Options Report

Darley Abbey Mills Bridge

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Contents

EXECUTIVE SUMMARY 1

1 INTRODUCTION 3
1.1 Site Location 3
1.2 Existing Structure 4
1.3 Options 5
1.4 Utilities 5
1.5 Assumptions & Exclusions 6

2 OPTION 1 – REMOVAL OF CROSSING 9
2.1 Option Description 9
2.2 Design 9
2.3 Construction 9
2.4 Environmental Considerations 10
2.5 Capital Costing 11
2.6 Whole Life Costing 12
2.7 Construction Programme 12
2.8 Project Risk Assessment 12
2.9 Summary Table 15

3 OPTION 2 – CONTINUATION OF MEDIUM-TERM SOLUTION 16
3.1 Option Description 16
3.2 Design 16
3.3 Construction 16
3.4 Environmental Considerations 17
3.5 Capital Costing 18
3.6 Whole Life Costing 18
3.7 Construction Programme 18
3.8 Project Risk Assessment 19
3.9 Summary Table 22

4 OPTION 3 – RE-CONSTRUCTION OF EXISTING BRIDGE STRUCTURE 23
4.1 Option Description 23
4.2 Design 23
4.3 Construction 23
4.4 Environmental Considerations 25
4.5 Capital Costing 26

4.6 Whole Life Costing 27
4.7 Construction Programme 27
4.8 Project Risk Assessment 28
4.9 Summary Table 32

5 OPTION 4 – 4M WIDE BRIDGE (ACTIVE MODES ONLY) 33
5.1 Option Description 33
5.2 Design 33
5.3 Construction 34
5.4 Environmental Considerations 35
5.5 Capital Costing 36
5.6 Whole Life Costing 37
5.7 Construction Programme 38
5.8 Project Risk Assessment 38
5.9 Summary Table 42

6 OPTION 5 – 4M WIDE BRIDGE (ACTIVE MODES AND EMERGENCY VEHICLE ACCESS ONLY) 43
6.1 Option Description 43
6.2 Design 43
6.3 Construction 43
6.4 Environmental Considerations 43
6.5 Capital Costing 44
6.6 Whole Life Costing 44
6.7 Construction Programme 45
6.8 Project Risk Assessment 45
6.9 Summary Table 50

7 OPTION 6 – HIGHWAY BRIDGE 51
7.1 Option Description 51
7.2 Design 51
7.3 Construction 51
7.4 Environmental Considerations 53
7.5 Capital Costing 54
7.6 Whole Life Costing 55
7.7 Construction Programme 55
7.8 Project Risk Assessment 56
7.9 Summary Table 60

8 OPTIONS SUMMARY 61

9 CONCLUSION & RECOMMENDATION 64

APPENDIX A 66

Appendix A – Designer's Risk Assessment 66

APPENDIX B 67

Appendix B 67

Early Contractor Involvement Scope 67

Table 1 – Options to be Investigated 1

Table 2 – Overall Whole Life Cost (Total Future Maintenance & inspection Cost + Total Capital Cost) 2

Table 3 – Options to be investigated 5

Table 4 - Routine maintenance schedule adopted for the purpose of whole-life costing analysis. 7

Table 5 - Option 1 Capital Cost 11

Table 6 - Option 1 Risk Assessment 12

Table 7 - Option 1 Summary Table 15

Table 8 - Option 2 Future Maintenance and Inspection Costs 18

Table 9 - Option 2 Overall Whole Life Costs 18

Table 10 Option 2 Risk Assessment 19

Table 11 - Option 2 Summary Table 22

Table 12 – Option 3 Capital Costs 26

Table 13 – Option 3 Future Maintenance and Inspection Costs 27

Table 14 – Option 3 Whole Life Cost 27

Table 15 – Option 3 Risk Assessment 28

Table 16 – Option 3 Summary Table 32

Table 17 – Option 4 Capital Costs 36

Table 18 – Option 4 Future Maintenance and Inspection Costs 37

Table 19 – Option 4 Whole Life Cost 37

Table 20 – Option 4 Risk Assessment 38

Table 21 – Option 4 Summary Table 42

Table 22 – Option 5 Capital Costs 44

Table 23 – Option 5 Future Maintenance and Inspection Costs 45

Table 24 – Option 5 Whole Life Cost 45

Table 25 – Option 5 Risk Assessment 45
Table 26 – Option 5 Summary Table 50
Table 27 – Option 6 Capital Costs 54
Table 28– Option 6 Future Maintenance and Inspection Costs 55
Table 29 – Option 6 Whole Life Cost 55
Table 30 – Option 6 Risk Assessment 56
Table 31 – Option 6 Summary Table 60
Table 32 – Options Summary 62

Executive Summary

Darley Abbey Mills Bridge spans across the River Derwent at Darley Abbey Mills in Derby and has been closed to all traffic due to its current condition. A medium-term structure has been installed on the same alignment while engineering solutions are investigated. Derby City Council has commissioned Arcadis to prepare an Options Report to recommend a preferred option.

Table 1 provides a description of the six options which Derby City Council have identified for investigation in this study. Bridge replacement Options 4 and 5 for have previously been investigated as part of a preliminary design option review by Arcadis and Knights Architects in November 2023. The scope of this Options Report does not include any consideration of the architectural form of these bridge replacement options but retains the alignment and span which were recommended in the earlier study. The preliminary costing provided in the early study are updated with input from Galliford Try, and they have also provided buildability advice and works durations.

