connecting it to the other lift tower on the far platform. Sustainability is also a key aspect of the bridge, with recyclable materials incorporated in the non-structural parts of the design, including the handrails. ■

## Grimshaw Architects, UK with Grimshaw Computational Design Group

### Wood you cross



The Wood you cross footbridge is conceived as two identical trusses, each set on pivoting bases, from which a configurable and lightweight system is suspended. The proposal responds to the multitude of potential alignment scenarios along the rail network. A move to a more sustainable and environmentally friendly process has been made using timber as the main structural material. For the support of the timber structural system, an advanced

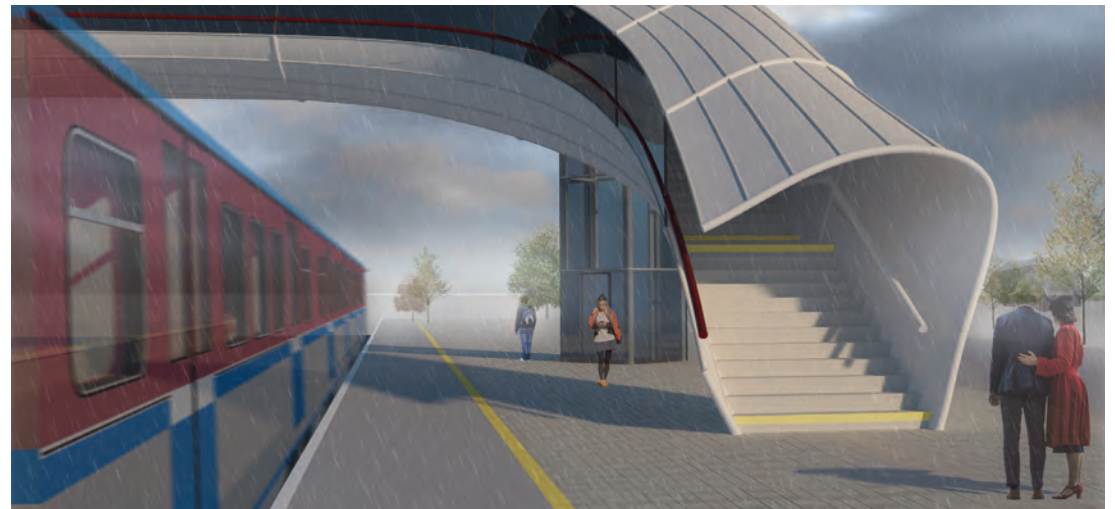
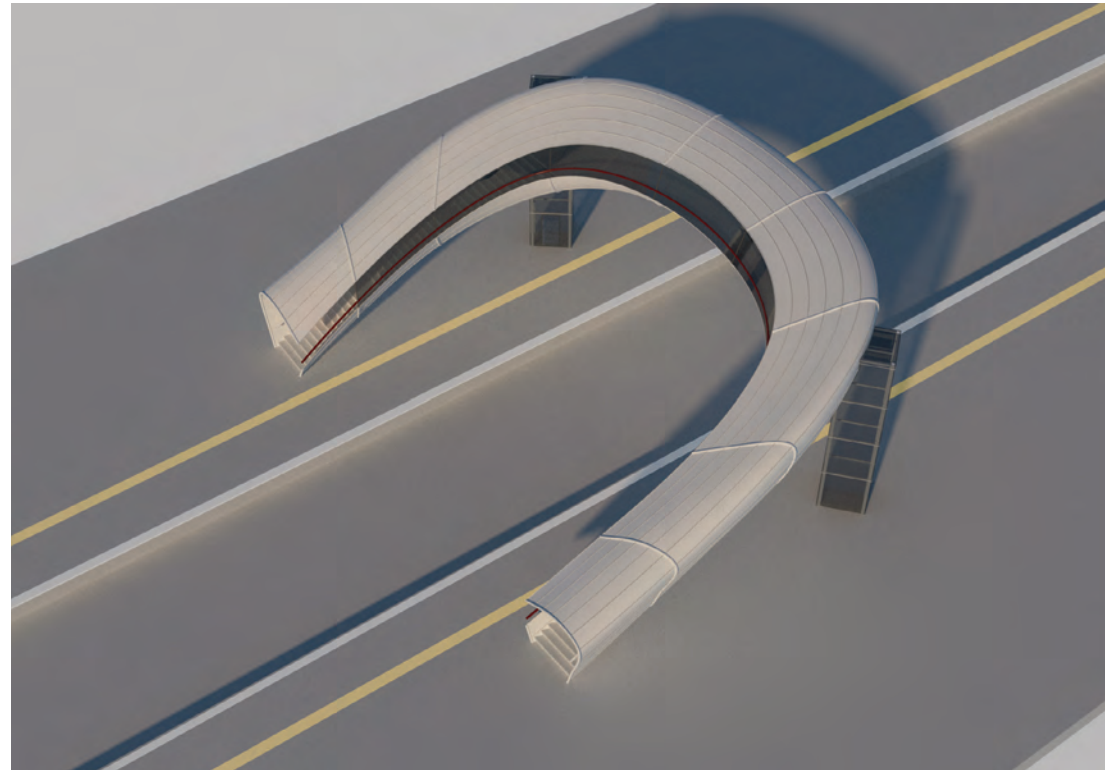


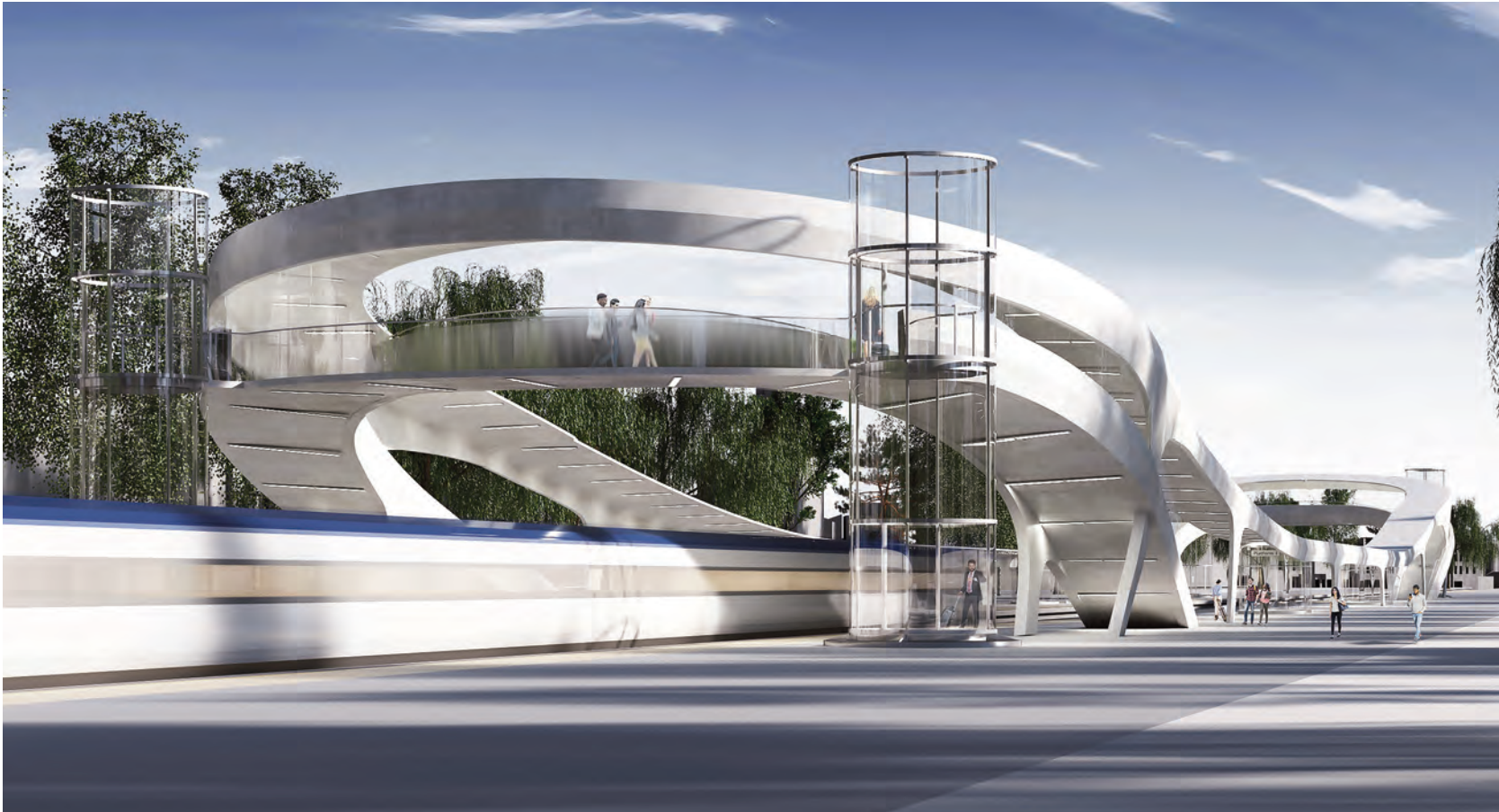
computational optimisation of different loading scenarios led to several geometric proposals for the footbridge layout. Lightweight and transparent volumes of the bridge, staircase and lifts achieve the integration of the whole system in different site scenarios. A dense array of square section steel elements is used on the sides of the footbridge, providing security and transparency. The enclosed space can host artworks by the local community. ■



## S+ Studio, Egypt

A curved-crease form combining stairs and the main span into one continuous fluid structure provides the key design element of this footbridge. The structure is connected at the upper level to lift towers rotated 45 degrees in respect to the platform. The footbridge is intended to give a dynamic experience to passengers crossing it and allows views towards trains moving below. Despite the design's modern appearance, it is inspired by the curved form of pre-British Railways steel footbridges. The footbridge is constructed by combining flat and curved sheets using robotic fabrication and emergent technologies. The low maintenance ETFE (ethylene tetrafluoroethylene) roof can be printed or fritted, to provide various levels of translucency. Solar photovoltaic cells can be integrated to enable the bridge to generate electricity. ■





## Meinhardt, UK with John McAslan and Partners

### *Access For All* Footbridge

The conventional approach to the design of the stair, link bridge and lifts in railway architecture is to express the elements as an assembly of individual components. This design addresses the problem that the stairs often appear more significant than the actual bridge in scale, by bringing all the elements of a footbridge

together into one flowing and unified construction. The stairs and span are combined into two parallel and inclined arches which extend dramatically from the intermediate landing of the stairs. The gently curving radial geometry of the footbridge assists the flow of passengers from platform to platform. This

