The Network Rail (Leeds To Micklefield Improvements) Order

Alternative Options Evaluation Study: HUL4/21 Austhorpe Lane Overbridge

Author	Network Rail
Date	June 2023
Revision Number	Rev 1

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1. INTRODUCTION

1.1 Purpose

1.1.1 This report considers the proposed development options for the HUL4/21 Austhorpe Lane Overbridge, relating to Transpennine Rail Upgrade electrification works, setting out options considered, the assessment methodology and resulting preferred option design.

1.1.2 This document will be submitted as part of the Listed Building Consent for the works, alongside the Heritage Statement.

1.2 Scope

1.2.1 This report contains the following sections:

- A summary of the technical justification for the bridge works and resulting benefits.
- An outline of the options that were considered and retained or rejected ahead of the assessment.
- A description of the assessment methodology
- The options assessment result
- A summary of findings and justifications for the preferred option

1.2.2 This report focuses on work associated with HUL4/21 Austhorpe Lane Overbridge (hereafter 'the bridge'). The bridge is a Grade II listed building and forms part of the original Selby to Leeds Railway, constructed in the 1830s. It is one of a number of similar bridges along the route, of which eight are listed and a further four are considered to be of historic interest. A concise Statement of Significance is presented in Section 4.

1.2.3 The bridge is in active use and carries Austhorpe Lane over the Leeds to York mainline railway (NGR SE 3682 3450). It is located between Cross Gates and Garforth, West Yorkshire within an area of predominantly residential development, with Thorpe Park retail and business park to the east. The railway is at this point within cutting, with the road carried over the railway at grade.

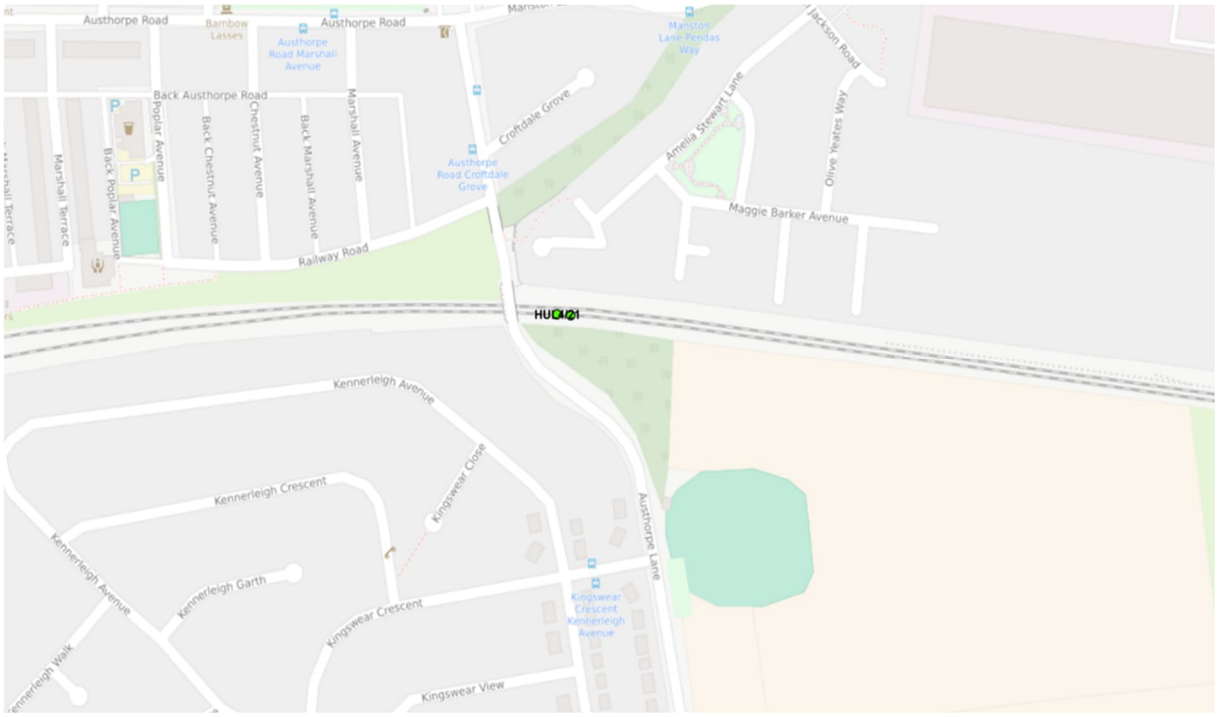

Figure 1 Location plan

1.3 Definitions

Term to be defined	Concise definition of term
Listed Building	A structure identified on the National Historic List of England due to its special historic and architectural interest. Protected by law.
TMLA	Track Lift Maintenance Allowance – allowance give for future maintenance tamping for the track to maintain the geometry for the safe passage of trains
VCC	Voltage Controlled Clearances
WLC	Whole Life Costs

Table 1 Definitions

1.4 Abbreviations

Abbreviation	Full terminology
BMV	Best and Most Versatile (relating to agricultural land)
GRIP	Governance for Railway Investment Projects
NHLE	National Heritage List Entry
OLE	Overhead Line Electrification
PROW	Public Right of Way
TOC	Train Operating Company
TRU	Transpennine Route Upgrade
TWAO	Transport and Works Act Order

WRaCCA	Weather Resilience and Climate Change Adaptation

Table 2 – Abbreviations

2. REPORT CONTENT

2.1.1 This section of the report summarises the strategic need for the TRU project which requires alterations to the Grade II listed Austhorpe Lane Overbridge (HUL4/21; NHLE 1419065) and the benefits that will be derived from the project.

2.1.2 TRU will help to promote sustainable transport in accordance with the National Planning Policy Framework (2021) (Chapter 9) and the government objectives set out in the National Policy Statement NPS for National Networks (2015). Section 2 of the NPS states:

2.1.3 The Government will deliver national networks that meet the country's long-term needs; supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:

- Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs.
- Networks which support and improve journey quality, reliability, and safety.
- Networks which support the delivery of environmental goals and the move to a low carbon economy.
- Networks which join up our communities and link effectively to each other.

2.1.4 Further paragraph 2.2. of the NPS states that "'there is a critical need to improve the national networks to address road congestion and crowding on the railways to provide safe, expeditious and resilient networks that better support social and economic activity; and to provide a transport network that is capable of stimulating and supporting economic growth." Paragraph 2.10 confirms that at a strategic level that there is a compelling need for the development of national networks.

2.1.5 TRU is an important commitment made by the Secretary of State for Transport that aims to create a better performing railway that passengers can depend on; one that provides more trains, more seats and creates a better-connected North. This will include a large number of key interventions between Manchester, Leeds, and York. The government commitment to delivering TRU was confirmed in the Integrated Rail Plan for the North and Midlands (November 2021), as the first phase of the wider Northern Powerhouse Rail project.

2.1.6 TRU will facilitate the provision of electrification of an operational railway. The project will, therefore, improve the provision of public transport (rail) through the local area and across the region in the long term, due to the intended provision of longer, faster and more reliable rolling stock on the route, alongside the reduction in freight across the road network. TRU will also support the UK response to the climate challenge through the electrification of the Transpennine route and subsequent de-carbonisation of rail transport.

