

NR/L2/CIV/003/Form D: Architectural and layout acceptance				
Document reference	160474-TAZ-OXF-DCL-FOD-EAR-010001	Revision	A04	
Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

DESIGN AND ACCESS STATEMENT

INTRODUCTION AND PROPOSAL DETAILS

This project proposes a fully accessible footbridge as a permanent replacement for the level crossing immediately south of Tackley Railway Station. Currently, the level crossing has been closed owing to significant safety concerns; the section of railway immediately south of the station passes through a large radius curve with a maximum permitted speed of 110mph, meaning that trains approach the level crossing at high speed with little warning. This has resulted in a high frequency of incidents on the level crossing, with it identified as one of the most dangerous crossings on the Wales and Western network and therefore one of the highest priority crossings for replacement. Currently, the crossing has been replaced with a temporary scaffold footbridge located immediately north of the station, however this does not offer step free access between platforms. Also, the level crossing served both a bridleway and a national cycle route – the existing temporary footbridge is inadequate for both equestrian and cycle use.

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This option proposes constructing the new permanent footbridge on the northern platform ends, where the current temporary structure is located. This would offer more convenient passenger access when in use but would necessitate the removal/relocation of the temporary bridge.

This Form D document shall discuss the architectural considerations that have guided the design for Option 1, including a Landscape and Visual Impact Assessment, Lighting Assessment and a general access statement for the works.



Figure 1: Architect's visualisation of the proposed structure, viewed from behind Platform 2.

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This proposal will result in the installation of an accessible, permanent Fibre-Reinforced Polymer (FRP) footbridge immediately north of the station platforms. It will consist of a single FRP span, approximately 15m in length, with a staircase and through lift either side of the railway. The lift shafts will be located adjacent to the platform ends in order to offer the shortest possible route for mobility impaired users, with the staircases arranged facing north, away from the platforms. Access footpaths will be provided to allow access to the staircases, with 1.8m high fencing either side of the footpaths in order to prevent access onto the railway and climbing onto the staircases. Cycle wheel ramps are to be provided on the staircases to assist cyclists.



Figure 2: Driver's eye view of the structure, looking south.

This structure is to be a derivative of Taziker's 'Legacy Vision' footbridge design; a modular, fibre-reinforced polymer system designed to acknowledge the heritage of its surroundings. It is to consist of an FRP deck with infill panels between main girders as a crash deck, with 1.8m high parapets consisting of vertical posts at 1.24m intervals. The parapets will include lattice infill panels, designed to replicate the appearance of a Victorian era wrought iron lattice footbridge. This will match well with the aesthetic of the station, with its heritage style platform lighting columns. It will also match with the heritage aesthetic of Tackley itself; a small, rural Oxfordshire village with many heritage stone buildings.

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Development of the proposal throughout the GRIP4 design has resulted in the following project-specific decisions and details:

- The structure is to be uncovered; as there have been no historic covered crossings at this location, it was agreed that a covered structure was not necessary as it does not constitute a diminishment in passenger experience compared to the previous crossing arrangements.
- As the structure is located off the platform ends, the lifts have been oriented to face towards the platforms in order to reduce the distance travelled for mobility impaired users. This will however increase walking distance for foot users.
- The main supports for the simply supported structure will comprise of trestle-type piers, as shown in Figures 1 & 2. Trestle supports are to be utilised for their light weight and ease of fabrication.