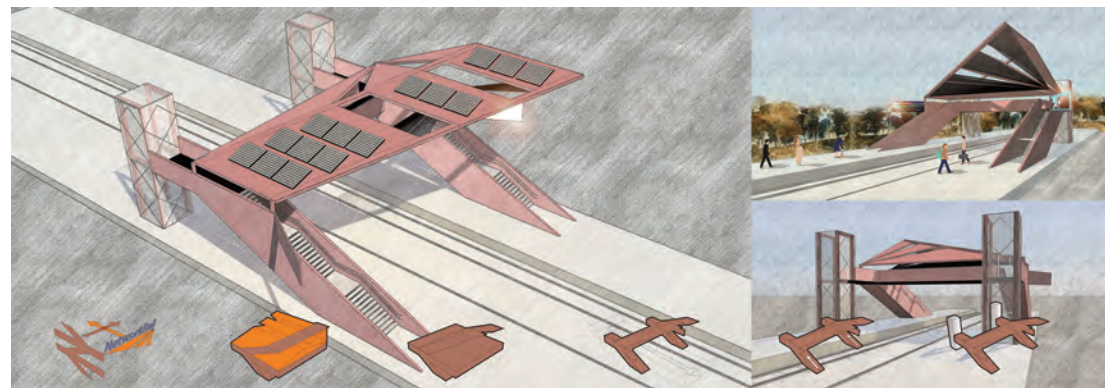
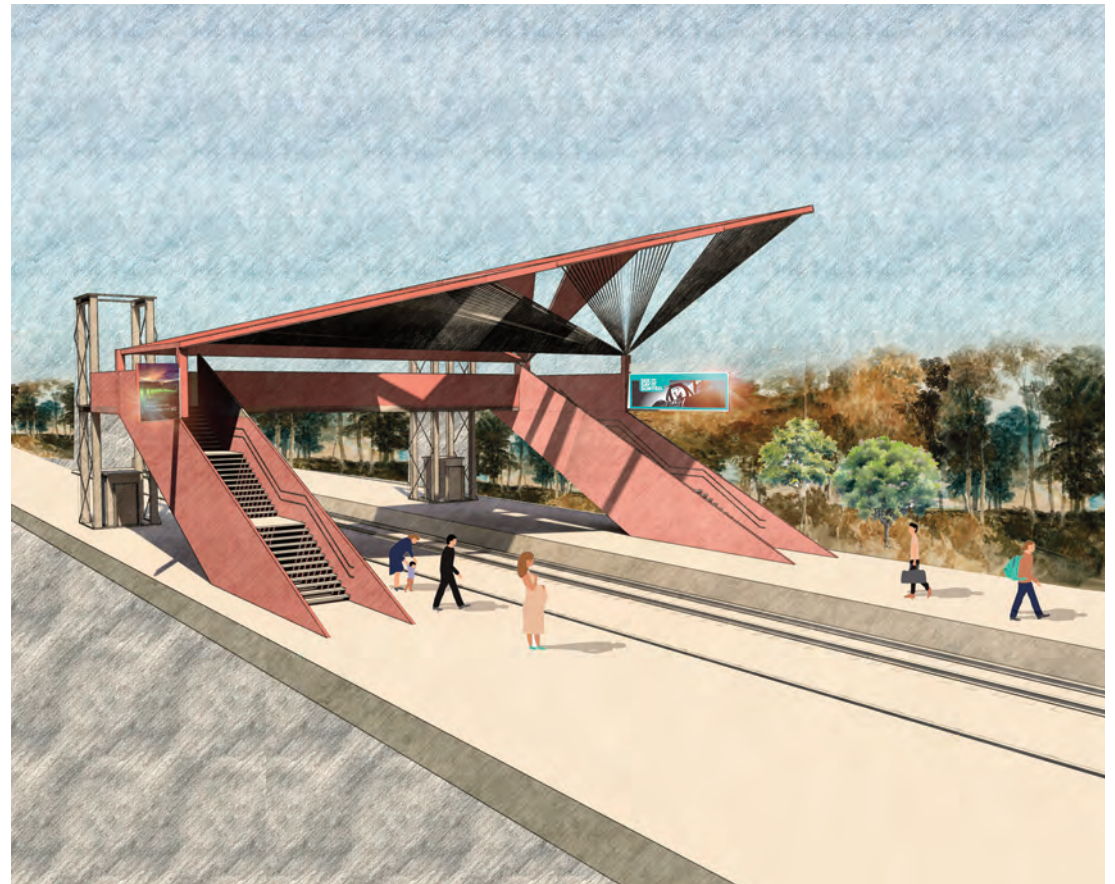
notion of continuous circulation is communicated by a sweeping structural ring beam on the inner edge of the bridge, stabilised by opposing legs. Concentrating the structure on the inside leaves the outer side of the footbridge structurally free, providing space for lift access. ■



## Tom Boyd, University of Westminster, UK

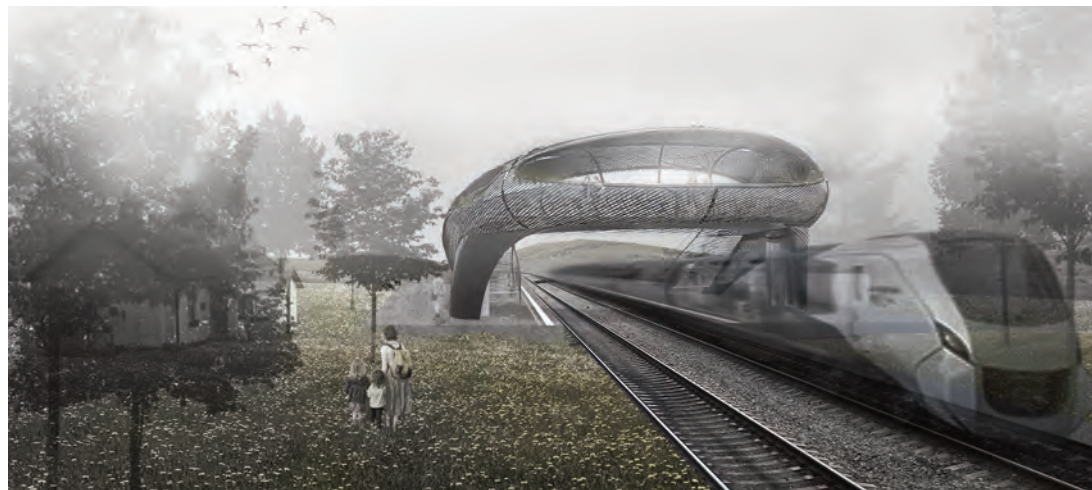
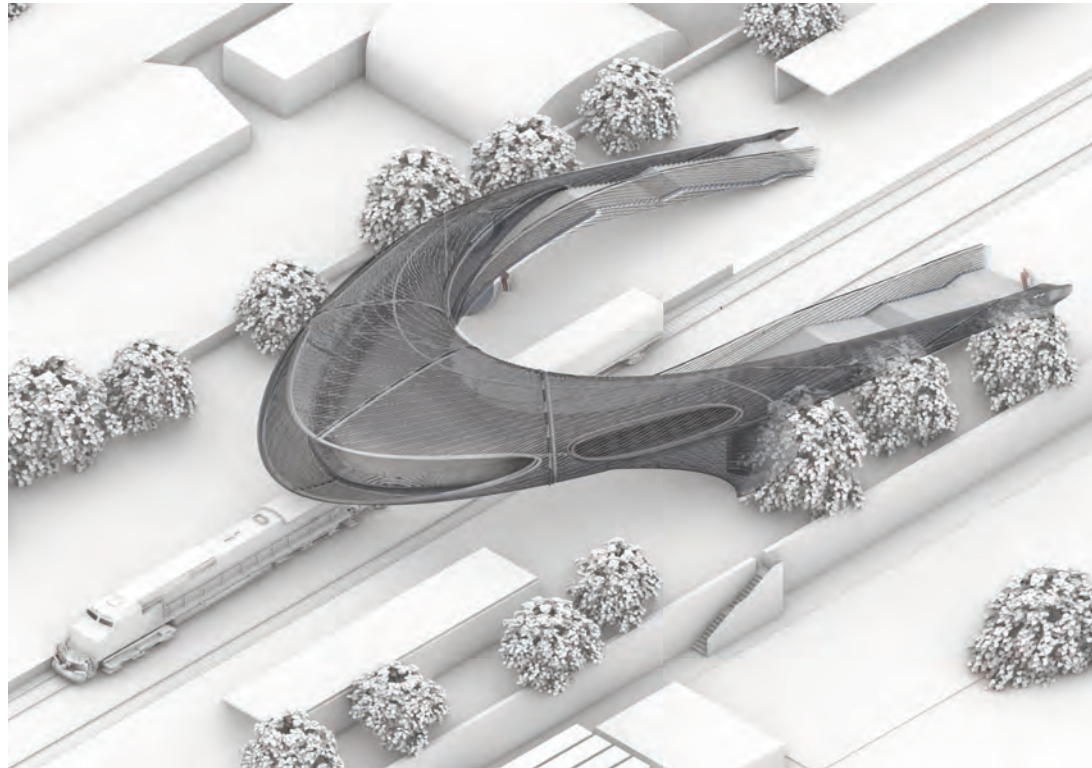
### Crow's Footbridge

The geometry of this footbridge takes inspiration from the motifs of both National Rail and Network Rail. By combining the two symbols into a singular form, a bridge, or link, can also be established between the two organisations. The side elevations of the bridge incorporate the British Rail 'double-arrow' logo, or 'crow's foot', now used as the basis of the National Rail branding, while the front and rear elevations of the bridge use the Network Rail logo, created from steel suspension cables, to inform the design. The bridge is clad in Corten steel, contrasting with the glazed lifts that provide users with views across the surrounding landscape. Solar photovoltaic panels are installed on the roof of the footbridge. ■