2.1.7 In section 4.9 of the Leeds City Council Core Strategy (2019) notes that the electrification of the Transpennine route (the TRU) is an important part of its sustainable transport plan.

2.1.8 The City Council 'Connecting Leeds Transport Strategy states that "The Transpennine Route Upgrade will enhance connections to Huddersfield and Manchester, providing reliable connections and quicker services." The delivery of the TRU is a major element of the West Yorkshire Combined Authorities Transport Strategy 2040.

2.1.9 Works to HUL4/21 Austhorpe Lane Overbridge are essential in achieving the proposed electrification of the route. Without works to the Listed Structure then the TRU Programme cannot be delivered at this location. Without works at this location the scheme as a whole cannot be achieved and the benefits of the TRU Programme will not be realised.

3. STATEMENT OF HERITAGE SIGNIFICANCE

3.1.1 Austhorpe Lane Overbridge is a Grade II listed building. It was designated in 2015 as part of a thematic review of the structures associated with the upgrade works to the Transpennine Railway from York/ Selby through to Manchester. The bridge is part of the original construction of the Leeds to Selby Railway in the 1830s following the designs of the noted engineer James Walker. Walker acted as consulting engineer, alongside his assistant Alfred Burges and was responsible for some of the detailed design. He was also responsible for instigating the four-track design which, although never implemented, resulted in a need to redesign the traditional railway structures to accommodate the wider line. The result was a single basket arch structure, enabling a wider span without the need for higher arch.

Figure 2 Austhorpe Lane Overbridge

3.1.2 Austhorpe Lane Overbridge follows Walker and Burges' basket arch design, despite the fact that the rock cutting in this area make it unlikely that it could have ever accommodated the promised four track. It should also be noted, that although originally designed for a four track arrangement in 1830, it would not accommodate a modern rolling stock four track arrangement.

3.1.3 The bridge is located between Cross Gates Station 0.5km to the west and Garforth Station 4km to the east. It is situated in a predominantly residential area, with Thorpe park business park and industrial expansions to the east. Historically the bridge provided a route between Manston to the north and Austhorpe to the south within a largely rural area, dominated by coal fields. The railway prompted rapid expansion of the area, concentrated around Cross Gates Station.

3.1.4 The bridge is constructed from sandstone and quarry faced limestone. The abutments are straight with a quarry faced impost band from which springs the semi-elliptical basket arch. The arch itself is formed by rusticated, v-jointed ashlar voussoirs above which rises the parapet, set upon a square moulded string course. The parapet itself is capped with a curved coping and oval piers and decorated with defined horizontal tooling. Running adjacent to the bridge to the west is a modern footbridge constructed from concrete with metal railings. To the east is a high level gas pipe running at arch height adjacent to the bridge. Both have necessitated the addition of modern fixtures to the historic structure.

3.1.5 The structure is Grade II listed in recognition of its historic and architectural interest. It has historic interest in its association with the Leeds to Selby

Railway, one of the earliest railways in the country, representing one of the original structures along the line dating to 1830-32. It is also of architectural interest due to its unusual basket arch design, employed to span four tracks rather than the usual two, and demonstrating technical innovation. This is characteristic of the Leeds to Selby line, with 12 examples surviving (eight of which are designated). The bridge survives largely unaltered from its historic construction. The adjacent footbridge is a later addition which obscures the western face of the arch; however, it is not physically attached to the historic structure. The results of survey in 2019 show the bridge to be in a fair condition.

4. REASONABLE ALTERNATIVES

4.1.1 The aim of TRU is to create a better performing railway that provides more trains, more seats and creates a better-connected North, in line with the commitments made by the Secretary of State. Non-electrification solutions were explored during the early phases of the project; however, these did not provide the outputs required by the project.

4.1.2 In order to achieve the benefits delivered by TRU, overhead line electrification (OLE) infrastructure is needed to power faster and more environmentally friendly electric trains. Due to the historic construction of the line, a number of historic structures cannot accommodate the proposed electrification in their current form. This includes Austhorpe Lane Overbridge which is not of sufficient height to accommodate the operational minimum requirements for clearance distances between the trains and the OLE.

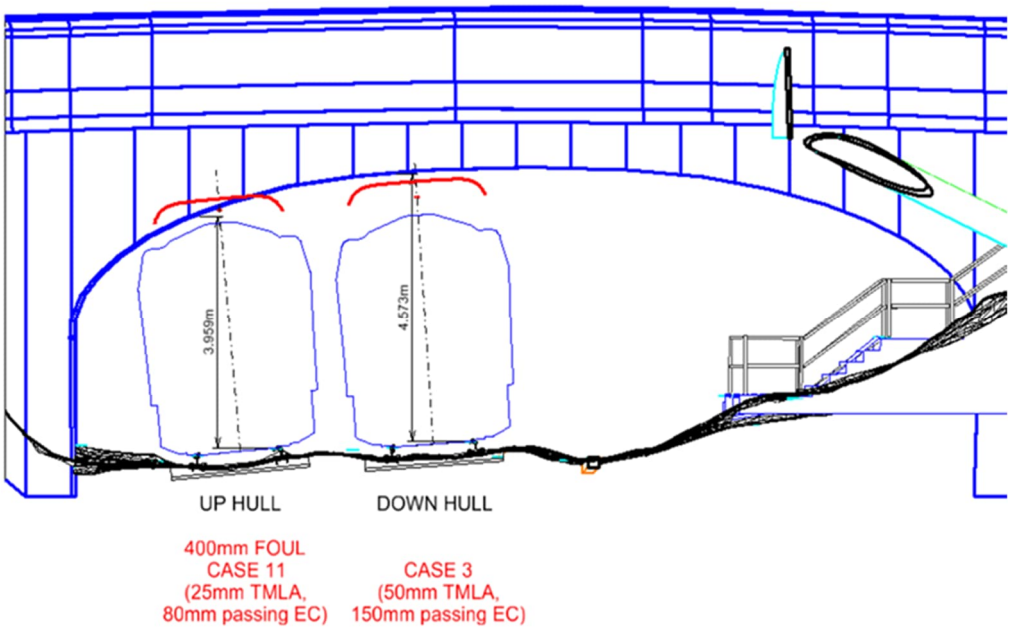

Figure 3 Current clearance

4.1.3 An initial engineering review was undertaken to identify alternative options which would facilitate OLE construction through the bridge. This process looked at various high-level options to achieve electrical clearance for the installation of OLE through the bridge;

- Structure intervention to increase soffit height
- Track lowers/slues to increase soffit height

4.1.4 These options included reviewing potential reduced electrical clearances with additional control mitigations i.e., surge arrestors, voltage limiting devices, where this provided economic or heritage benefits. All options also need to consider the adjacent footbridge and ensure pedestrian access across the railway.

4.1.5 The outcome of the initial engineering review was the identification of three potentially feasible options to enable the installation of new OLE.

- Option A (1 and 2) – Structure Intervention to raise soffit height
- Option B - Track Slue and Lower

4.1.6 For option A, two sub options were reviewed, Option A1 reconstruction of the bridge deck, Option A2 full reconstruction of the structure. For option B a combination of track lower and slue was considered to achieve the required clearance due to constraints posed by adjacent residential development. These vary the magnitude of the track slue/lower to take into account the potential to agree a sub-functional clearance for the structure. The option considered the minimum track slue/lower combination required to achieve sub-functional electrical clearance only. This would involve deviation from normal Network Rail standards following bespoke assessment of the specific conditions at the bridge location in question.