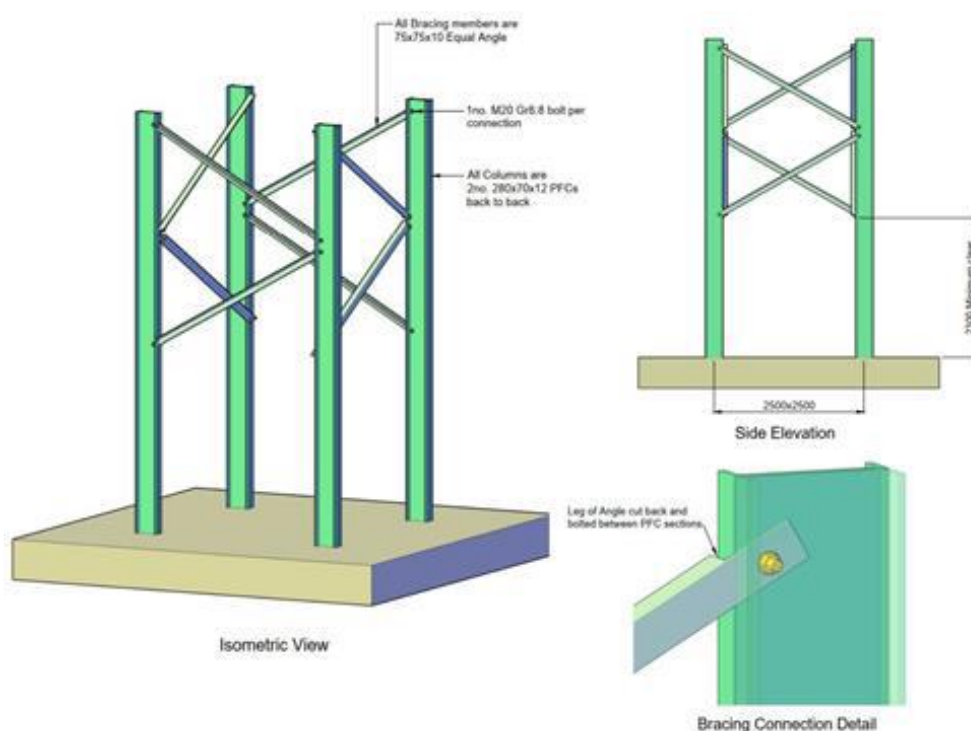


Figure 3: Proposed trestle supports.

- As the supports and lift shafts are further than 4.5m away from the nearest running edge on both sides of the track, collision protection in accordance with UIC 777-2R or GC/GN/5612 is not required.

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- Platform extensions will be required to provide access to the lift shafts and walkways, these will consist of FRP boards supported by FRP beams, carried by piled foundations. These platform extensions are to be included in the Form B detailed design submission.
- The staircases will consist of three flights on each side, landing at walkway level (500mm below platform level) on the far side of the lifts to the platforms. They will include an in-line half landing behind both top steps as well as a full landing between the main span and the lift shafts. The treads are to be of the POLYStep GRP slip-resistant type or similar approved product.

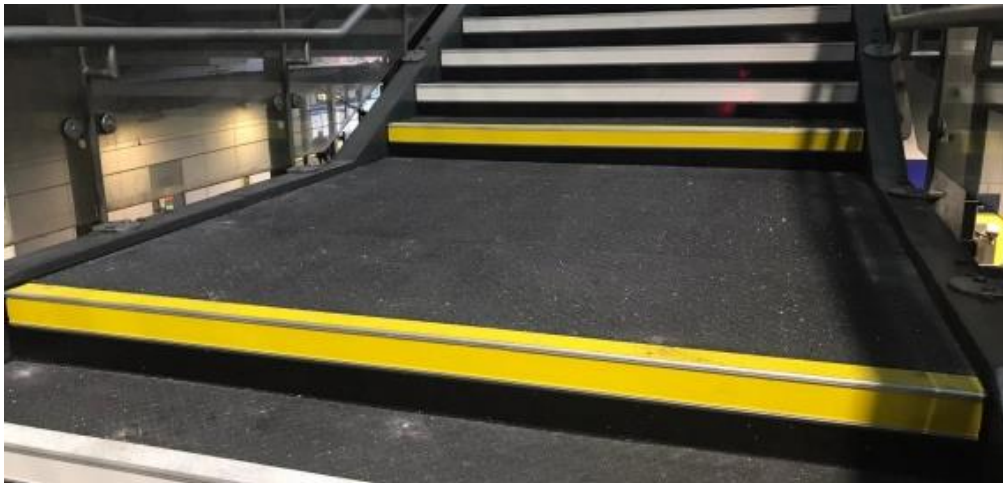


Figure 4: Typical POLYStep GRP slip resistant stair treads.

- The main span and landing decks are to consist of 10mm thick FRP plates incorporating bonded Plura 'GRIPfast' surfacing which provides a "near diamond hard gritted anti-slip upper surface". The landing structure beneath the decking comprises FRP C-Sections as they provide a high strength solution relative to their weight.