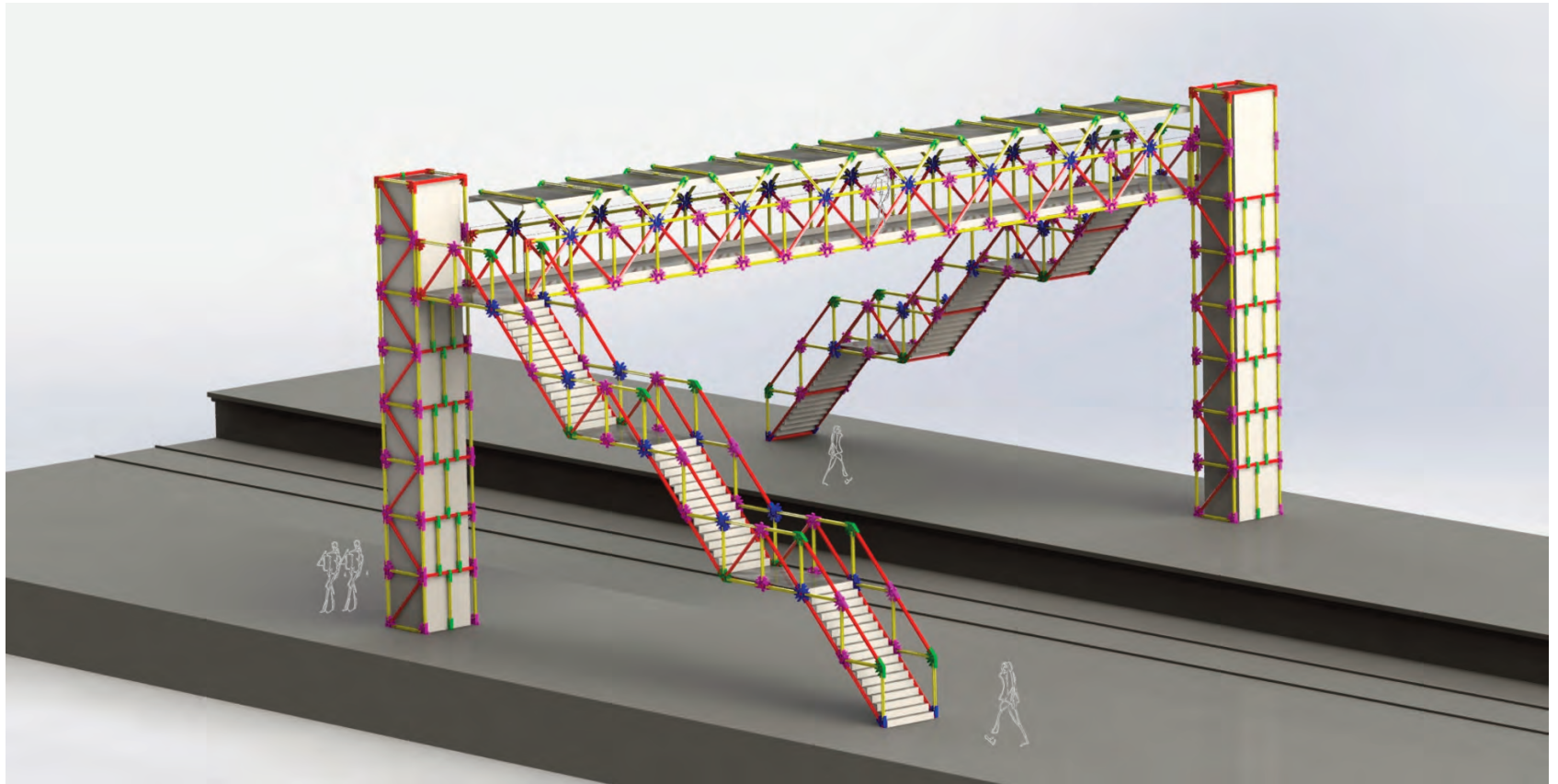


## Moller Architects, New Zealand Fluid Divergence

The Fluid Divergence footbridge presents a form that engages with contemporary methods of construction in order to achieve the experience of efficient pedestrian flow. Assembled on site with the aid of robotic arms, it challenges the orthogonal shape of traditional footbridges, hammered at 90-degree angles. Anchored by two structural legs that straddle the train tracks, its form leaps forward and opens out to host a generous viewing platform on the bridge span. Above the solidity of the station platforms and fast-moving trains below, this footbridge offers users an expansive open space within a woven carbon-fibre and polycarbonate cocoon. ■







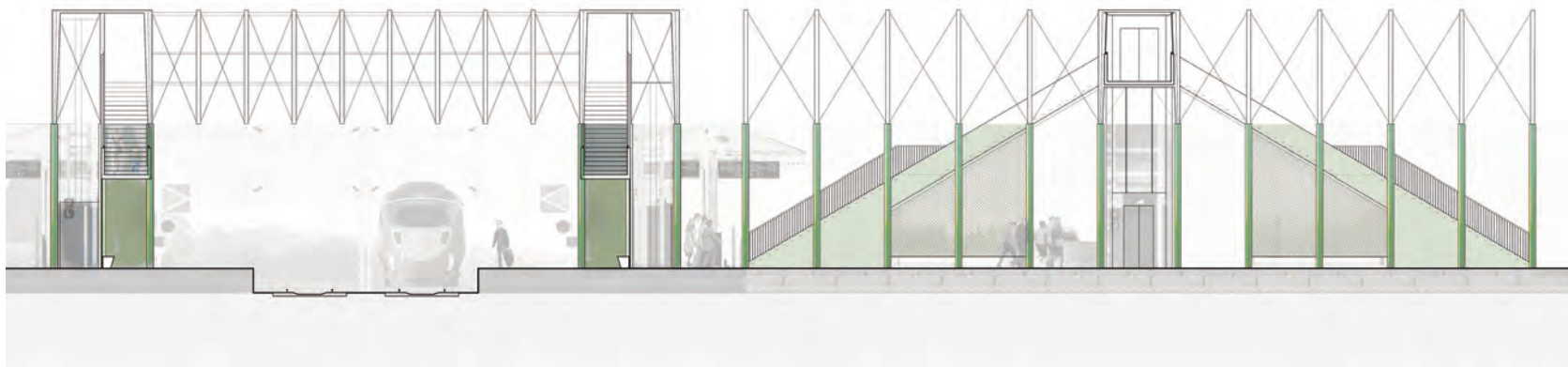
## Cake Industries, UK

The design is inspired by “k’nex”, a construction and engineering game popular since the 1990s. Fabricated from lightweight materials, the design is structurally simple; a U-frame truss exoskeleton spans the railway and is supported on structural lift cores, the trussed exoskeletons of which provide the bridge’s lateral stability. An internal shell of translucent glass reinforced polymer (GRP) creates a single skin that deals with the

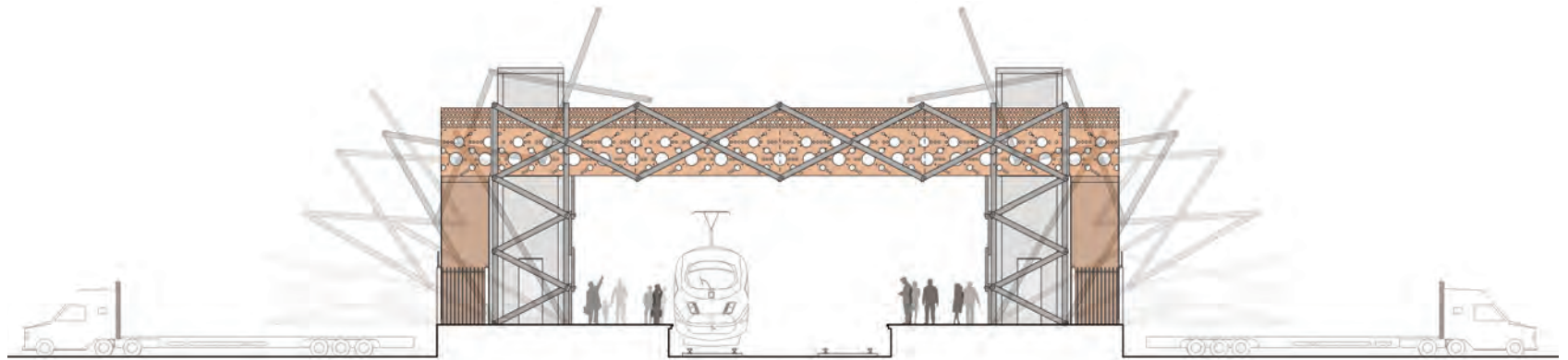
footbridge’s functional requirements as well as creating a soft glowing enclosure. LED lighting embedded in the GRP glows and changes colour to reflect the intensity of use and to direct people to the right platforms. The truss chords are fabricated from pultruded GRP cruciform sections, cut to length with an end plate. These are through-bolted to a fabricated steel connection piece to create a modular system. ■

**Feilden Clegg Bradley  
Studios, UK with Buro  
Happold Engineering**  
**Frequency Bridge**

The repeated vertical elements of this footbridge are inspired by the frequency of vibrations induced by a passing train. It is a materially efficient design, constructed as a series of A-frames with attached tension cables. The design activates more of the platform surface as an engageable spatial element; shelter is created under the stairs, delineated by a calm classical array of columns, clad according to local context, and the application of a strong colour graphic across the structure. This effectively zones the functions of the bridge - refuge or safety below and lightweight crossing above, to offer visual clarity to the two roles the footbridge offers. ■







## Andrew Paine Architecture, UK

Ease and speed of construction and maintenance and planning for end-of-life recycling or reuse are key drivers in this design. The primary structure and major secondary elements are fabricated off site. A 'pop-up' design sees the primary structure delivered as two assemblages, one on each side of the track. Their hinged base plates are bolted into groundworks, and the structures are then 'unfolded' vertically and horizontally, joining above the track to create the footbridge. The pedestrian walkway is slotted into the primary structure in prefabricated sections from platform level. Should major overhaul become necessary in future, the construction process can easily be reversed. ■







# MAKING NEW CONNECTIONS

---

# Making New Connections

## Giving Railway Design to the People

With the Footbridge Design Ideas Competition judged and Gottlieb Paludan / Strasky, Husty and Partners' Framing Bridge selected as the winner, it was time for Network Rail to formally announce the results to the world, which it duly did in December 2018. This might have marked the official end of the competition itself, but it was only one step in Network Rail's plans to improve the design of station footbridges and raise the profile of its design work in general. Network Rail's Professional Head Buildings and Architecture, Anthony Dewar, is a keen advocate for the democratisation of design, and that approach has informed the development of Network Rail's activities on its future footbridges since the completion of the Footbridge Design Ideas Competition.

The first sign of this new approach was a public exhibition at the RIBA's headquarters in London, showcasing the entries received into the Footbridge Design Ideas Competition. Not since British Rail's Design Panel ran public exhibitions of future trends in railway design during the 1960s has the British railway industry arranged an event quite like this. Organised by newly appointed Network Rail Principal Architect Frank Anatole and RIBA Competitions, the exhibition allowed visitors to admire the entries to the competition, which were featured both individually and as part of dramatic image montages. But it did more than that.

Like the Design Panel's exhibitions, the Footbridge Design Ideas Competition exhibition was designed to be both inspiring and educative. It presented a specially commissioned photographic retrospective by architectural photographer Luke O'Donovan of 100 existing Network Rail footbridges. The retrospective placed the Footbridge Design Ideas Competition in a wider context by showing visitors to the exhibition the station footbridge's design history, highlighting the long lineage of a piece of

railway infrastructure they had probably given little thought to previously. In line with the agenda to democratise Network Rail's design work, the exhibition had no entry fee.

The exhibition ran between February and April 2019, and began with a celebratory launch event attended by Network Rail's Chair Sir Peter Hendy, many of the designers behind the entries in the footbridge competition, and other special guests including Jane Priestman, Director of Architecture, Design and Environment for British Rail from 1986 to 1991. O'Donovan's photographic retrospective was made available as a limited edition book, *LINK: A study of Network Rail footbridges* with additional text by architectural historian David Lawrence, as were copies of Network Rail's recently published *Principles of Good Design*. Both have also been made available online. The two publications are helping inform and educate the public about Network Rail's renewed focus on good design as well as its design legacy.