4.1.7 A further options of bridge jacking was considered. This option involves lifting the existing masonry bridge arch and reinstating at a higher level. This option was immediately discounted for this structure due to the resulting impact of a significant raising of the carriageway level which cannot be accommodated at this location due to the immediately adjacent accesses to residential properties. This together with the specialist subcontractors view of the significant construction risk associated with jacking this type of flat masonry arch and the lack of available track access necessary to carry out such an operation, meant the option was immediately discounted as unfeasible.

4.2 Option A – Structure Intervention

4.2.1 Option A involves a structure intervention to raise the existing soffit height of the structure to accommodate OLE.

4.2.2 Two options have therefore been considered for A, reconstruction with a standard composite flat deck or reconstruction with a bespoke feature bridge. Both options are outlined here; however, for the purposes of this options evaluation, only the principle of reconstruction is assessed.

Option A1

4.2.3 Option A1 proposes the removal of the present basket arch and replacement with a flat deck to achieve the necessary clearance for electrification.

4.2.4 The composite flat deck option proposes the removal of the present basket arch and replacement with a flat deck to achieve the necessary clearance for electrification. The arch would be removed to springer level, with the stone abutments retained. A new superstructure would be installed on the original abutments. The precast concrete units would be faced with sandstone to maintain visual similarity to the existing structure.

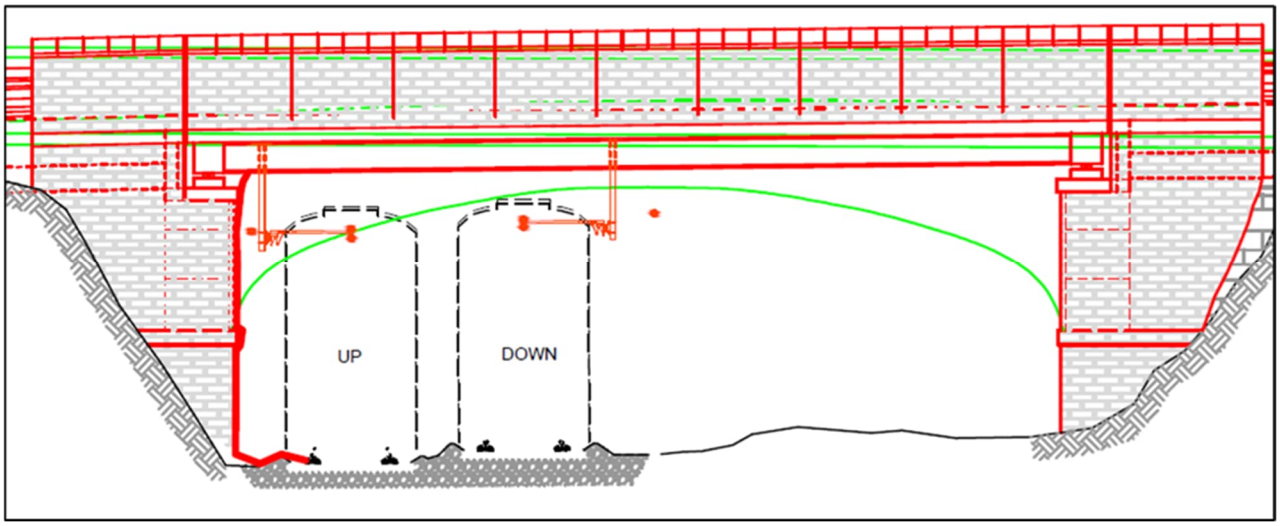

Figure 4 Deck reconstruction with composite flat deck

4.2.5 A Network Rail standard design concrete arch was reviewed, but there are technical limitations to the maximum span which can be achieved with precast concrete arches (9.4m max) is not sufficient given the existing arch span of 16.3m. In addition, and more importantly, the existing clearance issue would remain. In order to achieve sufficient clearance, the abutments would need to be built up from the springer level. This would significantly impact the existing highway alignment above. Due to the constrained nature of the site with residential properties to north and south, there is minimal scope to raise the highway above.

4.2.6 The new bridge would be constructed from concrete for the purposes of future maintenance; however, the new elements would be faced in reclaimed stone to reflect the original. The new parapets will also be higher (to a minimum of

1.8m) to deliver standard parapet protection over electrified lines. The current parapet height is c.1.3m high.

Option A2

4.2.7 The design of Option A1 is subject to further refinement. Whilst option A1 looks to retain the sandstone effect of the structure whilst achieving the necessary slimmed down construction depth required for the replacement superstructure, an alternative that could be offered would be to replace the superstructure with a modern feature bridge (Option A2). The design of the bridge would also be consistent with other replacement structures along the route to ensure a cohesion reflected in the historic route. For the reasons outlined above, the bridge would maintain a flat deck with an applied arch. This option would also involve the integration of the adjacent footbridge to the west. This combined solution includes removal of the existing overbridge arch superstructure, removal of the existing footbridge superstructure and substructure, and replacement with a new deck type structure, with new superstructure, substructure and foundations. Following engagement with LCC Highway Authority, this proposal also provides options for an improvement to the existing highway, including providing a carriageway in each direction as opposed to the existing single lane.

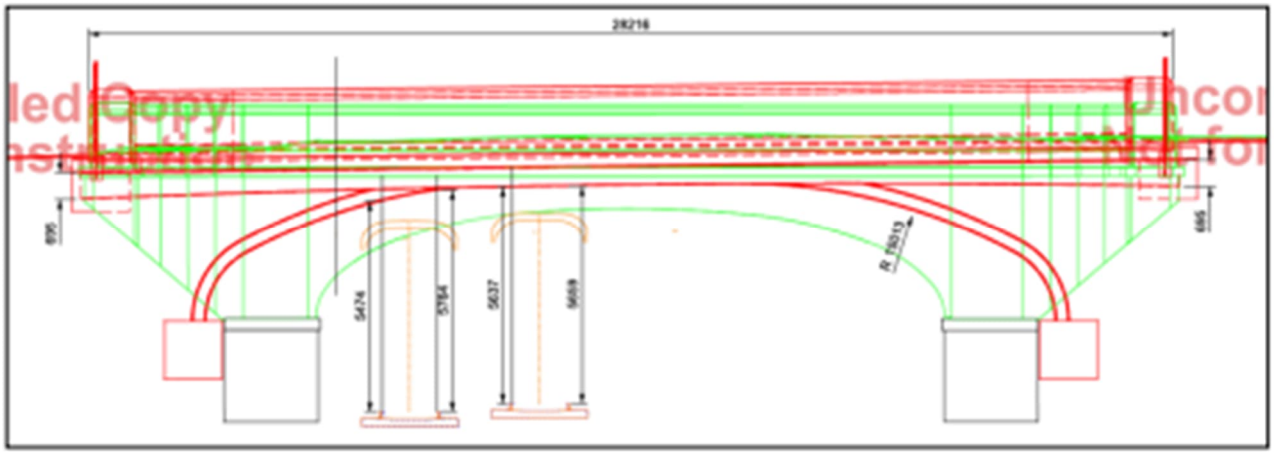

Figure 5 Reconstruction with an applied arch structure

4.3 Option B - Track Slue and Lower

4.3.1 A track lower and track slue solution will enable retention of the existing bridge structure to achieve the required electrical clearance. This solution will provide the minimum electrical clearance between the arch barrel soffit and the highest rail currently governed by the Up line by adjusting the position of the tracks vertically and horizontally.