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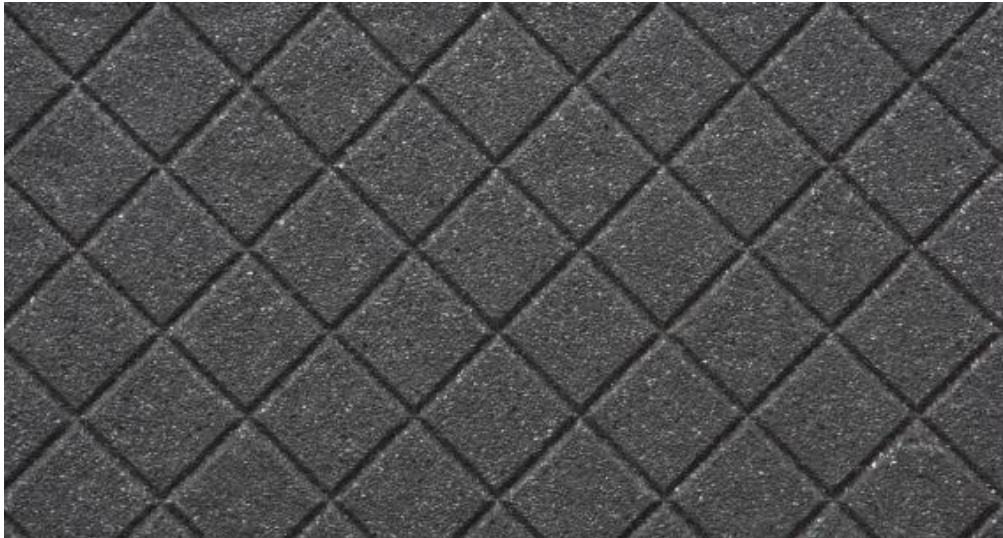


Figure 5: Typical 'GRIPfast' surfacing.

- Handrails will be provided at two levels (600mm and 950mm above pitch line/landing levels) over the length of the platform access stairs and will comprise 45mm nom. diameter pultruded FRP tubes mounted directly onto the parapet by means of cranked brackets that provide a zone, free of horizontal projections, below the handrail, of at least 50mm.
- Three of the four staircase parapets shall be of a 1.5m height with lattice infills consisting of diagonal/horizontal rails supported by vertical posts. The Down side parapet of the Platform 1 staircase will however be 1.8m in height with solid infills to provide privacy to neighbouring properties.
- The staircases are to be met by asphalt paved walkways, with a minimum clear width of 2m in accordance with 'Design Standards for Accessible Railway Stations'. 1.8m height palisade fences are to be provided to eliminate additional risk of trespass on the railway as well as to prevent climbing on the trestle staircase supports.
- The lifts are to be of the SCX 'motor room-less' type (or similar approved) in order to reduce the height of the shafts; these have been specified as they are the lowest height, commercially available units on the market. They are to be clad in FRP with lattices to match the main span.

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- As the staircases and passenger walkways are to be set into a cutting with minimal space for side slopes, retaining walls are to be utilised around the reduced level excavation for each staircase. This will have the effect of partially obscuring the structure when viewed from the north and west, where the embankments are at their highest. Tree cover will further hide the structure to reduce its visual impact. A 1.8m height palisade fence is to be installed atop both retaining walls to reduce fall risk.
- The footbridge structure will have a Design Life of 120 years in accordance with Clause 10.2 of NR/L3/CIV/020. The proposed fluoropolymer paint coating shall have an anticipated working life of 200 years. UV inhibitors within the FRP material will provide a minimum of 80 years of UV resistance should the coating system fail.
- Ancillary civils structures such as walkway ramps and riser walls, lighting/CCTV columns and platform extensions shall have a 120-year Design Life in accordance with Clause 10.2 of NR/L3/CIV/020.
- Foundations and Geotechnical assets (namely the retaining walls surrounding the reduced level excavation) shall have a design Life of 120 years in accordance with Clause 10.1 of NR/L3/CIV/071.
- All Drainage assets shall have a Design Life of 60 years in accordance with Clause 10.1 of NR/L2/CIV/005/09.

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- The structure shall be subject to a conventional inspection routine, anticipated to initially consist of three-yearly Detailed Examinations with annual Visual Inspections in accordance with NR/L3/CIV/006. This initially regular inspection regime is anticipated as FRP is currently a relatively novel and scarcely used material within the rail industry. We anticipate that this will extend to 12-yearly Detailed Examinations in the future due to the reduced deterioration rate of the material compared to conventional structures. There are relatively few Hidden Critical Elements within the design, and those few can be accessed for inspection by lifting the deck plates.



Figure 6: Example of a handrail lighting system, similar to the one currently being developed for the Legacy Footbridge.



Figure 7: Concept integral parapet lighting system developed for the Legacy Footbridge. Units such as this one would be mounted onto the bridge's main span.

- The bridge structure will be illuminated using integral lighting units embedded within the parapets. The walkways are to be illuminated using wall or fence mounted units. Please refer to the M&E Form A design documents included with this submission for further details.