To engage even more widely with the public, and railway users in particular, the Footbridge Design Ideas Competition exhibition subsequently transferred to London's Waterloo station and Manchester's Piccadilly station for short runs. It was also on display at the Quadrant:MK – Network Rail's Milton Keynes HQ. For those who could not visit the exhibition in person at any of its sites, RIBA Competitions created a website gallery for the competition ([www.ribacompetitions.com/networkrailfootbridge/](http://www.ribacompetitions.com/networkrailfootbridge/)), allowing anyone with a browser and internet connection, wherever they are located (particularly relevant given the global span of entries the competition attracted), to read the competition brief, meet the judges, and browse the entries. This would not be the only example of Network Rail putting its footbridge design ideas in the hands of as wide a range of people as possible.





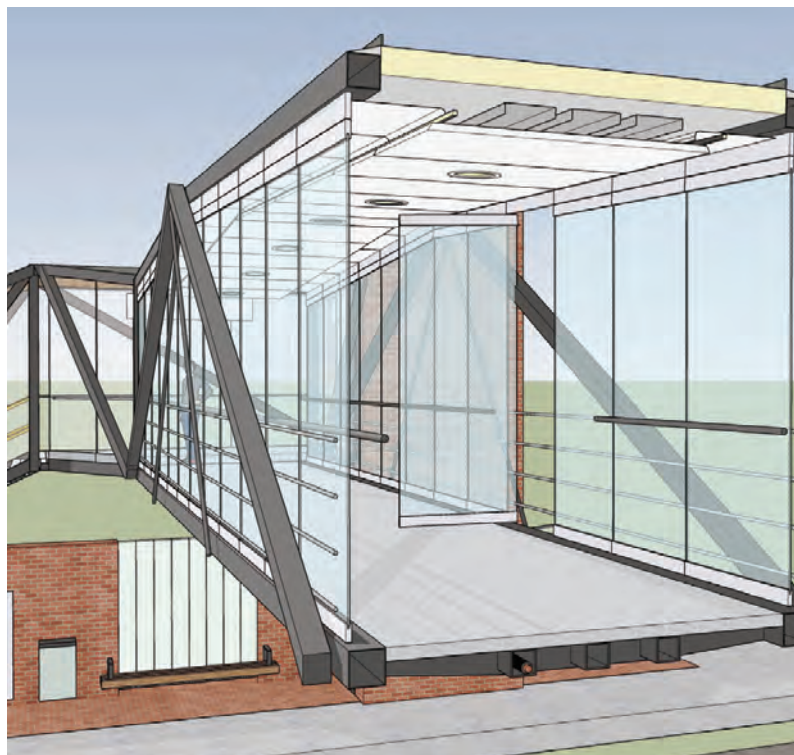
Footbridge Design Ideas Competition exhibition at RIBA headquarters, London

## Other Routes to New Footbridge Designs

As well as raising the profile of Network Rail's revived interest in high-quality design and architecture, it was hoped that the competition would lead to a design which could be added to Network Rail's new catalogue of standard footbridge designs for use at stations across the country. While the competition was one route through which the catalogue was to be populated, Network Rail was meanwhile pursuing other, more traditional, approaches to finding new footbridge designs. In the past, the railway industry often used just one standard design for infrastructure elements, and the company is keen for the catalogue to provide a choice from a range of standard footbridge designs, so that the most appropriate design for any particular location can be selected. When users and nearby residents of a station are presented with a new footbridge design, they will know that the most sympathetic choice has been made, rather than the rail industry imposing a single design solution on them, regardless of whether it truly suits the location or not.



The Beacon



Glazing on the Beacon can be cleaned from inside the footbridge

Through its existing architecture and engineering framework contracts, Network Rail had already tendered for new accessible footbridge designs suitable for installation at a variety of stations, which would also represent an improved aesthetic and experiential proposition compared to the estate of recently installed Access for All footbridges. Just as with the subsequent Footbridge Design Ideas Competition, these footbridges needed to include lifts rather than ramps for their step-free route, and to consider factors like ease of construction, maintenance access requirements, integration of services and adaptability into both roofed and roofless configurations.

Two partnerships were successful: Haskoll and Davies Maguire through the architecture framework contract, and Knight Architects and Arup through the engineering framework contract. Both met Network Rail's

aspiration as also expressed in the Footbridge Design Ideas Competition to raise expectations of the quality of future design. They both deliver the "ordinary excellence" that Dewar had also strived for in the competition. In fact, it was the publicity generated by the Footbridge Design Ideas Competition, and the raised profile of improved footbridge design it led to, which helped accelerate processes within Network Rail to ensure adoption of these two new footbridges into the catalogue of standard designs, with Anatole providing architectural advice and guidance throughout.

Both designs have a strikingly modern and attractive appearance, while retaining something of the character of earlier railway footbridges too, placing them firmly on the continuum of railway design.

Haskoll and Davies Maguire's footbridge is the Beacon (detailed on page





The Ribbon

167). Designed for deployment at smaller local and commuter stations, this elegant footbridge features a minimal steel truss for the main span, not unlike earlier truss railway footbridges. Knight Architects and Arup's design is the Ribbon (detailed on page 168) which incorporates clever angling of the lift towers, matched by the upper flights of the stairs, reducing the length of the walking route across the bridge and recalling the arched structure of earlier railway footbridges.

Both footbridges integrate wayfinding into their design, with large platform numbers displayed on the lift towers to assist passengers. This relates the two designs to another important Network Rail design project, the development of new wayfinding standards and the development of a new Rail Alphabet 2 typeface for use by Network Rail on both signage and

for web/print purposes (including this book).

They also respond to the concerns about the need for footbridge designs to be easily maintainable, which were explored in the Footbridge Design Ideas Competition. This is well illustrated by both footbridges' approach to the inclusion of glazing, which is appreciated by passengers, but can be perceived as a maintenance liability by station operators, given the difficulty of accessing the exterior of footbridges. The Beacon features hinged glazing panels which can be unlocked and opened inwards, enabling cleaning from the inside of the footbridge. Thin steel wires on the outside of the bridge prevent falls when a panel is open. The Ribbon has smaller glazed panels, which angle outwards from the footbridge across the main span, and again these are hinged to allow for easy maintenance when required.

## From The Framing Bridge to the Frame

Although entrants to the Footbridge Design Ideas Competition had been given no guarantees, it had always been one of Dewar's aims that the winning design would be capable of being worked up into a product which could be added to the catalogue of new and improved standard footbridge designs Network Rail was developing. Gottlieb Paludan's winning entry The Framing Bridge fulfilled this role admirably.

Following the conclusion of the competition, Gottlieb Paludan further refined the design to turn it into one sufficiently detailed for a contractor to build. Anatole's team (and Network Rail Architect Boaz Yariv in particular) provided input from Network Rail's side. Davies Maguire worked on the footbridge's structural engineering design. A minor refinement was to the footbridge's name, which became simply the Frame (see page 169).

One of The Framing Bridge's unusual features at the competition stage was that its covered main span was paired with uncovered staircases in the most developed version of the design - an unlikely configuration at a British railway station. Considerable thought was given to the development of both the fully covered and open versions of the footbridge. These were subsequently worked up into thoroughly considered and refined designs in their own right. The development of the connection between the staircases and the main span was particularly challenging, with Gottlieb Paludan keen to preserve the integrity of the main span's distinctive frame. The solution was staircase roofs which complement the main span but do not connect directly to it. The roofed versions of the staircases are now frame-like, with uninterrupted glazing on their sides, while the intricate parapets of the staircases detailed on the competition entry are retained on the roofless version.

Along with the Beacon and the Ribbon, the Frame completes the trio of initial designs in Network Rail's catalogue of standard footbridges. All three are now specified in Network Rail's recently published *Design Manual: Station Footbridges and Subways*, with supporting detailed design brochures available separately for each individual footbridge design. These brochures allow scheme designers who wish to use one of the footbridges on a project to understand the rationale and engineering assumptions behind each design.

**Continued on page 170 →**



The Frame



## Standard Footbridge Design

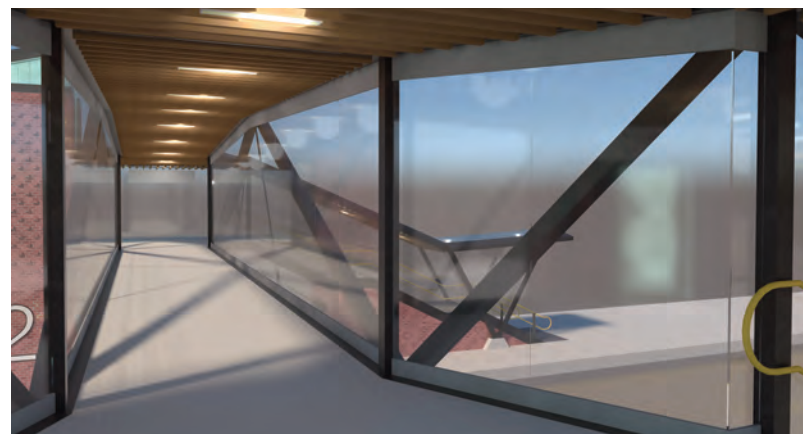
### Haskoll and Davies Maguire

#### The Beacon

This is a footbridge with a highly sophisticated appearance. An elegant and slender exposed truss forms the main span, with the design idiom of exposed structure, including the stringers, carried down the staircases. Full height glazing along the sides of the staircases and the main span gives the footbridge a light and modern appearance. The footbridge is transformed into a local landmark through the carefully considered design of the lift towers. These feature a strip of frosted glass running vertically up the front and back of the lift tower, through which the lift car can be seen moving up and down. The vertical glass strips extend into a four-sided lantern on top. With their internal lighting shining out of the glass lantern, these lift towers act as the 'beacon' from which the footbridge draws its name. This, along with the National Rail 'double arrow' logo at the top, pinpoints the location of the station within its surroundings. The lift towers feature platform number super graphics at their base to assist passengers with wayfinding within the station.

The main span is splayed at each end, with the lift and stairs set back. The extra space generated through this arrangement helps reduce congestion at the busiest parts of the footbridge, where pedestrians naturally change direction and speed. Sightlines from the main span to the lift and staircase entrances are also improved as they are not hidden behind 90-degree corners, and the full-height glazing also assists with this. The roofline of the staircase angles away from the stairs at platform level, creating an inviting entrance, and showing off the sophisticated timber slat ceilings, within which the lighting is concealed. There are no columns under the staircases between the lift towers and lift motor rooms, freeing up platform space.

Different cladding materials can be used on the lift towers and lift motor rooms. The default option is brick, detailed with a pattern of projected bricks, but local stone can be used to integrate with vernacular architecture in heritage locations. Timber and metal are other cladding options. ■



## Standard Footbridge Design

### Knight Architects and Arup

#### The Ribbon

The most obvious innovation of this footbridge is the rotation of its lift towers by 30 degrees, compared to the typical orientation of lift towers on railway station footbridges. Alongside an unusual lift door arrangement, on two adjacent rather than opposite sides, the lift entrances are rendered more visible at both platform and bridge level. Angling the upper part of the staircases, where they run alongside the lift towers, allows the stepped route across the bridge to be shortened compared to typical orthogonal footbridge layouts.