4.3.2 A track slue and lower involves locally moving vertically and horizontally the rails, sleepers, track drainage, track level services, ballast and sub ballast layers to provide clearance to the structure soffit. Track lowers and slues usually extend far beyond the structure due to restrictions on the change of gradient on the approaching tracks.

4.3.3 Based on the work carried out, a track lower in the order of approximately 690mm and a track slue of approximately 620mm are required to achieve the sub functional electrical clearance.

4.3.4 Slue solution would require a tightening of radius or introduction of bearing change somewhere along straight along with re-grading of slope in Up cess. Track lower solution would require earthwork assessment of the cutting slope adjacent to the Up Hull line and would potentially require geotechnical works to maintain slope stability. Track drainage on the Leeds side of the structure may be adversely affected.

4.3.5 The track lower and slue option will require the railway line to be shut for significant periods of time with alternate routes / buses provided for passengers during track construction works.

5. ALTERNATIVE OPTIONS ASSESSMENT METHODOLOGY

5.1.1 This section of the report describes the alterative options assessment methodology that was developed to assess the four options and sub-options and identify a preferred option.

5.1.2 An Options Assessment Matrix (OAM) was created to ensure all relevant matters (topics) were identified and considered by planning, engineering and environmental specialists as relevant.

5.1.3 The topics and assessment criteria were defined in order to allow an objective and consistent assessment of alternative options across all options. However, categorisation (Highly Unsupportive – Highly Supportive) did rely on an element of professional judgement and consistent application of professional judgement was ensured via a quality review.

5.1.4 The assessment topics and sub-topics are set out in the OAM at Appendix A of this report. A summary of the topics and sub-topics used is listed below.

- Environment and Consent Risk – addressing environmental concerns, planning risks and consents risk.
- Land & Property – addressing land access and availability concerns.
- Cost – addressing capital and maintenance cost constraints.

- Design / engineering feasibility – to address varying levels of design complexity.
- Construction – to address varying levels of construction complexity.
- Maintenance – to address varying levels of maintenance burdens.
- Deliverability – to address the impact on wider project programme timescales.

5.1.5 A RAG (Red Amber Green) type rating was assigned to each component of the assessment. The RAG rating includes five grades from Highly Unsupportive (red) through Unsupportive (amber) and Neutral (yellow) to Supportive (pale green) and Highly Supportive (green). The assembled factual evidence was assessed against the evaluation parameters by qualified professionals to award a grade (i.e., Highly Unsupportive – Highly Supportive), based on professional judgement and supported by a statement setting out the justification for each categorisation. Following all of the individual assessment, these were reviewed by a senior professional to moderate and ensure consistency.

6. ASSESSMENT OF ALTERNATIVE OPTIONS

6.1.1 This section of the report presents the findings of the options evaluation against the assessment topics.

6.1.2 The section below identifies overall considerations that are applicable to all options and sets the wider context for the options. These are summarised upfront to avoid repetition. Specific considerations relevant to each option are then identified under each option in the subsequent sections.

6.1.3 The below is a factual description of the relevant matters for each option to enable an understanding of the optioneering process. It is not intended to provide a justification for the options. This will be presented within the Heritage Statement which accompanies the Listed Building Consent.

6.2 Overall Considerations

6.2.1 There is a currently a high pressure gas pipeline running adjacent to the bridge. Relocation of the pipe is being undertaken with diversion below the railway.

6.2.2 Temporary acquisition of land would be required for all options during the construction phase. This acquisition may lead to a temporary adverse impact on pedestrian access which crosses the railway line adjacent to the bridge as it would need to be diverted while construction work was ongoing. Should the bridge design be combined to incorporate the exiting footbridge, this would constitute a permanent, minor diversion.

6.2.3 All options are to facilitate the provision of electrification of an operational railway; therefore, all options have the potential to replace diesel power on this route.

6.2.4 The existing bridge has high bat roost potential and its reconstruction could have potentially significant effects on the protected species. All options would disturb any protected species present.

6.3 Option A – Bridge Deck Reconstruction

Environment and Consent Risk

6.3.1 Option A (both 1 & 2) requires the demolition of the existing Grade II listed bridge and the construction of a replacement flat soffit bridge deck. Listed structures are protected by the Planning (Listed Buildings and Conservation Areas) Act 1990 and consent will be required for this option. In planning policy terms, clear and convincing justification is required for the harm caused to the structure (National Planning Policy Framework (NPPF), paragraph 200). Leeds City Council Local Plan policies P11 (conserve and enhance the historic environment, including the 19th century transport network), and P12 (conserve and enhance the character and quality of Leeds' townscapes and landscapes, including historical and cultural significance) are also relevant. Although Network rail considers it can be demonstrated that the alterations to the heritage asset are necessary to achieve substantial public benefits that outweigh that harm, this option has been graded Unsupportive on cultural heritage grounds to reflect the great weight to be applied to conservation of nationally designated heritage assets in national planning policy. However Option A2 offers a bespoke design, that looks to build in features that retain the ethos behind the original basket arch design, which new arch profiles replicating the shallow arch feature and reuse of sandstone materials on the bridge parapets to retain the existing appearance at road level.

6.3.2 Option A will require temporary closure of public rail transport as works to reconstruct the bridge can be done within standard possession access opportunities, although a road closure and temporary diversion of public footpath will be required. All options will be accessed from nearby secure compounds which are to be created temporarily, and access to the site will be via the rail line (or adjoining roads) during closure. Option A would require both full road closure of Austhorpe Lane and rail-line blockage during works to avoid risk to the public. However, given the number of crossings available, there would be an alternative route in the area. The option is therefore Supportive.

Land and property

6.3.3 Option A is Unsupportive in terms of land availability. Permanent land take is required to the southwest of the bridge, within the Green Park area in order to accommodate two carriageways as requested by Leeds City Council Highways. Temporary acquisition of land would also be required during the construction phase.

6.3.4 There is pedestrian access carried over a footbridge adjacent to the overbridge. Depending on the final design of the reconstruction, this will be temporarily diverted during construction, or permanently diverted along a new, integrated structure. Both options are considered supportive.

Cost

6.3.5 If a standard concrete flat deck option is installed, the cost of Option A is considered Neutral as it provides the most cost effective and risk free option to retain a structure at this location whilst achieving the necessary clearance for electrification. Whole Life Cycle (WLC) costs for a bridge reconstruction (circa £1.4m) are half those for the track slue options and between two and four time less than the track lower options.

Design/ Engineering Feasibility

6.3.6 Options for the replacement of the superstructure are available that achieve the slim deck construction required to facilitate electrical clearance for OLE below whilst reducing impact on the highway levels above which are constrained by adjacent properties and junctions. Both options are straight forward from a design and engineering point of view and as such have been scored as Neutral.