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- The structure has been detailed to maximise shop fabrication, taking into account transportation constraints and eliminating site bonding of structural connections. Vibration resistance of bolted site connections will be achieved by use of bolts with locking nuts or proprietary thread-locking adhesives, depending on the criticality of the connection, the size of bolt and future maintenance requirements.
- Member connections are to be by adhesive bonding, with bolts installed to clamp the mating surfaces at each connection to one another and to support the whole structure whilst the adhesive cures. Once cured, the adhesive will assume all load resistance under SLS and ULS conditions, as per the recommendations given for 'hybrid connections' in CIRIA C779 Section 5.5.6. The bolts are to remain in-situ to provide added resilience in the event of bonding failure or impact damage.

The current station consists of two 80m length platforms, with a glazed steel frame waiting shelter located approximately halfway along Platform 2 (up/east side), with a temporary footbridge consisting of steel 'scaffold' type framework with a timber deck and steel side boards. This is supported on concrete block foundations. Both platforms are relatively plain, with a timber fence along the rear and heritage style lighting columns at 12m spacings along the full length of the platforms. A basic 'bus stop' type waiting shelter is provided at the entrance to Platform 1, as well as litter bins and cycle stands.

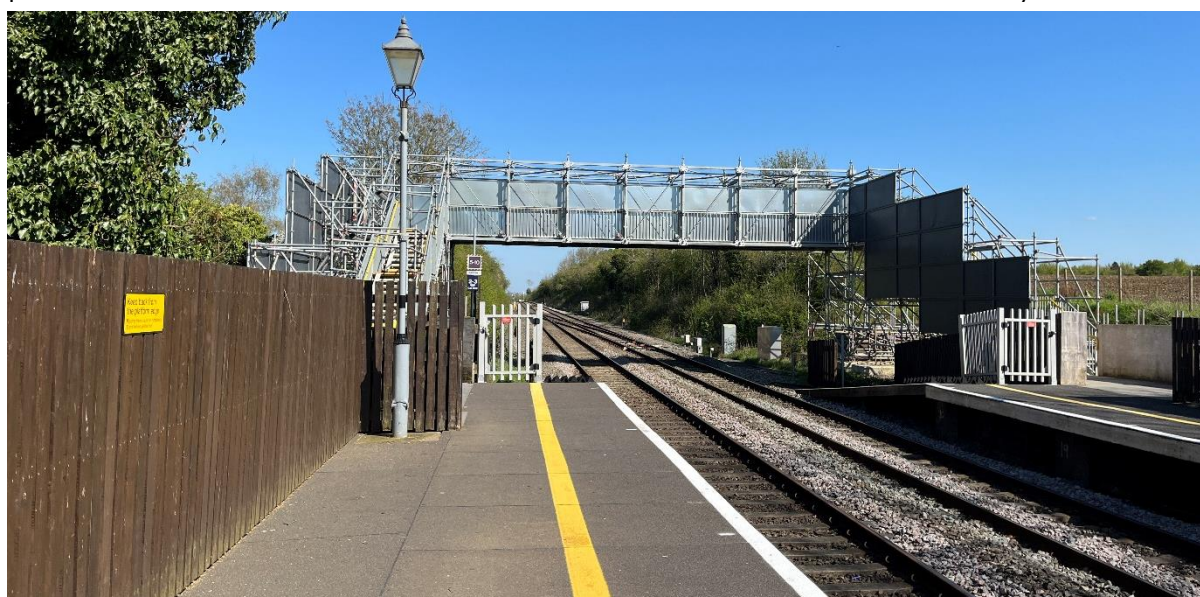


Figure 8: The temporary footbridge and platform ends, as viewed from Platform 1 looking north.

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Access to both platforms is gained via a ramp at the southern end of each platform, with a steel balustrade fence to limit access to the track. The since closed level crossing was located immediately south of both access ramps. Both platforms are lined with trees along the rear across the full length of the station, with high embankments either side of the railway immediately north of the station. Behind Platform 1 lies gardens belonging to adjacent residential properties, and behind Platform 2 lies a signalling electrical supply cabin, and behind that, undeveloped agricultural land.

This Form D document will set out the ways in which the proposed Tackley level crossing replacement footbridge design has considered Network Rail's ten aspects of aesthetic and architectural design, as well as how it has addressed concerns made by local residents and the planning authority.