One of the aims of this footbridge is to provide a legible structure with intuitive wayfinding for all users, and the route across the footbridge for both lift and stair users is clearly visible from the platforms. Legibility is enhanced by the use of bright green for handrails, wayfinding accents and large platform number signs at the upper level of the lift towers.

In the roofed version of the footbridge, the wide butterfly roof of the main span is a notable visual feature, complemented by a parapet made of glass panels which angle outwards and give a sense of space within the footbridge. The roof is carried down the staircases as an asymmetric structure, and can be extended along the platform to form a canopied area for the display of station information. Overall, the bridge has a continuous appearance, with the canopy and deck forming two 'ribbons' rather than the footbridge's separate elements - stairs, deck and lifts - being emphasised.

At platform level a semi-sheltered waiting area, part-protected by the bridge structure above, is available for passengers waiting for the lift as well as those remaining on the platform. Seating is provided in the form of small bench seats attached to the wall of the lift motor room under the staircases.

A range of different cladding materials is available to ensure the footbridge presents an appropriate local identity. ■





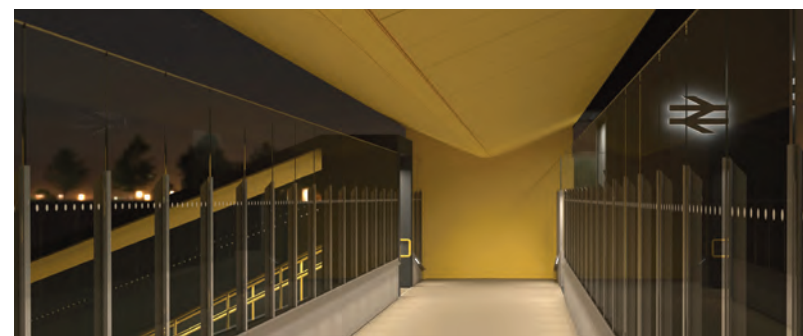
## Standard Footbridge Design

### Gottlieb Paludan Architects and Davies Maguire

#### The Frame

A development of the winning entry to the Network Rail Footbridge Design Ideas competition (see page 32), the Frame has been further refined so as to offer an elegant and contemporary version of the railway footbridge. Its minimalist design is suitable for stations both new and old; at heritage locations the design is complementary to older buildings, confidently highlighting the differences between traditional and modern.

The Frame retains the striking silhouette of the competition entry and its key design features: a high degree of visibility both out of and into the footbridge, and the extended 'wings' of the main span. These provide space for people to wait for lifts, away from stair users, or to take the opportunity to observe their surroundings from an elevated vantage point. The Frame also retains its distinctive grey and yellow colour palette, though there is an option to replace the yellow elements with pale green if desired. The colour



scheme and form of the footbridge is further enhanced at night by a sensitive lighting design, which has been significantly developed since the competition, and which works across both the roofed and unroofed versions of the footbridge.

Compared to the competition entry version, details of the parapets along the staircases and the main span of the roofed version have been altered, with a full run of glass panels now featured. The design of the top of the lift towers is also subtly different. Under the lower portion of the stairs, a lift motor room has been incorporated in line with typical British practice; it also helps prevent passengers walking into the back of the stairs. Directional signage has been added to the staircase entrances, while backlit National Rail 'double arrow' logos provide a stylish finishing touch to the lift towers. ■





Tide Mills footbridge proposal

## Better design down the line

One of the benefits of the Footbridge Design Ideas Competition was that it increased Network Rail's awareness of the design quality of its footbridges in general. This is already translating into better considered schemes, and not just at stations. Tide Mills foot crossing near Newhaven in East Sussex is one of the busiest in the county, presenting a very high risk to pedestrians. Trespass problems at the crossing are significant. The solution is a footbridge, but with the crossing located in the heart of the South Downs National Park, environmental sensitivities are particularly acute. The Ribbon footbridge's designers Knight Architects and Arup have created a high quality bespoke design for the site using local and natural materials which will weather and blend with the local coastal environment. Heavy timbers on the main span will screen the railway and Newhaven from users of the footbridge and instead frame a view out to sea over the beach and the historic ruined 'ghost' village of Tide Mills.



Ribbon footbridge proposed for Reston station





Ribbon footbridge proposed for Dawlish station

The first examples of the Beacon / Frame / Ribbon standard footbridge designs are due to start appearing by early 2022. The differing rates of progress of individual schemes makes it difficult to state with complete confidence where the first of the new designs will appear. However, plans submitted to the local council in summer 2020 for works to strengthen Dawlish sea wall in Devon, along which the railway runs, foresee a roofless version of the Ribbon footbridge being installed at Dawlish, to provide step free access at the station. A Ribbon footbridge also features in plans for a new station at Reston, recently approved by Scottish Borders Council.

A number of sites in Wales are meanwhile also developing footbridge schemes using the new catalogue of standard designs. Although Network Rail's Routes and Regions structure means that new footbridges are delivered locally, with adjustments to meet site requirements, Network Rail Principal Architect Frank Anatole keeps a watching brief on architectural developments from the corporate centre to ensure the new standards are upheld. This includes attendance at Network Rail's Design Advice Panel (one of Dewar's innovations) which gives input into significant infrastructure schemes.



Screenshot from ARki app showing the Ribbon design superimposed on New Cross Gate station

## Virtual Realities

While Network Rail's *Design Manual: Station Footbridges and Subways* and the individual design brochures for each of the three standard footbridges are aimed at an internal railway audience, Network Rail's ideology of democratising railway design has led to an alternative approach to engage public interest in the new catalogue of standard footbridge designs. It literally puts Network Rail's new footbridge designs in the hands of the public via a free smartphone app.

A collaboration with app developers Darf Design has seen the Ribbon, Beacon and Frame added to ARki, an app which allows users to explore three-dimensional computer models of buildings and other structures. The app features visualisations of the footbridges in both roofed and open configurations and allows users to view them from all angles, and change their cladding materials and colours. Users are not simply limited to visualising the footbridges in the abstract; ARki is an augmented reality app,



which can use the phone's built-in camera to overlay the footbridges onto the real world. This means that anyone with access to the app - from designers to passengers and local residents - can see how one of the standard catalogue footbridges would appear if installed onto an actual station. It is the first time Network Rail has ever released its architectural proposals into the public domain in this way.

ARki also provides a glimpse further into the future, because users are discovering that it features not just the three standard footbridges - Beacon / Ribbon / Frame - but an additional design too. Radically different in appearance to the other three, this is Futura, and its development exemplifies the different approach that Network Rail is taking to the development of its next standard footbridge designs, still at concept stage, for the catalogue.

ARki and the Network Rail footbridges - Futura in particular - reached a global audience in April 2021 when the app was showcased as part of the Apple Event which launched the new iPad Pro, making it perhaps the most viewed Network Rail footbridge design in history.

## Expanding the Catalogue: Concept Footbridges

Network Rail is developing its next standard footbridge designs through physical prototyping. Physical prototyping of concept designs has become somewhat less common in the privatised rail industry, but was used more frequently during the nationalised era, to try out concepts in real-world situations, and gain feedback from potential users.

The 1960s XP64 concept train and 1970s prototype commuter PEP trains, for instance, gave British Railways/Rail and its Design Panel the chance to test new passenger facilities and travelling environments. Railway infrastructure has been prototyped too; in its earliest days British Railways took on and developed a London, Midland and Scottish Railway concept for a "unit station", and later prototyped the Mod-X standard station building at East Didsbury in Manchester in the 1950s. A rare but more recent example from the modern privatised railway industry was Network Rail's building of

an off-network prototype of its 'modular station' in Hampshire, in the late 2000s.

It was understood and accepted that not every feature of these prototype designs would translate to series production examples, but the initial concepts allowed the rail industry to engage with passengers, as well as more generally promoting wider public understanding of the railway industry's developing design ideas. They allowed for the best elements of the designs to be taken forward while less successful features could be discarded. Increased scrutiny of railway industry costs from both funders and the wider public have perhaps made it more difficult in recent years to fund prototypes which might be mis-characterised as "failed" if particular design elements are not translated into production versions. However, the usefulness of having a physical prototype to test and display to interested parties cannot be underestimated.

Network Rail has returned to this approach of prototyping concept designs to inform the development of what it intends will be the next two standard footbridge designs for its catalogue. Both represent dramatic departures from the traditional railway footbridge in terms of materials and manufacturing, and are currently subject to intense research and

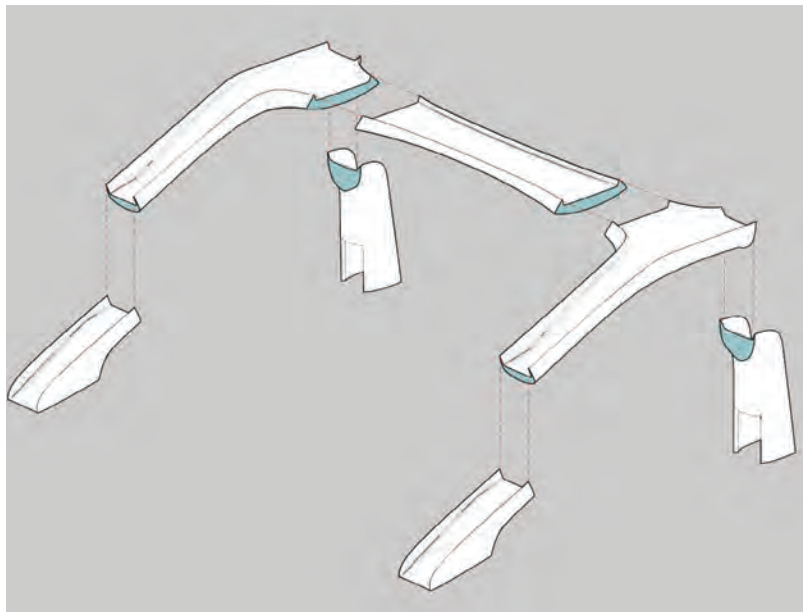


Installation of FRP bridge at St Austell

development work; work that was made possible after the Footbridge Design Ideas Competition improved the awareness among funders and stakeholders of future design possibilities for railway footbridges. The mechanisms through which these two designs, the Futura and AVA footbridges, are being pursued are also unusual for Network Rail.

## Modern Materials: Futura

Futura has already made it into the public domain via the ARki app, and its official launch came in September 2020, with Network Rail joining the National Composites Centre (NCC) as a member, to jointly develop Futura alongside its designers Marks Barfield Architects and COWI. The footbridge, which makes extensive use of fibre reinforced polymer (FRP) for its structure, will be developed into a full-size prototype, and is a project in which Network Rail Principal Engineer and footbridge competition judge Ian Grimes has remained closely involved.