Construction

6.3.7 Whilst the site presents challenges from a construction point of view, due to the proximity of adjacent residential properties and shallow mine workings, and environmental constraints of the adjacent Green Park area, it is expected that these constraints would be manageable with the correct mitigations in place. Temporary land access and partial/ full road closures will be required to facilitate the works.

6.3.8 Whilst the site is constrained and we will require a number of temporary works assessments and designs to facilitate the works, all the above issues are known and are manageable through design and construction planning. As such the replacement of the superstructure has been scored as Supportive.

Maintenance

6.3.9 The proposed new structure will require minimal ongoing maintenance for the next 50 years. This option is scored as Highly Supportive as it will replace a structure that currently needs regular maintenance checks and significant life extension works in due course.

Deliverability (timescales)

6.3.10 Option A will require several extended weekend possessions of the railway, but can be designed and delivered in line with the proposed TRU build programme, therefore it has been scored, Highly Supportive. Partial and full road closures will be required to support the works, but it is expected that these will be of manageable durations.

Feasibility

6.3.11 Option A remains feasible within the constraints of the project. There are constraints on what could be achieved as part of the reconstruction of the structure due to its relationship with the highway and the proximity of adjacent residential properties. However, through engagement with heritage and Highway stakeholders, TRU has a design option (Option A2) believed to be acceptable to all parties and can be progressed to detailed design.

6.4 Option B – Track Lower and Track Slue

Environment, Sustainability and Consent Risk

6.4.1 Option B looked at retaining the Grade II listed bridge and the significance of the listed structure would be sustained and the context, while undergoing minor visual changes, would not be altered from its present context or setting. The bridge parapets will still need modifications to provide suitable protection for an electrified railway, resulting in physical changes to the listed fabric.

6.4.2 The track lower and slue option of both the Up and Down Leeds Lines would require significant disruptive track access resulting in prolonged temporary closures (beyond what would be accepted by the train operating companies) through the area during works and road closures of Austhorpe Lane above to undertake stabilisation/underpinning works to the abutments and adjacent earthwork slopes.

6.4.3 Any works will be accessed from nearby secure compounds which are to be created temporarily, and access to the site will be via the rail line (or adjoining roads) during closure.

6.4.4 Option B will require excavation and will, therefore, generate large volumes of material. Option B1 would generate c. 10,500t of spoil for the track works plus c. 1500t of rock break out on the slope cutting. There is the potential that this material may be utilised in other areas of the Project and thereby reduce the use of primary aggregates, however, due to volumes (and potential unsuitability) this cannot be guaranteed. The extent of rock breakout and restabilising works has the potential to generate instability of embankments due to the removal of base material and increase in relative slope angle. In addition, works are in an area of known shallow mine workings, which would need to be considered in the formation design and would likely involve remediation. There is also a Yorkshire Water sewer crossing under the railway circa 20m west of the existing structure which cover would be reduced significantly due to the extent of the lower.

6.4.5 Option B involves excavation within the existing cutting, which, due to the requirements for shallow gradients, may involve excavation within areas at High (>3.3% annual) risk of surface water flooding west of the bridge, into which surface water flooding is likely to flow and which may increase the likelihood of flooding in a given year due to the lowering of ground level. While it is expected that suitable drainage will be installed for this option, given the existing topography this may need to be a pumped/attenuated solution requiring additional future maintenance and increasing the risk of damage to the railway from surface water flooding and increase the risk to operational users. The option is therefore Unsupportive.

Land and property

6.4.6 Option B is Highly Supportive in terms of land availability. No permanent land take is required as all work would be within Network Rail Land. Temporary acquisition of land would be required during the construction phase and to facilitate works to underpin/stabilise the bridge abutments and cutting slopes for the track excavation.

6.4.7 There is a PROW which is carried over a footbridge adjacent to the overbridge. This would also require temporarily diverting during construction to undertake underpinning/stabilisation to the abutment and adjacent earthwork slope. Both options are considered supportive.

Cost

6.4.8 The WLC for Option B was estimated to be around £24m due to the impact on the bridge sub-structures/adjacent earthworks, impact on the Yorkshire Water sewer and the likelihood of a requirement for mining remediation, between 4 to 5 times that of the preferred option A and with higher ongoing

maintenance costs to maintain sub optimal alignments and clearances. For these reasons this option was graded Highly Unsupportive from a cost point

Design/ Engineering Feasibility

6.4.9 Option B is Highly Unsupportive As the slue would be towards the south side cutting slope and to a significantly lower level, therefore the cutting earthworks would require breaking out and restabilising and underpinning works to the existing foot and road bridge abutments. The works are also in an area of known mine workings (Middleton Main) which would likely require remediation over the area affected due to the magnitude of the track lower and there is also the presence of a YW sewer that crosses under the railway on the west side of the existing structure. Therefore for all of the reasons given above, Option B is Highly Unsupportive from a design/engineering feasibility perspective.

Construction

6.4.10 The track slues/lowers would extend circa 600m each side of the structure in order to attain the track position at the structure to achieve electrical clearance and tie the track geometry back into the existing alignment. This together with works required to stabilise the surrounding structures would require track access beyond what can be made available. The works would also introduce multiple staging of signalling/telecoms to relocate lineside infrastructure and ensure sighting for signal on the Up Line within the track slue area is not compromised. The slues would also inflict further constraints to positioning of OLE gantries for electrification. Construction would also take place over a prolonged period, causing closure over long periods. The closure would continue for the duration of construction. For the above reasons Options B is graded Highly Unsupportive as the construction risks are too high and the programme of works too disruptive to be a valid option.

Maintenance

6.4.11 Option B would result in the management of sub functional/minimal clearances. The reduction of clearances will cause additional strain on the OLE resulting in greater wear. It would also introduce a sub optimal track alignment. A drainage solution would also be required to manage the sump effect of the track alignment, potentially requiring an attenuated or pumped solution that would be an extra maintenance burden not currently required with the existing track alignment. The existing road structure and separate LCC owned and maintained footbridge would be retained so would be an ongoing maintenance burden. Therefore, from a maintenance perspective,

Option B has been graded as Unsupportive due to the overall increased maintenance burden.

Deliverability (timescales)

6.4.12 Option B would require significant disruptive track access for a period that is not currently available within the existing programme and would not be acceptable to the Train Operating Companies (TOCs) due to the significant effect on commuter traffic between Leeds and York, Selby, Hull and misalignment with the "passenger first" directive. To undertake the works over a number of shorter disruptive possessions would not be feasible due to the magnitude of the track lower and slues required. This option is, therefore, Highly Unsupportive on deliverability.

Feasibility

6.4.13 Due to the required high risk stabilisation works, this option is not feasible within the constraints of the project. The works would require track closure over a prolonged period which falls outside that possible with the train operating companies as well as being disruptive to road and pedestrian footbridge users. The high risk construction activities required to implement this option are considered unviable.