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Figure 9: Visualisation of the structure, as viewed from Platform 2

1: Identity

Tackley Railway Station was opened as Tackley Halt by the Great Western Railway in 1931. Whilst very few historical photographs of the station are available for review in the public domain, 'Halts' were typically small stations served by rural stopping trains, with very modest amenities and footprints. The earliest photograph found, dating back to 1977, shows that the original platforms were a single carriage length and constructed from timber, with no footbridge, waiting shelters or lighting provided at that time – basic waiting shelters may have been provided previously but no photographic record has been found to confirm this. The station was heavily rebuilt between 1984 and the turn of the millennium with longer platforms, basic waiting shelters and platform lighting, resulting in the arrangement we see today.

The current station is very basic in nature, consisting of 2No platforms constructed from deck boards supported by concrete breeze-block footings, typical of BR-era rationalised station rebuilding projects. These platforms are bounded by basic timber fences and supplied with lighting columns along their full length. The only station buildings are the basic single storey waiting shelters provided on each platform following the rebuild.

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Figure 10: View from the temporary footbridge looking south, showing the existing station arrangement.

The strongest sense of identity possessed by the current station is the lighting columns, which are heritage style glass lanterns mounted atop vertical posts. Whilst not original features, they do help the station blend in with its surroundings and provide a sense of heritage that would otherwise be absent.

In stark contrast, Tackley itself is brimming with historical character, consisting of Cotswold-style stone buildings all centred around a triangular green. The station is located on the outskirts of the village, on the opposite side of the village to the green and near an area mainly consisting of newer houses, although there are several historical buildings on the opposite side of Nethercote Road to the station. The properties immediately adjacent to the station and proposed footbridge are all new-build or recent, and behind the historic buildings lies a housing estate consisting primarily of mid-late 20th century properties. Owing to the tree cover immediately adjacent to the proposed bridge location and the new-build houses in front of the trees, the new bridge will not be visible in the same view as any of the more historical areas or buildings within the village.

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Figure 11: A view of Medcroft Road, Tackley (Oxfordshire Villages, n.d.)

The proposed 'Legacy Vision' footbridge is designed to complement the aesthetic of areas such as this. Though Tackley Station never itself had a footbridge, many stations within Oxfordshire and the wider Wales and Western region either would have had, or still have, wrought iron lattice footbridges. This therefore presents an opportunity to add something new to Tackley station whilst recognising the heritage of the railway and the quaint aesthetic of the surrounding village.



Figure 12: Photo of Banbury station taken in 1952, prior to its modernisation. The original lattice footbridge can be seen overhead. (The Patrick Kingston Collection, as viewed on the Steve Banks website, 1952).

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2: Passengers

This proposal adds significant value to the passenger experience at Tackley station. Currently, there is no step-free access between platforms and given that it is an unstaffed station with no level foot crossing, assisted crossing between platforms is also not an option. This is compounded by the station only being accessible from the down/Platform 1 side and the entire village of Tackley also being located on this side. The culmination of this is that mobility impaired users can only board or disembark from northbound trains – a user wishing to travel to Oxford (the nearest large urban area) would need to travel north to Heyford or Banbury and change for a southbound train. Similarly, those arriving from the north would need to travel through Tackley to Oxford, and change for a northbound train.

The provision of a footbridge with lifts would be a step change for mobility impaired users as well as those with heavy luggage or cycles, and would significantly improve the user experience. The only alternative would be to reopen the level crossing, which would reintroduce significant safety risks especially as future improvements to the route would increase line speeds and potentially introduce even quieter electric trains.

3: Community Focused

This proposal will not only benefit rail users. The necessary closure of the level crossing has eliminated Tackley's only route for foot and cycle users to cross the railway, with the nearest alternatives being 900m to the south and 1200m to the north. This introduces a significant detour, effectively cutting Tackley off from neighbouring villages and public rights of way to the east. The existing temporary footbridge has partially alleviated this issue by maintaining walking access; the proposed footbridge will permanently guarantee this access, with a design life of 120 years in accordance with NR/L3/CIV/020.

The new structure will benefit persons of reduced mobility and families with pushchairs by providing lifts as an alternative to stairs, and cyclists will also benefit from provision of wheeling ramps allowing them to push their cycles across the bridge. The crossing will be safer and more secure with the provision of full lighting and CCTV coverage.

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4: Collaborative

The most significant challenges faced by any proposal to replace Tackley level crossing has always been planning and conflict with neighbouring property owners. The idea of a footbridge at the station was first proposed at the turn of the millennium, the planning application for which was refused by West Oxfordshire District Council (WODC) in 2001 on the grounds that *"that the proposed footbridge will, by reason of its size, design and use of materials represent an alien, incongruous and overtly urban feature in this rural location"*. It is likely that the proposal made by Railtrack at this time would have been for a standard "Series 400" type footbridge, which would present a relatively modern appearance in stark contrast to its surroundings.