Table 1 – Options to be Investigated

Option	Description
1	Full demolition of the existing structures (disused bridge crossing and footbridge) including full removal of the existing piers and local reinstatement at the bridge approaches.
2	Maintain the existing footbridge arrangement as a medium-term solution with future demolition of the disused bridge to prevent uncontrolled collapse.
3	Remove medium-term structure and demolish disused existing bridge. Re-construct the existing concrete bridge deck and substructure on the same horizontal alignment to match the current carriageway and footway width.
4	Full demolition of the existing structures including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) pedestrian and cyclist footbridge on a new alignment.
5	Full demolition of the existing structures including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) accommodating pedestrians, cyclists and emergency vehicles on a new alignment.
6	Full demolition of the existing structures including removal of the existing piers and reconstruction with a multi-span concrete 8m wide (trafficked width) highway bridge comprising a 4m wide combined footway/ cycleway on a new alignment.

The key findings are as follows:

Option 1 removes many of the benefits afforded by a historic fixed link in the area and reduces connectivity to Darley Abbey Mills over the River Derwent. This reduction in connectivity is considered to impact negatively on the local community.

Option 2 involves prolonging the use of the current footbridge as a medium-term solution and would incur significant future costs as the existing disused structure deteriorates further and will eventually require demolition. Since this option has a negative visual impact on the world heritage site and will incur significant future costs, it is recommended to limit the ongoing use of this existing arrangement as far as possible.

Of the four ‘construction’ options it was found that the multi-span vehicle access options, 3 and 6, were significantly more expensive than the single span steel options 4 and 5. This is due to the requirement for significant volumes of additional pier construction in the watercourse with the associated environmental

impacts, complexity of construction and health and safety risk. The estimated programme for these options – 206 and 234 weeks respectively, would lead to significant prolonged disruption for the local community.

Option 3 would restore the previous bridge crossing but would not improve pedestrian and cycling facilities or allow Fire Engines to cross the river. Option 6 is the most expensive option and provides dedicated pedestrian and cycling facilities while also providing full one-way vehicle access, but the long approach ramps needed at represent a significant design challenge at this constrained site and may not be feasible. Allowing vehicles to regain access to the bridge also creates traffic and parking related environmental impacts for local residents.

Options 4 and 5 which would be primarily formed from steel were found to be the most cost-effective. This was due to these options being single span only and therefore eliminating the requirement for extensive construction in the watercourse. Both options are structurally alike, but Option 5 has the added benefit of providing emergency vehicle access and is not significantly more expensive than Option 4. The preferred option is therefore recommended as Option 5.

Architectural variations for Option 5 were previously investigated in 30194918-ARC-SBR-XX-RP-CE-00002 Preliminary Design Options report and two sub-options 2 and 3b were recommended for further development. With reference to Table 2, Option 5 $_{(2)}$ has the lowest capital and whole life cost. This option also has reduced complexity for design and construction, compared with the sub option 5 $_{(3b)}$. Furthermore, it does not require a submerged section of the bridge which would increase future maintenance and impact on river flows.

Table 2 – Overall Whole Life Cost (Total Future Maintenance & inspection Cost + Total Capital Cost)

Overall Cost (£)			
Options	Total Future Maintenance & Inspection Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
1	0	3,081,756	**3,081,756**
2	2,414,967.34	0	**2,414,967.34**
3	187,785.30	15,156,785	**15,344,570**
4 $_{(2)}$	164,223.37	10,180,045	**10,344,268**
4 $_{(3b)}$	164,223.37	10,449,361	**10,613,584**
5 $_{(2)}$	164,223.37	10,220,442	**10,384,665**
5 $_{(3b)}$	164,223.37	10,489,759	**10,653,982**
6	272,421.95	21,576,870	**21,849,292**

The high-level figures noted in Table 2 should only be viewed as outline values only, effective at the time of report production. Arcadis Consulting (UK) Ltd will not be held responsible for the misuse of these figures or future fluctuations in cost proceeding the date of this report.

Recommendation

The recommended option to be carried forward is Option 5$_{(2)}$ which is the perforated U-beam single-span bridge deck formed in weathering steel. This option allows for pedestrian/cyclists and emergency vehicle access only and is considered to provide the best balance of value-for-money, connectivity, aesthetic value in keeping with the surrounding Grade I and II heritage environment and usage requirements.

1 Introduction

Darley Abbey Mills Bridge spans across the River Derwent at Darley Abbey Mills in Derby and has been closed to all traffic due to its current condition. A medium-term structure has been installed on the same alignment while engineering solutions are investigated. Derby City Council has commissioned Arcadis to prepare an Options Report to recommend a preferred option.

This Options Report investigates six possible options which are further described in Section 1.3 below. Due to the unique characteristics and constraints of the site, Derby City Council has also engaged Galliford Try to provide input on the construction methodology, programming, feasibility and costings for each option. The Client's scope for Galliford Try's input to this report is included in Appendix B. The health, safety and environmental considerations, whole life costs and project risks are also investigated to enable selection of a preferred option for Derby City Council to develop as a business case and take forward to the planning stage.