7. DEVELOPMENT OF PREFERRED OPTION

7.1.1 Taking the above assessment into consideration, the preferred option for the bridge is Option A1 structure intervention. Two main options were considered:

- Deck reconstruction with a flat composite steel/concrete deck
- Full replacement with an arched feature composite deck

7.1.2 The flat deck reconstruction option would involve removal of the existing arch superstructure and replacement with a new flat deck type structure. This would retain the sandstone effect of the original bridge through applied facing; however, it would remove the basket arch feature.

Figure 6 Standard bridge reconstruction with stone cladding to parapets

7.1.3 Whilst this option would retain the sandstone effect of the structure whilst achieving the necessary reduced construction depth required for the replacement superstructure, an alternative considered is to replace the superstructure with a modern feature bridge. This recognises the historic importance of the Transpennine route and the architectural importance of the individual structures, particularly those designed by Walker and Burges.

7.1.4 A process of design iteration has been undertaken to refine the replacement structure, focussing on the provision of an arch to emulate the historic character of the railway. Two options were considered; one that retained the flat deck, but incorporated an arch above the deck, and a second which recreated the basket arch, but utilised an applied weathered steel structure.

Figure 7 Bespoke feature arch

Figure 8 Weathered steel arch

8. CONCLUSIONS

8.1.1 Austhorpe Lane Overbridge (HUL4/21) is a grade II listed structure which forms part of the original Selby to Leeds Railway. It was constructed in the 1830s to the designs of Walker and Burges and incorporates an unusual basket arch form which was designed to accommodate a four track railway.

The bridge is one of 12 of its type which survive along the original route, eight of which are listed.

8.1.2 The structure does not meet the clearance requirements for the OLE as part of the proposed electrification of the Transpennine Railway. In order to achieve the benefits of the Transpennine upgrade, the height of the structure needs to be increased. Two options have been considered to achieve the necessary clearance while meeting Network Rail's minimum functional/ operation requirement. These were assessed against the Assessment Matrix. This concluded that the track lower and track slue options are not feasible due to impact on the associated highway, construction risk, programme impact and cost; therefore, bridge intervention is necessary.

8.1.3 Option A bridge intervention is therefore considered to be the only feasible option to deliver the benefits of the project. The option is considered Highly Unsupportive in heritage terms, involving the total loss of the listed structure. Work has been undertaken to compensate in part for this loss through the provision of bespoke structure which integrates features from the historic structure and compliments the group value of the Walker and Burges' bridges.

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APPENDICES

Appendix A Assessment Matrix

Assessment Topic	Assessment sub-topic	Evaluation Criteria	Evaluation Parameters				
			Highly Unsupportive	Unsupportive	Neutral	Supportive	Highly Supportive
Environment, Sustainability and and Consent Risk	Planning Policy/ Consideration	NPPF policy Adopted development plan policies Adopted development plan allocation Emerging development plan policies Emerging development allocation Extant planning applications Policy land allocation (e.g. Green belt) Other relevant local transport or environment policy.	Contrary to NPPF golden thread Inappropriate development in the Green Belt Clearly contrary to adopted development plan policy and allocations Clear land use conflict with extant planning application Clearly contrary to adopted transport or environmental policy	Some elements inconsistent with NPPF policies Partially contrary to adopted and emerging development plan policy and allocations Partial conflict with extant planning application Partially contrary to adopted or emerging transport or environmental policy	Consistent with NPPF policy No relevant adopted or emerging Local Plan policies No extant planning application	Consistent with NPPF policy In accordance with adopted and emerging local plan policies and allocations. Consistent with extant planning application In accordance with to adopted transport or environmental policy	Supported by NPPF policy Proposed development meets and exceeds adopted and emerging local plan policies Proposed development meets and exceeds land allocation requirements Would enhance extant planning application Supports delivery of adopted transport or environmental policy
	Consent Risk	Number & type of primary consents; need for listed building consent; need for appropriate assessment; need for EIA; need for special parliamentary procedures.	Appropriate Assessment required. High risk of primary development consent being refused (e.g. due to multiple likely statutory consultee / local authority / local community objections)	Appropriate Assessment required and outcome expected to be positive. Special parliamentary procedures are triggered (allotments, Common Land, National Trust land), which would significantly extend the programme. However outcome expected to be positive. Medium right risk of primary development consent being refused (e.g. due to likely statutory consultee / local authority / local community objections) Listed building consent unlikely to be supported by Historic England	EIA required. Habitat Regulations Screening Assessment Required. Multiple primary consents required: planning permission, Transport and Works Act Orders (to enable compulsory purchase of land, planning permission and operational authorisation). Listed building consents required. Public Inquiries in some cases anticipated.	EIA Screening required. Habitat Regulations Screening Assessment Required. Majority of works are permitted development; single primary consent required. Planning permissions and listed building consents required. However it is assumed that these would be granted subject to conditions.	EIA not required. Appropriate assessment under the Habitat Regulations not required. Primary development consents granted (i.e. all works are permitted development).
	Landscape/ Townscape and Visual	Visual impact on key receptors. Landscape character effects including on nationally (National Park / AONB) or locally valued landscapes and/or townscapes. TPOs Design quality	Permanent adverse visual effect on long views or multiple receptors (individuals / locations) or protected view Permanent adverse effects on landscape character as a result of the introduction of unsympathetic feature within area of national designation/ high landscape value that cannot be mitigated against. Removal of tree subject to TPO	Permanent adverse visual effect on limited number of near viewpoints Permanent adverse effects on landscape character as a result of the introduction of unsympathetic feature within area of local landscape designation/value and/ or townscape designation/ value. Inappropriate development within local context/ unsympathetic to existing character	Replacement of existing with feature of similar scale and design Minor and negligible changes to existing structure Location within a landscape / townscape able to absorb change Temporary adverse impact from construction works resulting in temporary adverse effects on landscape character and visual amenity	Design sensitive to setting/ context and character No obstacles key view	Introduction of new public space/ access and improvements to existing landscape High quality/ innovative design making positive contribution to context