Residents in neighbouring properties have also raised concerns regarding the appearance of the structure, its impact on their privacy and the effect it will have on sunlight levels on their properties. The height of the lift shafts was a particular concern in this regard: This has been addressed by specifying an SCX motor room-less type lift, with no workings above the lift car. This reduces the height of the lift shafts by approximately 1m, the SCX system in particular being specified as it is the shortest available lift type on the market. Privacy concerns have been addressed by raising the parapet height on the side bordering neighbouring properties up to 1.8m and including solid parapet infills.

The Legacy Vision Footbridge design was chosen to alleviate aesthetic concerns raised by both the planning authority and neighbouring residents, as this will better reflect the heritage setting of its surroundings. Wrought iron lattice footbridges are synonymous with heritage rural railway stations and are evocative of the railways of the past. This, in turn, compliments the heritage village aesthetic, with historic railways often being a part of the wider idyllic rural scene.

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The standard colours for such a footbridge are Holly Green (RAL 14C39) with White (RAL 9010) lattice infill panels – the green intended to blend the structure in with surrounding vegetation. This can however be specified to match the environment in which the bridge sits – as an example a similar scheme in the southwest of England employed a “chocolate and cream” livery using the historic Great Western Railway colours of Light and Dark Stone, recalling the original station footbridge that was demolished several decades before. Those colours were chosen after a poll was conducted with local residents; a similar process could be employed as part of the stakeholder engagement for Tackley to ensure that local residents feel involved with the process.

The possibility of an alternative site located approximately 50m from the platform ends is also being considered as a way of exploring alternative solutions with local stakeholders. The benefit of this is that the adjacent street and properties diverge away from the railway to the north, meaning that adjacent properties would be further away from the new bridge. This option however presents significant practicality concerns, namely a greater distance needing to be travelled to cross between platforms. This will disadvantage mobility impaired users and may encourage trespass on the railway – there have been recorded incidents of persons jumping onto the track to cross the line even with the much closer temporary footbridge arrangement.

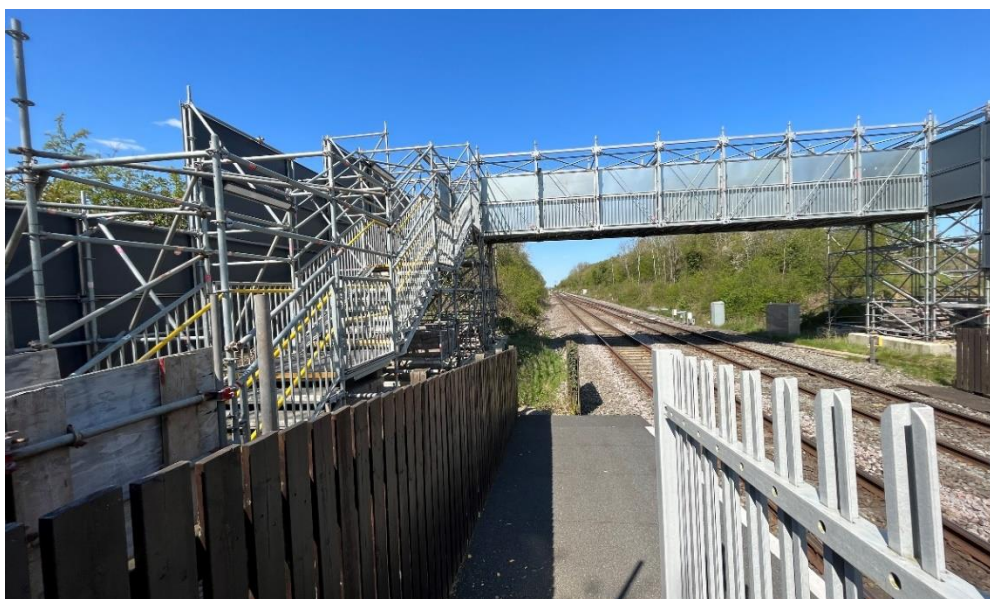


Figure 13: Platform 1 side temporary footbridge staircase, showing the privacy screens in place for adjacent residents.

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Another advantage of this proposal is that the bridge and staircases will be located within what is now a cutting, with retaining walls surrounding a reduced level excavation within which the staircases and main span trestle foundations are sited. As such, the bottom portion of the staircases will be below the level of the ground and boundary fence, with tree cover and boundary fences atop the retaining walls improving privacy even further. The parapets on the main span will be 1.8m high, preventing viewing of neighbouring gardens for the majority of users.