Module assembly for Futura

Although FRP is widely used in some UK industries already, including yacht-building and Formula 1, there is not yet a fully mature FRP structures industry. Network Rail's collaboration with the NCC is set to help change this. The NCC is the UK's lead composites engineering research and development body and part of the 'Catapult' network overseen by government-funded public body UKRI. Its involvement in the Futura project not only allows for construction of the footbridge prototype, but, through its role in promoting composites technologies, is intended to help the wider development of the UK FRP structures industry itself.

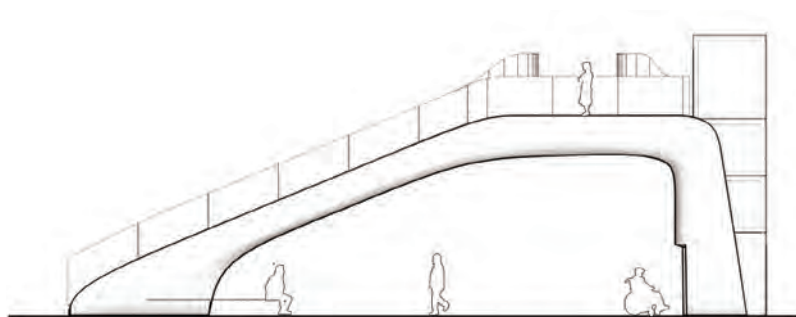
It is not the first time that FRP has been used for a railway footbridge. A small, non-station footbridge over the railway at St Austell in Cornwall was installed in 2007 (see page 173). And in 2012 the Grade II listed but life-expired steel footbridge at Dawlish station in Devon was replaced by an FRP replica weighing only one-third of the original.

However, this is the first time that an FRP footbridge has been developed by Network Rail as a standard design, rather than a one-off, and Futura will be by far the most dramatic application of FRP as a structural material for railway footbridges. If its design looks familiar, that is because the Futura footbridge is a development of Marks Barfield Architects / COWI's unnamed long-listed entry into the competition.

Using FRP as Futura's main structural material allows for a futuristic, flowing design (detailed on page 176), in which each element of the footbridge merges into the next. Although the competition entry suggested forming the FRP by using moulds, further development work has led to an alternative approach in which a machined foam core will be wrapped in fibres with resin then injected into the wrap. This is the approach used in many other FRP products, and offers more flexibility to accommodate different bridge lengths, for instance, than would be the case if moulds were used.

Because FRP is much more lightweight than traditional footbridge structural materials, without any loss of strength, the footbridge is easier to transport to site. A Futura will arrive on site in just seven premade modules that connect together, making it quick to install, without the need for such extensive foundations as traditional footbridges. On a full-life analysis, it is expected to be less costly than a traditional footbridge due to significantly reduced maintenance requirements, and its construction process will emit much less carbon dioxide than that for traditional footbridges. The railway





Futura

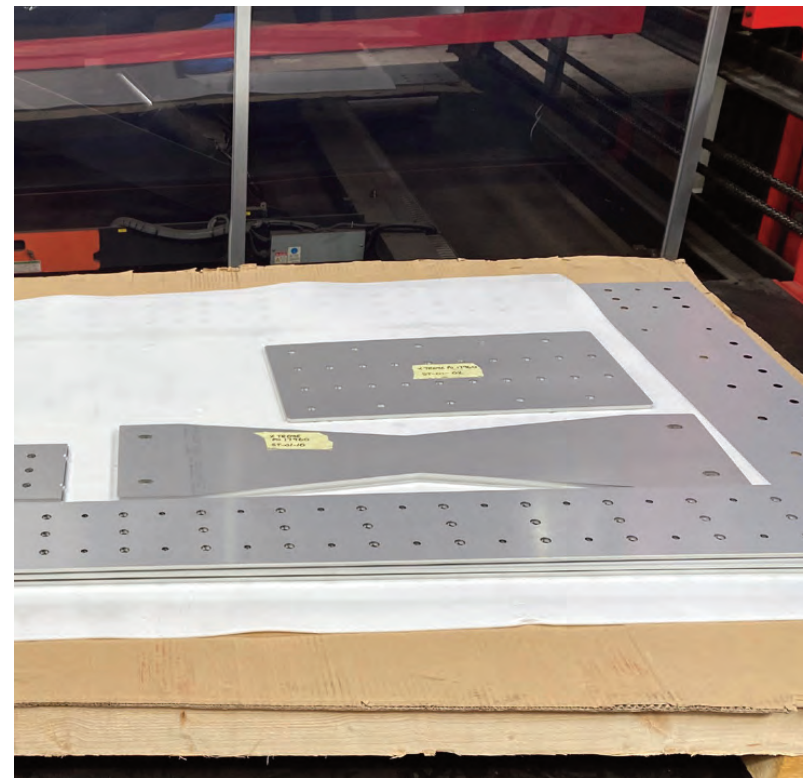
industry will need to play its part in reducing its overall carbon emissions as part of the national move to net-zero, and the use of FRP for structures could make a significant impact in this area of activity.

The prototype will allow the concepts and thinking behind Futura to be fully tested, but may also pave the way for an eventual roll out of FRP footbridges across the Network Rail estate. Development of composite materials for footbridge construction is a key area of interest for Network Rail, and the company is also supporting development of another FRP footbridge design for use at level crossings or foot crossings, at non-station locations. With the help of nearly £400,000 from the UK government's Small Business Research Initiative Rail Demonstrations: First of a Kind 2020 competition, designer and manufacturer AUS developed an FRP footbridge which uses no adhesives nor steel connectors in its construction at all.

## Modern Manufacturing: AVA

The other potential addition to Network Rail's standard catalogue is AVA (detailed on page 177), which is being developed for Network Rail's small and medium-sized stations. While Futura's innovation lies in the material used in its construction AVA's innovation stems from its method of manufacture. The process for creating AVA is as far removed from traditional footbridge construction as anything Network Rail has done to date.

AVA is made from stainless steel which is being used in a radically different approach to traditional footbridge construction. While traditional footbridges are constructed from many smaller pieces, built up to create a



AVA will be constructed from laser cut stainless steel sheeting

large structure, AVA is better described as being manufactured. Large sheets of stainless steel are precision cut with lasers, and then folded up by robotic manipulators to create the elements of the bridge, like giant metal origami. These elements are then attached to each other by steel pin-in-block connections. Despite the AVA footbridge being made of metal, the plan is that it will not feature a single weld.

The concept might sound futuristic but it has already been proved entirely viable through the manufacturing of a full-size section of an AVA main span. The shapes that can be created with this cutting/folding approach are surprisingly complex.

**Continued on page 178 →**

## Concept Footbridge Design

### Marks Barfield Architects and COWI, with the National Composites Centre and Network Rail

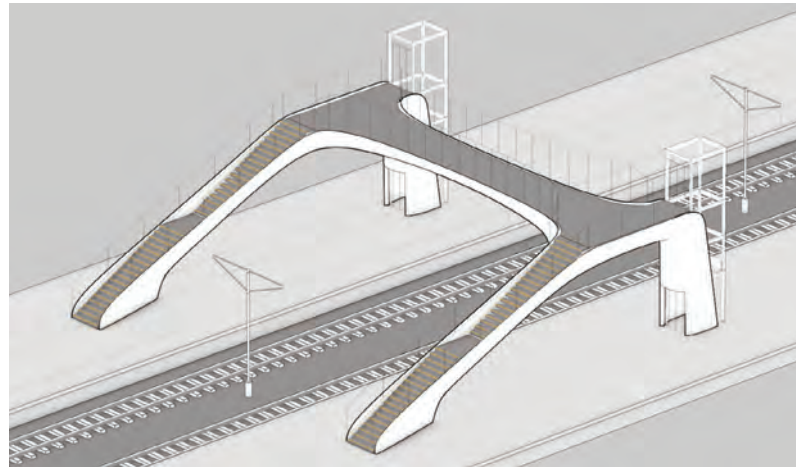
#### Futura

Futura retains the sleek, organic curves of the long-listed entry from Marks Barfield Architects and COWI (see page 50), now selected by Network Rail for further development via the National Composites Centre. Although design work is ongoing and the final design is subject to change from the images here, its appearance is expected to remain similar to that of the competition entry. Its flowing sculptural form is a complete departure from typical railway footbridges and represents a new design idiom for these structures.

The use of FRP as a structural material, wrapped around a machined foam core, means that Futura is much more lightweight than typical steel and masonry railway footbridges. This simplifies the foundations for the footbridge and makes installation easier and quicker. An FRP footbridge also needs less maintenance across its lifetime than that of a traditional footbridge. Passengers, however, are more likely to notice the lack of columns underneath the bridge resulting from its lighter weight, freeing up platform space below. Lighting integrated into the underside of the footbridge illuminates these areas.

The footbridge can be easily configured to adapt to site constraints, the foam core is machined to whatever height, length or width is desired, before it is wrapped in its FRP exterior. The finish of the bridge will be of a high quality, and, in line with the low-maintenance philosophy, options are being investigated for finishes with a lifespan of up to 60 years. Although the white finish seen in the concept images is an attractive option, other colours can be used.

Futura is finished with parapets formed of glass panels; these are full height in the covered version of the footbridge. Although the glass-clad steel lift towers illustrated remain under consideration for the final design, an alternative option uses the curve-fronted all-in-one lift tower modules being developed as part of the AVA footbridge (see opposite). ■





## Concept Footbridge Design

**Expedition, Hawkins\Brown, Walker Construction, X-treme, SCX, Atelier Ten, The MTC, Norman Foster Foundation, Quantum Infrastructure and Network Rail**