	Biodiversity	Ecological designations (SSSI, Nature Reserves, Special Area of Conservation, Special Protection Area, Local Wildlife Site, Ramsar) Protected species and/or their habitat Other recognised ecological, biodiversity, nature conservation important receptors (red databook or other notable species)	Works within, or outside, an internationally or nationally designated ecological site resulting in permanent damage to these sites despite mitigation. Irremediable loss of protected and/or irreplaceable habitat. Development likely to have significant adverse effect on protected species.	Works within, or outside, an internationally or nationally designated ecological site requiring significant mitigation to avoid permanent damage. Development within, or outside a locally designated wildlife site likely to cause some harm. Net loss of biodiversity at a scale difficult to offset. Adverse effect on protected and irreplaceable habitat. Adverse effect on protected species.	No net loss of biodiversity. It is anticipated that this would involve mitigation and compensatory measures.	Overall biodiversity gain. Mitigation measures above what is required to mitigate any harm.	Enhancement of designated area of nature conservation and habitat of protected species.
	Cultural Heritage	Internationally designated heritage assets (World Heritage Sites) Nationally designated assets (Areas of Archaeological Importance; Scheduled Monuments; Listed Buildings; Conservation Areas; Registered Parks and Gardens) Non-designated historic structures (archaeological sites, locally listed structures) Opportunities for enhancement of heritage assets	Substantial harm to, or loss of designated heritage assets : Scheduled Monuments, battlefields,listed buildings, registered parks and gardens and World Heritage Sites.	Less than substantial harm to designated heritage assets	Conserves heritage assets in a manner appropriate to their significance. Sustains the significance of heritage assets.	Better reveals the significance of heritage assets. Puts heritage assets to viable uses consistent with their conservation. Secures the future conservation of a heritage asset.	Better reveals the significance of heritage assets. Puts heritage assets to viable uses consistent with their conservation. Secures the future conservation of a heritage asset. Puts heritage assets to viable uses consistent with their conservation. Enhances the significance of heritage assets. Makes a positive contribution to local
	Air Quality	Air Quality Management	Significant anticipated temporary air quality issues associated with construction which cannot be managed using industry standard best practice measures. Permanent anticipated adverse operational air quality effects. Site lies within an AQMA and is in contradiction with relevant local air quality action plan.	Anticipated temporary air quality issues associated with construction which cannot be managed using industry standard best practice measures. Some anticipated adverse operational air quality effects. Site lies within an AQMA and is in temporary contradiction with relevant local air quality action plan measures due to construction.	Anticipated temporary air quality issues associated with construction can be managed using industry standard best practice measures. No additional operational adverse air quality effects. Site lies outside AQMA	Anticipated temporary air quality issues associated with construction can be managed using industry standard best practice measures. Reduced adverse operational air quality effects. Site lies outside AQMA and is aligned with relevant local air quality action plan measures.	Local air quality substantially improved as a result of the development. Site lies outside AQMA and actively supports relevant local air quality action plan measures.
	Noise and Vibration	Noise sensitive receptors (residential properties, community facilities and PRoW) Noise Important Area Tranquil area	Likely to affect a large number of noise sensitive receptors Operational noise increase above Significant Observed Adverse Effect Level (SOAEL). Increase to noise within a designated noise important area. Construction or operational vibration levels likely to result in structural damage to buildings and adverse effect on health and wellbeing of communities. Operational vibration not tolerable for humans.	Likely to affect a moderate number of noise sensitive receptors Operational noise increase above Lowest Observed Adverse Effect Level (LOAEL) but below the SOAEL. Construction vibration levels evaluated to have potential to result in cosmetic damage to buildings or reach intolerable levels for human receptors. Operational vibration is likely to be perceptible by human receptors.	Likely to affect few noise sensitive receptors. Operational noise increase at or approximating to Lowest Observed Adverse Effect Level (LOAEL). Construction sound, noise and vibration effects can be partially mitigated to acceptable levels New operational vibration levels likely to be perceptible to human receptors.	Operational noise increase between Lowest Observed Adverse Effect Level and No Observed Effect Level. Slight reduction in operational noise and vibration levels at noise sensitive receptors compared with that currently experienced.	Construction sound, noise and vibration effects can be effectively mitigated to acceptable levels. Operational noise increase at or below No Observed Effect Level. Moderate or large reduction in operational noise and vibration levels compared with that currently experienced.
	Soils and Geology	Presence of contaminated land Designated area of geological conservation Safeguarded mineral resource	Permanent adverse effects to designated area of international geological conservation Permanent adverse effects to Soils, including loss of mineral resources, directly supporting an EU designated site. Creates contaminated land which cannot be mitigated. Contributes to land instability which cannot be mitigated.	Adverse effects to designated area of national geological conservation. Adverse effects to soils, including loss of mineral resources, directly supporting a nationally designated site. Contributes to land instability which can be mitigated.	Effective use of land, including reusing previously developed land. Minimised harm to geological conservation interests. Where appropriate incorporates extraction of safeguarded mineral deposits prior to development taking place. Makes no contribution to land instability or contributes to land instability which can be mitigated.	Best and most versatile agricultural land, restored to a higher agricultural grade following construction. Protects geological conservation interests. Remediates and mitigates despoiled, degraded, derelict contaminated and unstable land. Avoids safeguarded mineral deposits. Makes no contribution to land instability.	Removal of existing contamination. Reveals and expands knowledge of geological conservation interests. Makes no contribution to land instability.