1.1 Site Location

The existing site area consists of Darley Abbey village on the west side of the River Derwent and Darley Abbey Mills Complex on the east side of the river. The location is part of the Derwent Valley Mills UNESCO World Heritage site and there are several listed structures near the existing bridge including Darleys Restaurant close to the west abutment and the downstream weir. See Figure 1 below.

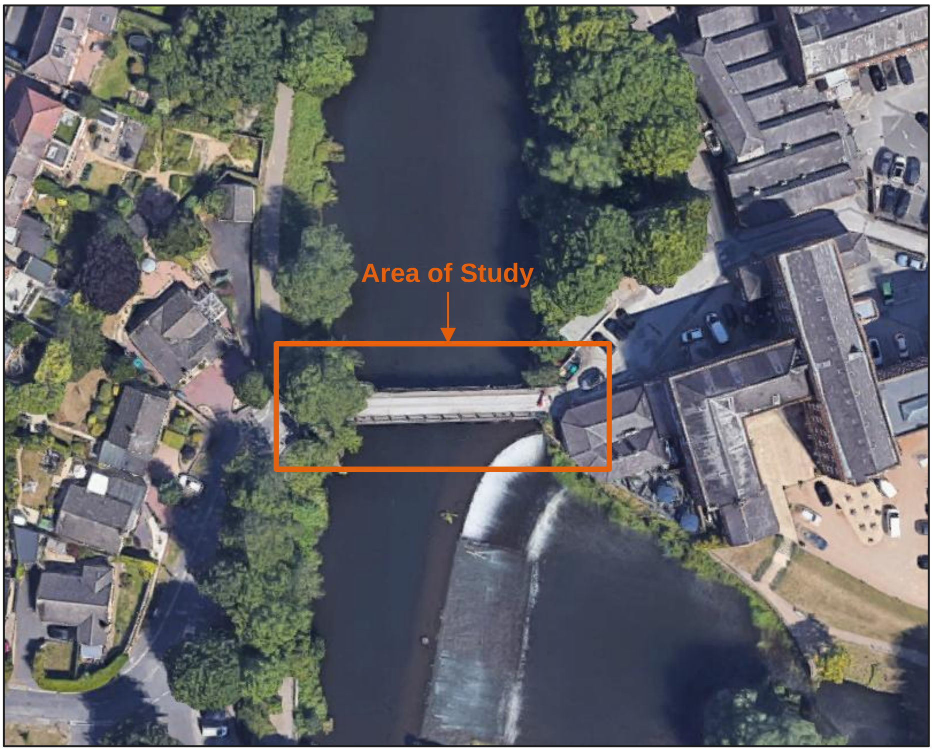

Figure 1 – Existing bridge location

1.2 Existing Structure

Darley Abbey Mills Bridge is a six span reinforced concrete bridge deck with cast iron piers. The deck comprises a reinforced concrete slab deck that spans two longitudinal reinforced concrete edge beams which bear onto the cast iron cross beams.

The eastern most pier is a solid masonry pier with stepped toe foundations supporting two cast iron piles above the water level. This pier also has a mass concrete scour apron. The remaining piers consist of cast iron piles, two per pier bedded into the river bed. The cast iron piles support a large cast iron transverse I beam carries the superstructure.

There is a mass concrete invert between the east abutment and the eastern most pier which extends to the next pier and across the river channel. The downstream weir interfaces with the east side of the existing structure.

The masonry pier is supported on limestone block foundations, extending above the water level. The remaining piers are cast iron piles which are assumed to be screw driven as per the 2013 Dive Survey Report, however the penetration depth is unknown. The dive survey also notes a separate freestanding structure between the western most pier and the west abutment with similar characteristics to the eastern most pier but with a brickwork pier built over it. The abutments are supported on limestone blocks and have stepped toe foundations at bed level.

Figure 2 – Existing Bridge

Additionally, there is a masonry wingwall adjoining the east abutment on the downstream side of the bridge, which acts as a retaining wall for Darley's Restaurant.

1.3 Options

Table 3 provides a description of the six options which Derby City Council has identified for investigation in this study. Bridge replacement options 4 and 5 for have previously been investigated as part of a preliminary design option review - 30194918-ARC-SBR-XX-RP-CE-00002 Preliminary Design Options report - by Arcadis and Knights Architects in November 2023. The scope of this Options Report does not include any consideration of the architectural form of these bridge replacement options but retains the alignment and span which were recommended in the earlier study for Options 4 and 5. The preliminary capital costs provided in the early study are also updated with input from Galliford Try. Each option is described and evaluated in the following sections of the report.

Table 3 – Options to be investigated

Option	Description
1	Full demolition of the existing structures (disused bridge crossing and footbridge) including full removal of the existing piers and local reinstatement at the bridge approaches.
2*	Maintain the existing footbridge arrangement as a medium-term solution with future demolition of the disused bridge to prevent uncontrolled collapse.
3	Remove medium-term structure and demolish disused existing bridge. Re-construct the existing concrete bridge deck and substructure on the same horizontal alignment to match the current carriageway and footway width.
4	Full demolition of the existing structures including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) pedestrian and cyclist footbridge on a new alignment.
5	Full demolition of the existing structures including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) accommodating pedestrians, cyclists and emergency vehicles on a new alignment.
6	Full demolition of the existing structures including removal of the existing piers and reconstruction with a multi-span concrete 8m wide (trafficked width) highway bridge comprising a 4m wide combined footway/ cycleway on a new alignment.