### AVA

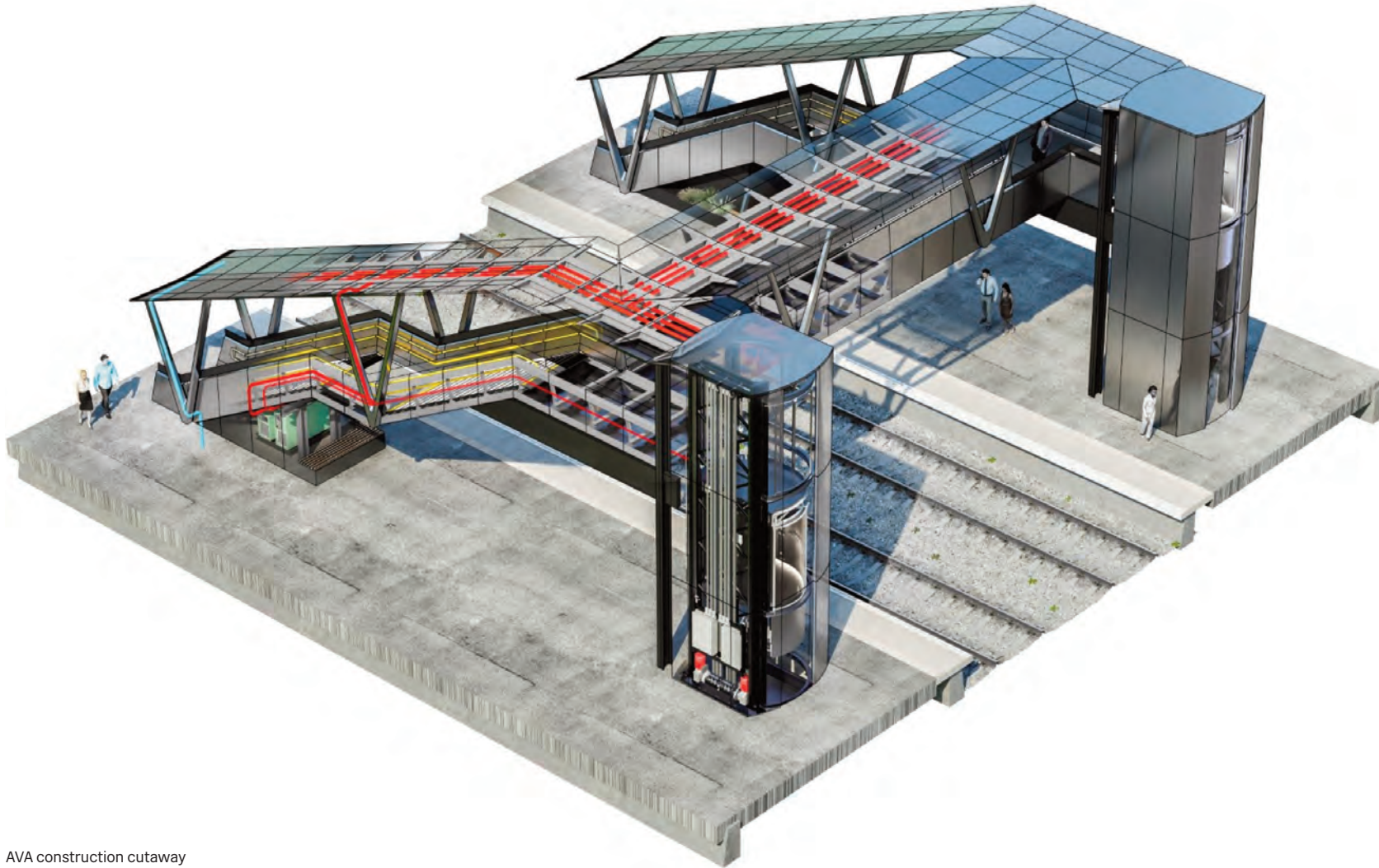
AVA's design has evolved through an iterative process which has seen various design options developed, refined, discarded or prototyped at full size. The use of stainless steel as the main material and an intriguing manufacturing process (see page 175) have combined to inform the development of the design for this lightweight footbridge. The final design envisages an uncompromisingly modern appearance. Angles and inclined planes abound, along with distinctively slender V-shaped structural elements. The lift towers – all-in-one modules in their own right – have a metal-clad curved exterior, contrasting with the angular design of the rest of the bridge.



A glazing strip runs along the main bridge span, attached to a metal parapet and sitting behind the V-shaped elements. Above the glazing strip the bridge is open, as it is along the sides of the staircases, above parapet height.

Stainless steel presents challenges when used on buildings of this scale. Despite its name it can stain over time when exposed to wet weather, potentially presenting an off-putting and low-quality appearance. It is also highly reflective and, in a railway environment, could give rise to dangerous glare that might dazzle train drivers. However, both issues have been cleverly addressed by glass bead-blasting the stainless steel to give a high-quality finish which is both non-reflective and weather resistant. ■





AVA construction cutaway

The manufacturing of the test section has been followed by ongoing refinement of the appearance of the footbridge as it moves towards a complete physical prototype.

AVA is being developed by a consortium comprising Expedition, Hawkins\Brown, Walker Construction, X-treme, SCX, Atelier Ten, The MTC,

Norman Foster Foundation, Quantum Infrastructure and Network Rail. The MTC (Manufacturing Technology Centre) is another Catapult centre, this one dedicated to developing innovative manufacturing processes and technologies. The project is part of the UK government-supported Transport Infrastructure Efficiency Strategy (TIES) Living Lab initiative, which is



promoting the adoption of innovative approaches to the construction of all transport infrastructure in the UK, not just in the rail sector.

A key innovation of AVA is the almost infinite adaptability of its design. Until now most railway footbridges have had to be built as bespoke products, or at least significantly redesigned from their template, to fit into the varied locations they find themselves. Any lengthening or widening of staircases or spans could require substantial reworking of the structural elements they are made from. Because AVA is built by laser-cutting sheet metal, there is no pre-existing stock of structural elements; the footbridge is built from scratch each time, meaning staircase widths, span length and widths, and overall height of the footbridge are completely adjustable, down to very fine increments, to provide the perfect fit for each location.

This adjustment process is controlled through a “Bridge Configurator” tool - a computer package which allows the dimensions of an AVA bridge to be dictated before manufacturing commences. Once decided, the sheet metal is simply cut to match the dimensions requested. It is analogous to the way that online kitchen planners have revolutionised the purchase of made-to-measure kitchens suitable for any size of room, but on a wholly different scale.

Like Futura, AVA’s design is lightweight, and it will do away with the traditional (and costly) deep foundations required for traditional railway footbridges. Instead, it will be mounted on screw piles. It is expected that AVA could be up to a third cheaper than some of Network Rail’s earlier footbridges.

As well as leading to a new footbridge design for Network Rail, the project is expected to have wider spin-offs. One element of the AVA design is a first-of-a-kind all-in-one lift module from consortium member SCX, designed to be significantly more reliable than current railway station lifts. This module comprises not only a lift tower, but the lift car inside, along with all the necessary drive systems. Such lift modules will be fully assembled and tested at the factory prior to transport to site as a single item.

Through the TIES Living Lab initiative, it is possible that AVA could find roles outside the railway industry. Highways England and Transport for London are amongst the TIES Living Lab partners and the AVA footbridge product might eventually prove itself useful for them too; democratising railway design indeed.



One of the winning entries in the “Sitting Pretty” station bench competition:  
Lacuna, London Waterloo

## Further Competitions

When the Footbridge Design Ideas Competition was launched, no-one knew how much interest it would generate, nor whether it would be successful in leading to new designs of footbridge with practical applicability to the British railway network. Its unqualified success has shown it to be an appropriate way of bringing new design ideas to the railway industry and it has been followed by a series of subsequent Network Rail design competitions. These



have covered subjects as diverse as station benches, passenger experience interventions and an exhibition display unit for use at London Euston station.

In May 2021 it was announced that Edinburgh-based 7N Architects with Arup, Gardiner and Theobald and Lisa Mackenzie Landscape Architect had won the Network Rail/RIBA Competitions design competition “Re-imagining Railway Stations”. Launched in summer 2020, it sought inspiring and creative new ideas for the design of small and medium-sized railway stations and like the Footbridge Design Ideas Competition, it was open to all. The competition was informed by a series of “ThinkStation” workshops organised in advance of the competition by Design Council, the Government’s advisor on design, which also administers Network Rail’s Design Advice Panel, an advisory body on design aspects of Network Rail’s major projects. Again, like the Footbridge Design Ideas Competition, “Re-imagining Railway Stations” was backed up with a photographic retrospective and historical overview. This time, earlier British attempts to develop new designs of small and medium sized railway stations were detailed in the book *HUB: Making places for people and trains* by Luke O’Donovan and David Lawrence.

## A Risk Worth Taking

The Footbridge Design Ideas Competition was a risk for Network Rail, but one which has paid off handsomely. It has given architects and designers new to the rail industry an opportunity to demonstrate their ideas. It happened because the company was brave enough to take a different approach in its pursuit of high-quality design. The designers of the footbridges which Network Rail has developed (or is developing) for its catalogue of standard designs, speak highly of Network Rail as a client. The company is regularly described as positive, open and keen to hear designers’ ideas, even when these challenge rail industry norms.

This book, and the Footbridge Design Ideas Competition are a celebration of the power of imagination; the creativity of taking a piece of railway infrastructure as apparently simple as a footbridge, and daring to ask, “What if...?” It is not just the professional dreamers at architecture, engineering and design companies who have asked this question, but Network Rail itself. Britain’s rail infrastructure owner is back in the railway design game. ■



## Image sources

Images of footbridge designs p25, p32-159 supplied by entrants to the Network Rail Footbridge Design Ideas Competition, administered by RIBA Competitions.

Images of footbridge designs p164-169, p174-178 supplied by designers via Network Rail.

Exhibition launch event photography  
© Stonehouse Photographic on behalf of Network Rail  
p23, p163

© Daniel Wright  
p10-12, p15-17, p179, p183

© Andrew Garnett  
p14

Network Rail  
p13, p15 (Chirk), p16 (Cambridge North), p20, p21, p170-173, p180

RIBA Competitions  
p26-28

## Bibliography

Weston Williamson + Partners on behalf of Network Rail, *Network Rail Design Manual, Station Footbridges and Subways* [Document NR/GN/CIV/200/07] (n.p.: Network Rail, 2020)

Thornton, Robert and Wood, Malcolm: *The Architecture and Legacy of British Railway Buildings* (Marlborough: The Crowood Press, 2020)

Lawrence, David: *British Rail Architecture 1948-97* (Manchester: Crécy Publishing, 2018)

Lawrence, David and O'Donovan, Luke: *LINK: A study of Network Rail footbridges* (London: Network Rail, 2019)

Lawrence, David and O'Donovan, Luke: *HUB: Making places for people and trains* (London: Network Rail, 2020)

## Web resources

<https://www.ribacompetitions.com/networkrailfootbridge/> accessed January 2021

<https://www.gov.uk/government/collections/access-for-all-programme> accessed January 2021

<https://www.gov.uk/government/publications/access-for-all-stations> accessed January 2021

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/3188/Stations\\_in\\_England\\_and\\_Wales.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/3188/Stations_in_England_and_Wales.pdf) accessed January 2021

<https://webarchive.nationalarchives.gov.uk/2012015090904/http://assets.dft.gov.uk/publications/railways-for-all-strategy/railways-for-all-strategy.pdf> accessed January 2021

[https://www.telford.gov.uk/info/20490/telford\\_central\\_footbridge/3385/project\\_overview](https://www.telford.gov.uk/info/20490/telford_central_footbridge/3385/project_overview) accessed January 2021

<https://commonslibrary.parliament.uk/how-accessible-are-britains-railway-stations/> accessed March 2021

<https://research.historicengland.org.uk/redirect.aspx?id=7008%7C%20Historic%20Railway%20Buildings%20and%20Structures%20overview%20of%20development%20pressure%20and%20review%20of%20significance%20Volume%202> accessed March 2021

<https://www.nccuk.com/news/ncc-partner-with-network-rail/> accessed March 2021

<https://www.aus.co.uk/news/post/huddersfield-company-creates-innovative-life-saving-footbridge-for-rail-crossings/> accessed March 2021