	Water Environment	Environment Agency Flood zone Surface water groundwater	Development in Flood Zone 3 that occupies flood storage capacity or impacts flow of surface or groundwater - difficult to mitigate. Could enable pollution pathways that enable migration of contamination from a site. Groundwater source protection zone 1 Large adverse effect on a sensitive water body that cannot be mitigated. Sustainable water management measures cannot readily be incorporated into the design.	Development in Flood Zone 2/3 that occupies flood storage capacity or affects flow of surface or groundwater acceptable mitigation solution proposed. Groundwater source protection zone 2 or 3 Limited sustainable water management measures can be incorporated into the design.	Site within flood zone 1 Temporary disruption to water body quality (including practicable and proportionate mitigation). Sustainable water management measures can readily be incorporated into the design.	Design reduces flood risk. Enhances local surface water and groundwater quality. Sustainable water management measures can readily be incorporated into the design.	Design significantly reduces flood risk. Removes interruption to surface and groundwater. Creation of flood storage. Sustainable water management measures can readily be incorporated into the design and will improve existing situation.
	Transport	Transport impacts on the local community through the transport of materials, waste and employees. Impacts on connectivity and accessibility for local community, including severance and impacts on walkers, cyclists & horse riders.	Safe and suitable access to construction sites is unavailable and cannot be created. Removed accessibility of public transport. Permanent adverse impact on strategic and sustainable transport networks including impact on non-motorised users.	Safe and suitable access to construction sites is unavailable and cannot be created without adverse impacts. Reduced accessibility of public transport. Impact on strategic and sustainable transport networks including impact on non-motorised users.	Safe and suitable access to construction sites is available or can be created temporarily. Temporary impact on accessibility of public transport. Temporary impact on local transport networks including non-motorised paths.	Safe and suitable access to construction sites is available. Maintains existing accessibility of public transport. Maintains existing local transport networks including non-motorised paths.	Utilises opportunities to transfer significant construction related traffic onto sustainable transport modes. Improves accessibility of public transport. Utilises opportunities to promote walking cycling and public transport.
	Resource Management	Waste generation Use of primary materials	Scheme is likely to result in a very large effect in relation to the generation of waste which cannot be reused or recycled; or the substantial use of primary aggregates and materials.	Scheme is likely to result in a large effect in relation to the generation of waste which cannot be reused or recycled; or the use of primary aggregates and materials.	Scheme is likely to result in a near neutral effect in relation to the generation of waste which cannot be reused or recycled; or the use of primary aggregates and materials.	Scheme is likely to result in a positive effect in relation to the minimal generation of waste which cannot be reused or recycled; or the minimal use of primary aggregates and materials. It supports the reuse of renewable resources; uses recycled materials; incorporates recovery, recycling and reuse of materials generated during construction; and energy recovery.	Scheme is likely to result in a positive effect in relation to the minimal generation of waste which cannot be reused or recycled; and maximises use of secondary and recycled materials. Utilises and/contributes to renewable energy systems (district heating systems etc).
	Weather Resilience & Climate Change	Route Weather Resilience & Climate Change Adaptation (WRCCA) Plan high and medium priority impact areas.	The medium and high impacts are not avoided or expected to be mitigated.	High impacts are not avoided or expected to be mitigated.	All medium and high impacts can be either avoided or addressed through mitigation.	All of the avoidable high impact are avoided.	All of the avoidable medium and high impacts are avoided.
	Carbon	Qualitative assessment	Scheme is likely to result in a very large impact in terms of embodied and lifetime carbon emissions.	Scheme is likely to result in a large impact in terms of embodied and lifetime carbon emissions.	Scheme is likely to result in a moderate impact in terms of embodied and lifetime carbon emissions.	Scheme is likely to result in a small impact in terms of embodied and lifetime carbon emissions.	Scheme is likely to result in a neutral or negative impact in terms of embodied and lifetime carbon emissions.
Land & Property	Land availability Third party assets	Land Acquisition requirements Effect on utilities and statutory undertakers	Permanent acquisition of third party land required - sensitive occupiers: residential property; community assets; businesses; land subject to special parliamentary measures (common land, allotments, National Trust) etc.	Permanent acquisition of third party land required - no sensitive occupiers. Temporary acquisition of land / rights - known obstructive landowners. Adverse effect on utilities and statutory undertakers (assets)	No permanent acquisition of third party land required. Requires permanent acquisition of third party air rights. No adverse effect on utilities and statutory undertakers (assets)	No permanent acquisition of third party land required. No third party air rights required.	No permanent or temporary third party land requirements.
	Land use and accessibility, including: - private property & access - community land & assets - agricultural land	Effects on private property & tenants Effects on community land assets including local green infrastructure and open space Effects on development land and business Effects on agricultural land holdings	Permanent significant adverse effect on private property or tenants and/ or access to private property Permanent loss of access to community land assets including local green infrastructure and open space and/ or access to them. Likely significant adverse effect on businesses Permanent loss of agricultural land holdings including permanent loss of best and most versatile agricultural land (Grade 1,2,3a) and/ or access to it.	Permanent adverse effects on private property or tenants and/or access to private property Adverse effects on community land assets including green infrastructure and open space and/ or access to them. Moderate impact/ adverse effect on businesses Adverse effects on and/ or access to agricultural land holdings including best and most versatile agricultural land (Grade 1,2,3a).	Temporary loss of access to private property or tenants Temporary loss of community assets including green infrastructure and open space and/ or access to them. No impact on businesses Temporary loss of best and most versatile agricultural land (Grade 1,2,3a) and/or Agricultural Land Classification Grade 4 or 5 - fully restored.	Minimal effect on private property and/ or access to private property or tenants Enhancement of existing community assets including green infrastructure and open space and access to them. Beneficial effect on businesses No permanent loss of best and most versatile agricultural land (Grade 1,2,3a). Minor effects on Agricultural Land Classification Grade 4 or 5.	No effect on private property/ access to private property or tenants. Creation of new community assets including green infrastructure and open space and access to them. Significant beneficial effect on businesses No permanent loss of best and most versatile agricultural land (Grade 1,2,3a). Minor temporary effects on Agricultural Land Classification Grade 4 or 5 due to construction.
	Public Rights of Way (PRoW)	Diversionary Routes - Convenience & suitability (incl. length, maintenance & accessibility) and enjoyment of diversionary route (for existing users)	Diversionary route substantially longer than existing route Long term and costly maintenance of diversionary route required No accessible alternative access proposed Amenity of diversionary route (including views, noise, landscape) significantly reduced compared to existing route Likely significant adverse effect on businesses or other defined user groups of the existing crossing (e.g. horse riders, cyclists)	Diversionary route slightly longer than existing route Long term low cost maintenance of diversionary route required Accessibility of diversionary route is worse than existing route (including level change, quality and evenness of footpath, access for disabled or older people or people with young children) Amenity of diversionary route (including views, noise, landscape) of lower quality than existing route Moderate impact/ adverse effect on businesses or other defined user groups of the existing crossing (e.g. horse riders, cyclists)	Diversionary route of similar length to existing route Short term low cost maintenance of diversionary route required Diversionary route reprovides like for like accessibility (including level change, quality and evenness of footpath, access for disabled or older people or people with young children) Temporary impact on amenity and views of diversionary route No impact on businesses or other defined user groups of the existing crossing (e.g. horse riders, cyclists)	Diversionary route shorter than existing route Diversionary route poses no safety risks and provides enhancement in some areas Diversionary route causes no maintenance issues Diversionary route improves accessibility for some users (including level change, quality and evenness of footpath, access for disabled or older people or people with young children) Some improvement on amenity of diversionary route (including views, noise, landscape) Beneficial effect on businesses or other defined user groups of the existing crossing (e.g. horse riders, cyclists)	Diversionary route significantly shorter than existing route Diversionary route safer than existing route Diversionary route is maintenance free / improves maintenance issues Diversionary route provides improved accessibility for all users / the public (including level change, quality and evenness of footpath, access for disabled or older people or people with young children) Amenity of diversionary route (including views, noise, landscape) is of significantly higher quality than existing route Significant beneficial effect on businesses or other defined user groups of the existing crossing (e.g. horse riders, cyclists)
	Safety	Safety for all users	Introduces significantly less safe route across railway line than existing route. Increases need for pedestrians and other non-motorised users to use road network	Diversionary route poses greater safety risk than existing route. Increases need for pedestrians and other non-motorised users to use road network, but appropriate pavement/ cycleway is provided	Diversionary route causes temporary safety risk Leads to temporary increases need for pedestrians and other non-motorised users to use road network, but appropriate pavement/ cycleway is provided	Diversionary route poses no safety risks and provides enhancement in some areas Reduces need for pedestrians and other non-motorised users to use road network compared to existing route	Diversionary route safer than existing route Provides enhanced route four pedestrian and other non-motorised users
Cost**	Whole Life Cycle Costs	Capital construction costs Maintenance costs	High Capital and high maintenance Cost	High Capital and neutral maintenance cost	Medium Capital and neutral maintenance cost	Low Capital and neutral maintenance cost	Low capital and low maintenance cost
Design / engineering feasibility**	Key design constraints, e.g. maintenance and public safety; wire height affecting height of any bridge solution.	Extent of temp works needed Procurement lead times Fabrication complexity	High design Complexity	Medium design Complexity	Standard design Complexity	Low design Complexity	Retain /Modify Asset
Construction**	Buildability, including site access.	Extent of site constraints to be managed Extent of temp works needed Procurement lead times Fabrication complexity	High build complexity/Challenging site constraints	Medium build complexity/Challenging site constraints	Standard build complexity/Manageable site constraints	Low build complexity/Manageable site constraints	Low build complexity/No site constraints
Maintenance**	Maintenance Regime	Meets Transversal Requirements Impact on Maintenance budget Maintenance staff exposure to lineside risks	High Ongoing Maintenance Burden	Medium Ongoing Maintenance Burden	Standard Ongoing Maintenance Burden	Standard Ongoing Maintenance Burden	Low Ongoing Maintenance Burden
Deliverability (timescale)	Meets Programme Requirements	Access Availability Alignment with multi-disciplinary programmes Programme Deconfliction	Impacts proposed commissioning dates	Causes delay to programme timescales	Meets programme timescales	Improves programme timescales for asset delivery	Enables Early commissioning/Benefits