**The feasibility of repairing and re-opening the original bridge structure has previously been investigated and discounted. Refer to Darley Abbey Existing Bridge Feasibility Report 30194918-ARC-SBR-XX-RP-CE-00001.*

1.4 Utilities

The existing disused structure carries a gas main which is affixed to the external (outward facing) side of the upstream side of the structure. Similarly, a water main which is formed of lead pipe, and a cable tray carrying an electricity cable are affixed to the downstream external face of the structure. Small ducts are fixed to soffit which archive drawings suggest are or were used for a spring water pipe and a gas pipe. Derby City Council would arrange suitable advance diversions to facilitate each option.

1.5 Assumptions & Exclusions

Capital Costs

The following assumptions and exclusions were considered in the Capital Costing evaluation:

1. The cost does not include the diversion of utilities.
2. The cost does not include any survey cost required during the design stage (eg. ground investigations, environmental and ecology surveys, topographical surveys, flooding analysis/surveys, archaeology, diving inspections, building/bridge condition and structural surveys.)
3. The cost does not include use of private land and land remediation works.
4. The cost does not include cost for permits, consents & licenses.
5. Optimism bias and costing of project risks has been excluded and is to be assessed when producing the business case.
6. Consultation, planning and business case preparation.
7. Costings assume the works will commence for each option in April 2027.

Whole-Life Costs

The following assumptions and exclusions were considered in the whole-life cost calculations.

1. Inspection costs consider only time-charge estimates for inspection personnel. Other associated costs such as traffic management costs, access equipment hire, and site transportation hire (inspection team hire car, or public transport) costs are not included.
2. Costs for scheduled routine maintenance is included for joints and bearing replacement, bridge deck resurfacing and re-waterproofing and parapet replacements. These costs are based on Galliford Try's estimated maintenance costs for each element to the following schedule. Bearing replacement works programme duration vary between 4 and 9 weeks due to the variation in number of bearings between options.
3. The values supplied within are discounted 'Present Value' (PV).This is the current value of a future sum of money. The reporting of future maintenance costs after discounting is in accordance with the methodology supplied within DMRB CD 355: Application of Whole Life Costs for Design and Maintenance of Highway Structures. The discount factors used year-on-year are obtained from the UK Treasury 'Green Book'. Discount rates are applied as follows, in accordance with CD 355 and The Green Book:

   (i) Years 0 to 30 – 3.5%

   (ii) Years 31 to 60 – 3.0%

   CD 355 provides a maximum evaluation period of 60 years only for future maintenance events.

Table 4 - Routine maintenance schedule adopted for the purpose of whole-life costing analysis.

Item	Year of routine maintenance requirement.	Allowance for maintenance works (weeks)
Bridge joint replacement	26, 50	2 (each year)
Bearing replacement	40	4 - 9
Resurfacing & Re-waterproofing	50	2
Parapet Replacement	50	2
Medium term structure replacement	30	N/A

It has been assumed in the whole life costs that the medium-term structure is to be replaced at 30 years. This assumption is based on the need for repainting which would require lifting the bridge out for repainting off site. This is treated as equivalent to installing a replacement structure.

Embodied Carbon

The embodied carbon has been calculated for each option by determining the quantities, dimensions and material types for each component/element for each bridge option from available information and drawings.

Unit densities were then determined using a range of sources, such as manufacturer information, where available, and Annex A of BS EN 1991 1-1. Factors for determining embodied carbon per material type were obtained from the Inventory of Carbon & Energy (ICE) database (v4.0) which is available online.

Total quantities were calculated for each option for each material type. These were then multiplied by each respective material carbon factor to provide values of embodied CO_2.

These values were then divided by the total calculated mass per material to derive a value of embedded CO_2 per unit of mass, grouped into superstructure and substructure elements, and summed to provide the overall values reported.

The carbon factors supplied within ICE (v4.0) have been calibrated for each material to account for whole-life embodied carbon, accounting for raw material extraction, transportation of raw materials, manufacturer, transportation to site, construction, operation and end-of-life processes.

The following assumptions and exclusions were considered in the embodied carbon calculations:

1. The embodied carbon calculation considers only the material volumes used for each structure option.
2. The embodied carbon generated for demolition and dismantling activities, transportation and processing of waste material generated by demolition has not been considered. Although it has not calculated, the steel in the existing bridge is expected to be recycled.
3. Carbon generated from planned routine future inspections and repair works has not been considered.
4. Materials, emissions and waste handling estimates for ramped approaches have not been included, as preliminary design for these features has not been realised.
5. Materials, emissions and waste handling estimates for ancillary structures / elements such as bollards, off-structure road resurfacing (including the disposal of road planings), excavation and backfill volumes, landscaping / topsoiling, and tree/vegetation clearance have also been omitted.

6. Limitations

This report investigates the feasibility of options and provides a preliminary comparison of the construction methodology, environmental considerations, traffic management, costs, programme and risk associated with each option noting the following limitations:

- A detailed investigation of the ground conditions and interpretation of the findings will be required to develop the preferred option at the next design stage.
- The recommended option will be subject to consultation and planning requirements which may require more detailed environmental surveys and an assessment of the impacts.
- Additional surveys will be required at a later stage, for example topographical, diving, archaeological.
- Land occupancy.
- Environment Agency consents.
- The Project Risk evaluation for each option are preliminary and subject to further development by Derby City Council.
- Interference and constructability of new substructure and foundations with any existing substructure and foundation elements has not been investigated as part this report and has been outlined as a risk.