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/892665/Competition\\_Results\\_-\\_SBRI\\_Rail\\_Demonstrations\\_-\\_First\\_of\\_a\\_Kind\\_2020.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/892665/Competition_Results_-_SBRI_Rail_Demonstrations_-_First_of_a_Kind_2020.pdf) accessed March 2021

<https://www.networkrail.co.uk/communities/passengers/station-improvements/access-for-all-improving-accessibility-at-railway-stations-nationwide/> accessed April 2021

## Connections – The Network Rail Footbridge Design Ideas Competition

**Published in a limited edition of 250**  
**ISBN 978-1-5272-9512-4**

**Foreword**

© Anthony Dewar and Frank Anatole

**Main text**

© Daniel Wright

**Adjudication Panel commentary  
and observations**

© RIBA Competitions / Jonathan McDowell

**Endpaper montages**

Christopher Thorp, RIBA Competitions

**Book design and production**

Natalie Clarke

**Editing and project management**

Anne Sayer

**Specialist advice**

Andrew Garnett

**Acknowledgements**

Particular thanks for their help in providing  
input and/or material for this book are due to:

Anthony Dewar at Network Rail

Simran Chadha, Catherine Horwill and  
Sabina Mohideen at Design Council

James Porter at RIBA Competitions

Jonathan McDowell at Matter Architecture

Competition management services for the  
Network Rail Footbridge Design Ideas  
Competition were provided by RIBA  
Competitions

Network Rail Infrastructure Limited  
1 Eversholt Street  
London NW1 2DN

Tel: 03308 578000  
networkrail.co.uk

Company number: 2904587  
Registered in England and Wales

This book was commissioned by Design  
Council and is copyright © 2021 Network Rail

This book is typeset in Rail Alphabet 2,  
designed by Margaret Calvert and Henrik Kubel  
for Network Rail

The author has made every effort to ensure  
that all information used in the production of  
this book has been checked and verified.  
However, corrections and clarifications are  
welcome and can be submitted to  
changesquared@gmail.com for incorporation  
in any future edition.







Tynemouth Metro station, originally built circa 1882 for the North Eastern Railway

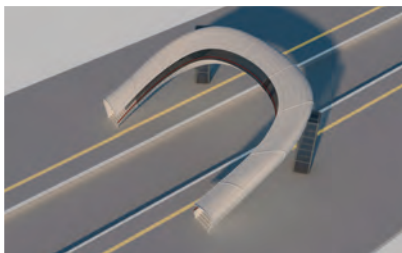
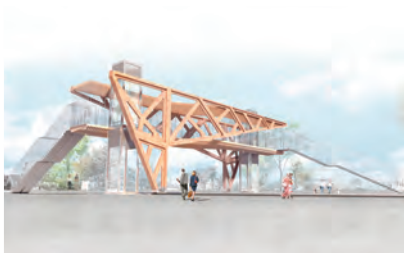
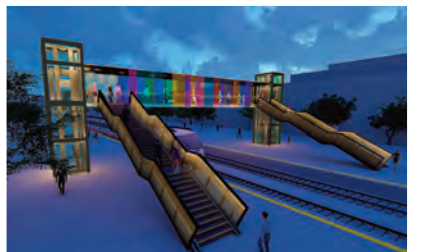
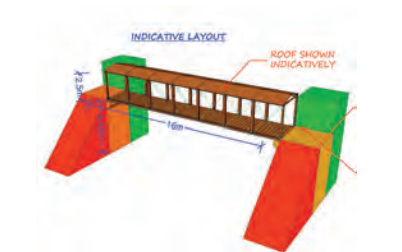
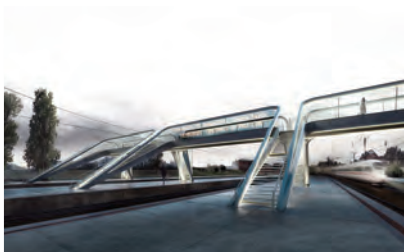
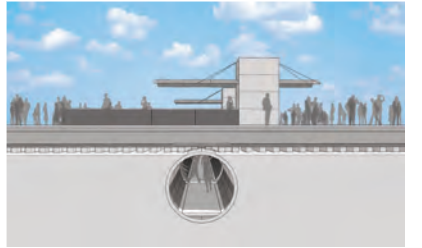
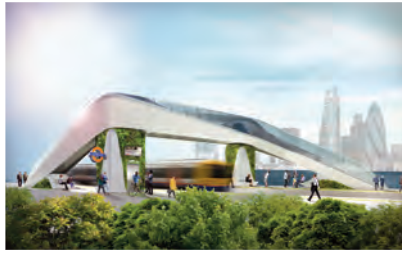
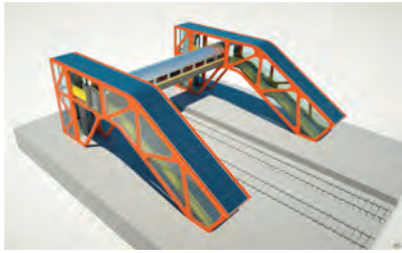
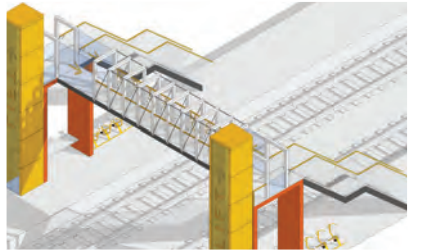
## About the author



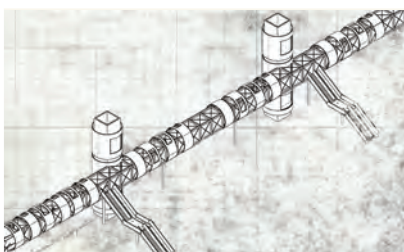
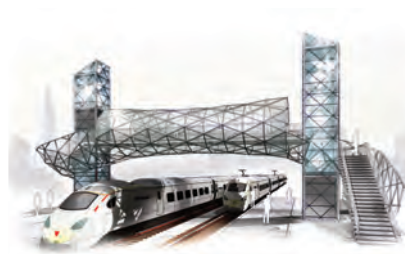
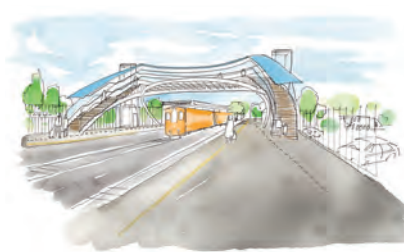
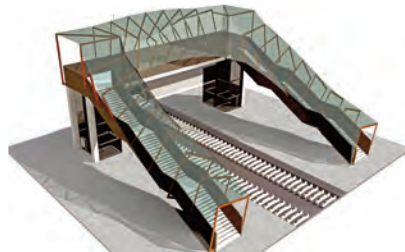
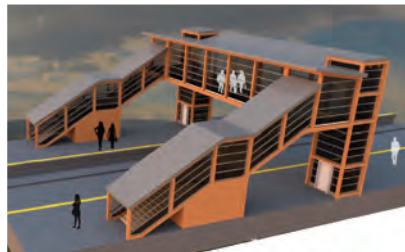
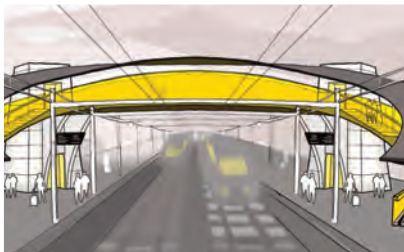
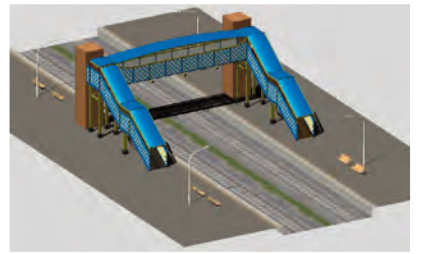
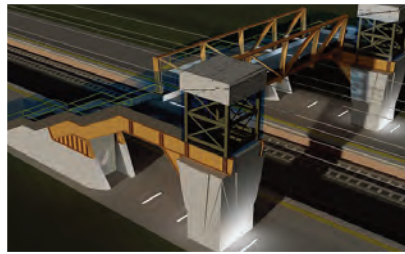
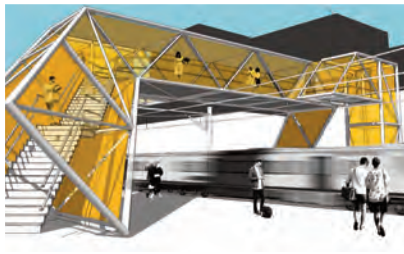
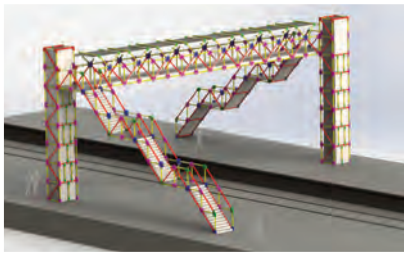
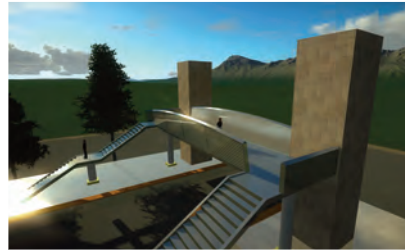
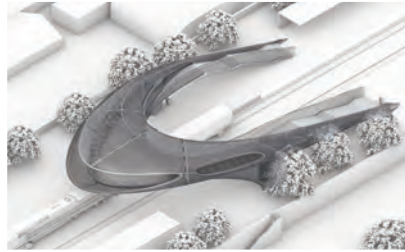
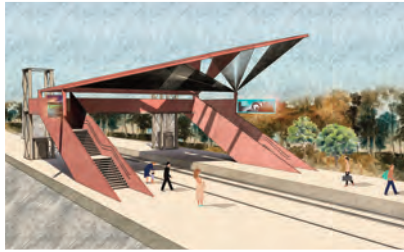
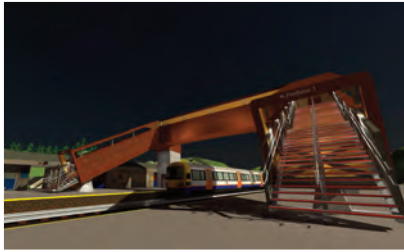
Daniel Wright has a lifelong love of railways and transport in general, and a particular interest in transport architecture. His favourite station is Los Angeles Union Passenger Terminal and his favourite footbridge is at Tynemouth station on the Tyne and Wear Metro. He holds a First Class Honours degree in Transport Management. After working as a transport journalist and a transport planner for a number of years he launched transport architecture and design website *The Beauty of Transport* in 2012, which he continues to write.

[thebeautyoftransport.com](http://thebeautyoftransport.com)











**Design  
Council**

**RIBA**   
Architecture.com

ISBN: 978-1-5272-9512-4



9 781527 295124 >