5: Inclusive

As discussed in Section 2, the main benefit of this proposal would be to provide step-free access between platforms for both passengers and members of the local community, where currently none is provided. This would provide Tackley with a station that can serve all passengers, and its community, equally. The structure including staircases and walkways has been designed in accordance with the Department for Transport's 'Design Standards for Accessible Railway Stations' to ensure usability. Additional Passenger Information System (PIS) screens are provided to ensure that passengers using the footbridge are provided with up-to-date travel information.



Figure 14: Partially transparent lattice parapets aid visibility for users.

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An additional benefit is security for users, with full lighting and CCTV coverage to be provided for the footbridge and all approach walkways. The open parapets with partially see-through lattices also improve visibility across the structure, further improving the usability and safety of the bridge.

6: Connected

As discussed previously in Section 2, this proposal will improve connectivity both for the station and Tackley as a wider community. The closure of the existing foot crossing, whilst necessary, has negatively impacted connectivity both between platforms and between Tackley and areas to the east. The temporary footbridge has only partially solved this problem, as it only allows convenient access for able bodied users without heavy items of luggage or cycles. This, in turn, has led to misuse of the crossing, as shown in Figure 15 (below):



Figure 15: A cyclist seen walking over the tracks between platforms, despite the temporary footbridge being in place. (BBC, 2020).

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The provision of step free access with lifts and cycle wheel ramps will allow safe and convenient access for all users, including both rail passengers and local residents. This will, in turn, reduce misuse of the crossing point, improving the safety and punctuality of the route. Whilst the delays caused by trespass incidents and fatalities would indeed cause significant disruption to Tackley station users, the effect on the wider route is substantial. In addition to local services between Banbury and Oxford/Didcot, the route sees long-distance CrossCountry traffic running from Bournemouth, Southampton and Reading in the south to the Midlands and the north of England. It is also located on the core freight route from the Southampton ports towards the Midlands, North of England and Scotland. Closure due to a serious incident may disrupt thousands of journeys, cause significant disruption to international supply chains and cost the railway thousands of pounds in delay minutes. Reducing the risk of such disruption by providing convenient access is therefore of national benefit.

7: Contextual

This proposal will add significant value to the local area, by providing the community with a safe and fully accessible station fit for 21st century travelling needs. The current arrangement does not allow persons of reduced mobility or those carrying heavy items of luggage to travel south or arrive from the north. This means that residents wishing to visit the closest major settlement, Oxford, must travel north and change at Banbury, the closest fully accessible station. This adds significant travel time, meaning such users are better off seeking alternative methods of travel, most likely by road, for both leisure journeys and business commutes. Encouraging use of rail by improving accessibility therefore benefits the village too by reducing road traffic.

Provision of greater accessibility may also encourage use of the station from further afield; for instance, leisure travellers wishing to visit Tackley from the north currently may not be able to disembark from their train, potentially encouraging them to drive or discouraging them from travelling there altogether. This again may reduce traffic and increase revenue for businesses.

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It will also add value for non-station users, by providing a fully-lit, secure and permanent crossing point across the railway. Cycle wheel channels will allow those carrying cycles to easily cross the bridge, and its location closer to Nethercote Road reduces the distance travelled significantly when compared to Option 2. Lifts allow persons with reduced mobility or families with pushchairs to cross the railway and access the public rights of way to the east.

8: Enhancing Heritage

The aesthetic style of the proposed structure is intended to recall the architectural styles of historic railway footbridges. Whilst there was never a footbridge installed at Tackley halt, the Great Western Railway installed wrought iron lattice footbridges across much of their network, including at Banbury to the north. This was true of many Victorian-era railway companies, with this type of structure being relatively lightweight, easy and cheap to construct and visually attractive by the standards of the time. This has led to these structures becoming synonymous with the historic railway aesthetic, with surviving examples often well appreciated by the communities they serve.

Whilst the proposed structure will be undoubtedly modern, the use of lattice panels and contrasting colours recalls this aesthetic, minimising the visual impact of a modern structure on a historic and rural area such as Tackley. This will provide a design which recognises the past of the route, the aesthetic of its surroundings but will be fully compliant with modern accessibility standards and make use of state-of-the-art materials.



Figure 16: An assembled Legacy Vision footbridge main span, similar to the proposed main span for Tackley station (S. Khalifeh/Taziker, 2023).