Arcadis has not checked the buildability advice, costings and programming for each option provided by Galliford Try and accepts no liability for any inaccuracies in this information.

2 Option 1 – Removal of Crossing

2.1 Option Description

This option consists of the full demolition of the existing disused bridge and footbridge structures including the removal of piers and abutments in the waterway. Local reinstatement and landscaping will be incorporated at the bridge approaches. This would result in the loss of crossing facilities for all users, with traffic using alternatives such as the A38 bridge to the north and pedestrians and cyclists detouring to Handyside bridge to the south.

2.2 Design

The removal of the crossing would entail the demolition of the current bridge including piers and abutments. Following this, the embankments would require stabilisation, surfacing finishes (i.e. paving), and additional railing to act as a barrier between the pavement and river. Localised landscaping would also be required.

2.3 Construction

Methodology

The existing footbridge would be craned out using the same method as it was installed by positioning a crane on the public highway adjacent to the west abutment. The proposed method of demolition for the disused bridge is to install a floating scaffold beneath bridge to allow access. Temporary bracing structures may also be needed. The superstructure would then be removed using robotic demolition equipment. A crane would support deck sections whilst they are cut free with robotic demolition equipment and lifted away for processing. Existing cast iron pier columns would be removed to existing bed level by divers and retained for Derby City Council's use.

Health & Safety

The main hazards identified for this option are:

- Working from or adjacent to the watercourse.
- Stabilisation of structure during demolition
- Access constraints for cranes and plant.
- Demolition of existing bridge – potential to cause pollution of watercourse

For the full Designer's Risk Assessment, refer to Appendix A.

Traffic Management

The removal of the bridge will result in river crossing access being permanently removed for vehicles, pedestrians and cyclists. This will result in users needing to cross the River Derwent by using alternative crossings. The nearest pedestrian and cyclist crossing is Handyside, while the closest vehicle crossing is the A38 Bridge.

2.4 Environmental Considerations

During construction

Removal of the bridge will result in a temporary disruption to the river flow.

Demolition of the structure poses pollution risks to the underlying River Derwent watercourse which must be controlled. Aggressive demolition may cause damage to the Grade II listed weir.

The demolition of the existing disused structure and the removal and transportation from site of the medium-term structure will require vehicle diversions. This will result in greater carbon emissions due to extended travel distances for local residents.

Demolition of the structure may also require the removal of mature trees which line the west bank of the river in close proximity to the existing west abutment. There is the opportunity to replace any removed vegetation during the reinstatement of approaches.

Liaison with the Environmental Agency will be required to ensure that the proposed dates of demolition do not impact protected species and habitats, for example Salmon breeding.

Post construction

The removal of the crossing, without constructing a replacement bridge, will not lead to the additional carbon emissions that would result from the materials used in building an alternative bridge. However, the removal of the crossing will result in traffic being diverted and therefore increased emissions by vehicles due to prolonged journey times. The waste produced from removing the bridge has not been considered in the comparison, as this is the same for all options.

Removal of the bridge may be beneficial in providing greater privacy for local residents by reducing footfall in the area due to removal of the existing crossing point into Darley Mill/Restaurant. The lack of access to the Darley Mills Restaurant will enable local residents to benefit from the reduction in noise from visitors and greater security than the current situation.

Removal of the bridge may also benefit surrounding private residencies by reducing local car parking from members of the public intending to cross the river to visit Darley Mill/Restaurant, however it is noted that a dedicated car park exists behind the mill on the opposite side of the river.

Removal of the piers from the watercourse will reduce debris build up and the river will be clear of the barrier to flow.

Carbon Assessment

A demolition carbon assessment has not been conducted for this option.

2.5 Capital Costing

The estimated Capital Cost for Option 1 is £3,081,756 exc. VAT. This is broken down as follows:

Table 5 - Option 1 Capital Cost

CAPTIAL COST ESTIMATE	
Item	**Demolition of existing structure**
	£3,081,756
Mobilisation/demobilisation	£187,300
Enabling works	£100,800
Removal of Medium-term structure	£118,300
Removal/Demolition of existing bridge	£1,490,000
Foundations and substructure	-
Bridge Fabrication and Installation	-
Finishes (incl electrical and lighting)	£35,000
Landscaping	£40,000
Sub Total (Capital Cost)	£1,971,400
Preliminaries	£439,315
Design, Checking and Planning, 10%	£197,140
MHA4 fee (including Overheads and Profit) - 6% assumed	£163,280
Contractor's Risk and Contingency, 7% assumption, optimism bias not included	£168,750
Inflation, assuming 5.5% assumed over 2 years to Feb 2027, to be revised against BCIS indices	£141,871
Total Cost	**£3,081,756**

Refer to section 1.4 of this report for assumptions, exclusions and limitations.

2.6 Whole Life Costing

Whole life costing for Option 1 is identical to the capital costing, as detailed in Section 2.5 of the report. This is because whole life costing also accounts for the sum of future routine inspection and maintenance costs discounted back to present value costs. Therefore, the whole-life cost estimate for Option 1 is £3,081,756.

2.7 Construction Programme

The estimated construction schedule for Option 1 comprises of a 24-week programme which runs between from 14/04/2027 to 01/09/2027.

2.8 Project Risk Assessment

Table 6 - Option 1 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Limitations on vehicular access to Darley Abbey Mills including for emergency vehicles, nearest crossing is A38 bridge 1.5km to the north.	4	5	20	High	DCC	Local Authority to ensure suitable routes are available for emergency services to access Darley Abbey Mills.
Not meeting LTN/120 standards on some stretches of the route	3	5	15	High	DCC	Cyclists to use other routes.
Utilities diversion required	3	3	9	Medium	DCC	Surveys sought and updated at each stage of the project's design Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost Early and ongoing engagement with utilities providers for diversion costs and timescales
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	3	3	9	Medium	DCC	Assessments required to be undertaken by engineers to support demolition methodology at early stages.
Environmental impact: Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings Loss of mature trees on approaches Impact on watercourse and surrounding infrastructure including during construction Impact of the structure on the surrounding heritage area	1	3	3	Low	DCC	Reinstatement of trees at approaches. Removal of structure will reduce impact on surrounding area. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering

Impact of structure on surrounding protected wildlife.						**permanent and temporary works.**
Pollution of watercourse	**3**	**3**	**9**	**Medium**	**DCC**	**Early contractor involvement required to determine demolition methodology. Early stakeholder engagement to gain required approvals**
Limited access site eg crane or access from river, site access for plant and deliveries. Including impact on neighbouring properties.	**4**	**5**	**20**	**High**	**DCC**	**Early contractor involvement throughout design process.**
Flood risk impact on construction programme	**3**	**3**	**9**	**Medium**	**DCC**	**Early engagement with Environment Agency and early contractor involvement throughout design process.**
Engineering difficulty of solution	**2**	**1**	**2**	**Low**	**DCC**	**Early contractor involvement required.**
Not securing funding	**4**	**1**	**4**	**Low**	**DCC**	**Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services.**
Unsupportive public response to consultation. Lack of long term support from local community groups and affected businesses leading to reduced public perception of realised benefits. **Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.**	**2**	**4**	**8**	**Medium**	**DCC**	**Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can't be incorporated**
Permanent removal of existing crossing for vehicles compromises journey times for local residents and businesses	**5**	**5**	**25**	**High**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Providing measures which enhance the journey time could have an adverse effect on active travel modes severance or bus journey time /experience	**3**	**2**	**6**	**Low**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform**

						and get inputs into the optimal design layout
Cost increases as design develops due to inflation on materials, changes in the required design or programme prolongation i.e. fluctuations in Steel price over multi-year construction programmes.	**3**	**2**	**6**	**Low**	**DCC**	**Risk modelling and optimism bias are used within cost estimates at each stage and these are redefined as design/ cost matures to reflect greater certainty. Early Contractor Involvement during detailed design/ FBC**
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	**3**	**2**	**6**	**Low**	**DCC**	**Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts Consider the importance of non-quantifiable benefits/ wider impacts of scheme**
Delays and cost over-spend due to missed approvals and approval deadlines.	**3**	**2**	**6**	**Low**	**DCC**	**Understand fully the requirements, timescales and deadines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig. Delegate clearly in The Contract and onward communication who is responsible for each.**
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets on the West side of the River Derwent may promote increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.	**3**	**2**	**6**	**Low**	**DCC**	**The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).**
Increased risk of flooding downstream due to removal of the existing bridge	**5**	**2**	**10**	**Medium**	**DCC**	**Carry out hydrological study to assess the flood impact.**
Financial impact on local businesses during construction	**4**	**4**	**8**	**High**	**DCC**	**Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.**

Works affecting private land owners cannot be agreed through negotiation	**4**	**3**	**12**	**Medium**	**DCC**	**Identify any affected private land owners and commence early consultation**

2.9 Summary Table

Table 7 - Option 1 Summary Table

Option description	**Removal of Crossing** Full demolition of the existing structures including removal of the existing piers and local reinstatement at the bridge approaches.
Design	Reinstatement works at abutments and light landscaping.
Construction	Demolition of existing bridge will involve floating temporary works and use of robotic demolition equipment. Cranes will support deck sections as they are cut and removed. Existing supports in watercourse will be removed by divers.
Environmental	Pollution of the river course. Potential removal of mature trees for demolition access. Potential damage to Grade II listed Weir by aggressive demolition activities. Removal of barriers to river flow Potential vehicle-emission increases due to removal of existing crossing point. Potential reductions in local parking and noise from visitors to the Darley Abbey Mills. Potential greater level of privacy for local residents and increased security. No carbon assessment for Option 1 has been carried out.
Capital Costing	£3,081,756
Whole life Costing	£3,081,756
Programme	From: 14/04/2027 To: 01/09/2027 (24 weeks)
Risk	Refer to Section 2.8 – Risk Table for Option 1 Total risk score - 202

3 Option 2 – Continuation of Medium-term Solution

3.1 Option Description

This option considers the costs and impacts of maintaining the current medium-term footbridge solution with anticipated demolition of the existing disused bridge as its condition deteriorates. This would provide access for pedestrians via the scaffold ramp structures that are currently in place, with no option for any vehicle crossing.