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9: Innovative

The proposed footbridge is to introduce several innovations, chief among which will be the use of Fibre-Reinforced Polymer (FRP) as a main structural material. Currently, use of FRP within the rail industry has been limited, however several FRP structures have been installed on the network, with a prime example being the replacement station footbridge at Dawlish. FRP made for a great alternative to steel, which would corrode quickly in the moist, salty environment found there.

Use of FRP has historically been limited due to concerns regarding ultra-violet radiation resistance, cost, fire performance, load bearing capacity and constructability. More advanced FRP compounds have however tipped the balance further in its favour when compared to traditional materials. UV inhibitors embedded within the material can provide UV resistance for a minimum of 80 years, in the event that the coating system fails.

Lower maintenance costs are also a significant benefit of using FRP. The structure and coating are all designed for a minimum 120 years operational life as per Clause 10.2 of NR/L3/CIV/020. This would be true of any footbridge regardless of material, however unlike steel the FRP material will not corrode, and will only require repainting if the paintwork peels, fades or a new colour scheme is requested by the asset owner. The structure is to be maintenance free for a minimum of 25 years as per NR/L3/CIV/006.

Constructability remains an issue; FRP is an inherently hard material and as such specialised tools and blades are required to drill or cut through it. This has been partially mitigated by designing the bridge in such a way that workshop fabrication is maximised as much as is practicable, with large sections of the bridge pre-fabricated and fully bonded in the workshop being bolted together in their final positions on site.

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Stage	1) Single option and/or for Planning Application 2) Approval in Principle 3) Detailed Design	Date	09.02.24	

Fire resistance has also been significantly improved. A test section of the structure subjected to a BS 476-21:1987 'Ad-hoc fire resistance' test showed that the structure remained within the specified test parameters for deflection, integrity and insulation until the test was called off at 132 minutes – the minimum requirement for a station footbridge is 20 minutes. Testing for reaction to fire under BS EN 13501-1:2018 using unpainted material samples resulted in a classification of **B-s3,d0**. As the minimum recommended by Network Rail for station environments is **C-s2,d0**, this shows that the structure is compliant for reduction of flaming droplets and performing better than required in terms of fire behaviour, however smoke production exceeded the allowable volume.

This has led to the adoption of an FRP compound with a more smoke-resistant resin mixture, which will allow the material to achieve a B-s2,d0 or better rating, therefore achieving compliance with Network Rail requirements for station structures.

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10: Environmental

Reducing the environmental impact of the scheme through sustainable construction is a major part of this project. The main way in which the impact of the scheme has been reduced is using FRP as a main structural material, with steel use limited to connecting bolts, foundations and ancillary or non-civils components. FRP has a much lower embodied carbon per tonne than steel, as the pultrusion process for manufacturing the elements requires much lower temperatures and therefore uses significantly less energy than would be used to produce a tonne of steel. This benefit is further increased by FRP being lighter than steel, reducing the tonnage used.

To demonstrate the reduction in embodied carbon of the proposed bridge when compared to a comparable steel structure, the estimated embodied carbon for both were calculated. These calculations are given in the Appendices; please refer to these for a detailed breakdown. For comparison, a standard Network Rail 'Series 400' LMZ-type footbridge of the same span length and height was used, this being the likely conventional alternative. Earthworks, ancillary civils, M&E assets and lifts were not considered as they are likely to be largely similar for both cases, as the bridge location would be unchanged. Construction emissions such as excavation, transportation and installation were also omitted as they are likely to be comparable and affected by where the materials are sourced.

These calculations showed a reduction in embodied carbon of approximately 50%, equating to approximately 67 tonnes of carbon saved. This is a significant amount, especially as the railway works towards its ultimate goal of net zero.

To reduce the impact of adverse weather on the structure, a full drainage system is to be incorporated for the bridge deck and approach walkways. Bridge drainage is to be achieved by introducing a 1:200 longitudinal fall to the deck plates, guiding water towards drainage outlets fitted into the deck. Walkway drainage is to be provided by gullies set into the walkway surfacing; this is to be designed with appropriate factors of safety to account for increases in water volume due to climate change.

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The use of retaining walls in place of side slopes, whilst necessary due to space constraints, also provides resilience to adverse weather events by reducing the risk posed by landslides affecting the structure and the railway. Locating the structure within a cutting and with a number of large trees in a close proximity helps shelter bridge users from wind in easterly and westerly directions, especially those using the approach paths, with 1.8m high parapets protecting users from northerly and southerly gusts. Raised retaining walls with 1.8m high fences on top also protects the structure and any users from debris being blown off the embankments.