3.2 Design

Bridge access remains open to the public for pedestrian crossing only, provided the medium-term structure remains. There are no dedicated cycle paths for cyclists, however there are no systems in place to prevent cyclist use. It is assumed that the no maintenance will be undertaken on the disused bridge but there will come a point where its condition deteriorates and temporary propping and controlled demolition is required. This decision point will be informed by the ongoing inspections of the bridge. After approximately 30 years, the medium-term footbridge structure will need to be replaced to keep the crossing open.

3.3 Construction

Methodology

See Option 1 for demolition of existing structures.

The proposed method for replacing the existing medium-term footbridge would be using the same method as it was installed. It would be craned out by positioning a crane on the public highway adjacent to the west abutment.

Health & Safety

The main hazards identified for this option are:

- Deterioration leading to instability/collapse – The disused structure will require regular inspection and/or monitoring to prevent uncontrolled collapse.
- Climbing and unauthorised access - Unauthorised access to the substandard and unmaintained existing structure could lead to collapse of parts of the existing weak structure e.g. parapets and endangerment to life through drowning.

For full Designer's Risk Assessment, refer to Appendix A.

Traffic Management

Continuation with the medium-term structure means pedestrian access, cycle paths and walkways will remain open to the public. However, vehicles will continue to be denied access and will require diversions across alternative routes, such as the A38 bridge.

Due to no further works required in the short-term, no further disturbances or disruptions can be expected. However eventual impacts can be expected when the temporary structure reaches the end of its lifespan.

3.4 Environmental Considerations

As the current medium-term steel lattice footbridge remains in place, there will be a continued visual impact on the UNESCO site.

Future demolition of disused bridge

The disused bridge structure will remain beneath the medium-term structure and continue to deteriorate with concrete spalling into the river. The existing piers will remain in the watercourse and provide a barrier to river flow with debris build up continuing to be an issue. For environmental consideration during future demolition, refer to Option 1 section 2.4.

The absence of vehicle access will necessitate diversions for crossing the river, leading to increased carbon emissions due to the extended travel distances.

The existing medium-term structure may cause debris to accumulate and may trap litter in the space between the original bridge deck and the soffit of the footbridge attracting vermin. Control measures are required to target this risk during ongoing maintenance and management of the existing structure. By keeping this option in-situ, there is no impact on any existing trees and fauna along the riverbanks adjacent to the bridge.

Carbon Assessment

A full carbon assessment has not been conducted for this option as no construction works are involved until future replacement of the medium-term footbridge.

3.5 Capital Costing

There are no capital costs for Option 2.

Refer to section 1.4 of this report for assumptions, exclusions and limitations.

3.6 Whole Life Costing

The whole-life costing for Option 2 assumes the following:

- Principal inspections scheduled at 6 yearly intervals, and general inspections at 2 yearly intervals.
- Demolition of disused existing bridge at 10 years.
- Future replacement of medium-term footbridge at 30 years.

The value supplied is the PV (Present Value) calculated after discount factors are applied based on Appendix B of CD 355.

Table 8 - Option 2 Future Maintenance and Inspection Costs

Future Maintenance and Inspection Costs (£)				
Options	**Future Inspection Costs (£)**	**Demolish disused bridge (£) (Yr 10)**	**Future Medium-term structure replacement (Exc VAT) (£)**	**Total Future Maintenance & Inspection (Exc. VAT) (£)**
2	49,503.51	2,258,581.31	106,883.53	2,414,967.34

Table 9 - Option 2 Overall Whole Life Costs

Overall Cost (£)			
Options	Total Future Maintenance & Inspection Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
2	2,414,967.34	0	**2,414,967.34**

The total whole life cost for option 2 is £2,414,967.34.

3.7 Construction Programme

There is no construction programme for this option but future demolition of the disused structure would be the same as Option 1.

3.8 Project Risk Assessment

Table 10 Option 2 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Limitations on vehicular access to Darley Abbey Mills including for emergency vehicles, nearest crossing is A38 bridge 1.5km to the north.	4	5	20	High	DCC	Local emergency services to ensure suitable routes are available to access Darley Abbey Mills.
Not meeting LTN/120 standards on some stretches of the route	3	5	15	High	DCC	Cyclists to use other routes.
Piers remaining in River Derwent presents increased flood risk	3	4	12	Medium	DCC	Scour protection and debris clearance to be undertaken. Regular monitoring and maintenance required.
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	4	4	16	High	DCC	Regular inspection and maintenance required.
Environmental impact: Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings Loss of mature trees on approaches Impact on watercourse and surrounding infrastructure including during construction Impact of the structure on the surrounding heritage area Impact of structure on surrounding protected wildlife.	1	4	4	Low	DCC	Reinstatement of trees at approaches. Removal of structure will reduce impact on surrounding area. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering permanent and temporary works.
Pollution of watercourse	4	4	16	High	DCC	Early contractor involvement required to determine demolition methodology. Early stakeholder engagement to gain required approvals
Existing medium term structure becomes unserviceable	5	5	25	High	DCC	Regular inspection and maintenance required. Replacement of medium-term structure every 30 years circa.
Limited access site eg crane or access from river, site access for plant and deliveries. Including impact on neighbouring properties.	4	5	20	High	DCC	Early contractor involvement throughout design process.

Flood risk impact on construction programme	**3**	**3**	**9**	**Medium**	**DCC**	**Early engagement with Environment Agency and early contractor involvement throughout design process.**
Engineering difficulty of solution	**2**	**2**	**4**	**Low**	**DCC**	**Early contractor involvement required.**
Lack of political support to invest in walking and cycling routes and behavioural changes initiatives.	**3**	**3**	**9**	**Medium**	**DCC**	**Effective communication with stakeholders to obtain buy in of the proposals**
Not securing funding	**4**	**1**	**4**	**Low**	**DCC**	**Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services.**
Unsupportive public response to consultation. Lack of long term support from local community groups and affected businesses leading to reduced public perception of realised benefits. **Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.**	**2**	**4**	**8**	**Medium**	**DCC**	**Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can't be incorporated**
Permanent removal of existing crossing for vehicles compromises journey times for local residents and businesses	**5**	**5**	**25**	**High**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Providing measures which enhance the journey time could have an adverse effect on active travel modes severance or bus journey time /experience	**3**	**2**	**6**	**Low**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	**3**	**2**	**6**	**Low**	**DCC**	**Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated** **Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts** **Consider the importance of non-quantifiable benefits/ wider impacts of scheme**
Delays and cost over-spend due to missed approvals and approval deadlines.	**3**	**2**	**6**	**Low**	**DCC**	**Understand fully the requirements, timescales and deadines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig.**

						Delegate clearly in The Contract and onward communication who is responsible for each.
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets on the West side of the River Derwent may promote increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.	**3**	**2**	**6**	**Low**	**DCC**	**The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).**
Increased risk of flooding downstream due to removal of the existing bridge	**4**	**3**	**12**	**Medium**	**DCC**	**Carry out hydrological study to assess the flood impact.**
Delisting of Derwent Valley Mills UNECSO world heritage site	**5**	**4**	**20**	**High**	**DCC**	**Avoid prolonged use of Option 2, consult with all stakeholders and obtain architectural input to ensure any new bridge crossing will complement the site and ensure its current status.**
Prolonged use of Option 2, reputational impact on Derby City Council	**5**	**4**	**20**	**High**	**DCC**	**Undertake options study, consult with Stakeholders and develop the business case to secure funding for the preferred solution.**
Financial impact on local businesses during construction	**4**	**3**	**12**	**High**	**DCC**	**Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.**
Uncontrolled collapse of existing Darley Abbey Mills Bridge	**4**	**5**	**20**	**High**	**DCC**	**Carry out controlled demolition of the original bridge before the condition deteriorates causing collapse.**
Works affecting private land owners cannot be agreed through negotiation	**4**	**1**	**4**	**Low**	**DCC**	**Identify any affected private land owners and commence early consultation**

3.9 Summary Table

Table 11 - Option 2 Summary Table

Option description	Maintain the existing footbridge arrangement as a medium-term solution with future demolition of the disused bridge to prevent uncontrolled collapse.
Design	Bridge access remains open to the public for pedestrian crossing only, provided the medium-term footbridge structure remains. It is assumed that no maintenance will be undertaken on the disused bridge, and it will continue to deteriorate and require demolition. After approximately 30 years, the medium-term structure will also need to be replaced to keep the crossing open.
Construction	Disused bridge demolition (Same as Option 1). The proposed method for replacing the existing footbridge will be using the same method as it was installed. It will be craned out by positioning a crane on the public highway adjacent to the west abutment.
Environmental	Pollution to the watercourse due to further deterioration of the current heritage-structure. As the current medium-term steel lattice footbridge remains in place, there will be a continued visual impact on the UNESCO site. No effect on existing trees and fauna. Increased journey distances for vehicles to available river crossings leading to increased fuel consumption. Existing piers will continue to cause barriers to river flow until they are eventually demolished. See Option 1 for environmental effects of demolishing the disused bridge. No Carbon Assessment has been carried out for Option 2.
Capital Costing	£0
Whole life Costing	£2,414,968.34
Programme	Refer to Option 1 for future demolition of existing disused bridge. The future maintenance/replacement of the footbridge has not been considered at this stage.
Risk	Refer to Section 3.8 – Risk Table for Option 2 Total risk score - 299

4 Option 3 – Re-construction of Existing Bridge Structure

4.1 Option Description

This option includes the removal of the medium-term structure and demolition of the existing disused structure including abutments/piers. A new structure will be built on the current alignment and will be a 4m wide bridge with pedestrian and vehicular access. The vehicular access will be limited to a single lane 7.5T limit to restore the previous access arrangements. The structural form of the replacement bridge has not been investigated at this stage but is assumed to consist of precast concrete bridge deck slab and in-situ concrete abutments and piers.

4.2 Design

The 6-span structure would replicate the existing 37m span and be supported by 5 no. intermediary in-situ concrete crosshead beams each supported by 3 no. columns. The columns would each be supported by a piled foundation. The in-situ concrete abutments are assumed to be piled and constructed in the same location as the existing abutments. This design also includes new bearings and flexible expansion joints. The proposed bridge deck cross-section is replicated below in Figure 3 from the Options Report ECI Scope. The assumed 4m wide deck would only allow for single 2.5m traffic lane and 1.5m footway with cyclist sharing the carriageway with vehicles. The structure will be designed for a maximum vehicle load of 7.5T and provided with a suitable traffic management system to prevent overloading. Some emergency vehicles such as the 26T fire engines will not be able to use the bridge, therefore resulting in a permanent loss of access for these vehicles. Vehicular grade parapets will be installed on the deck. It is assumed that the deck will need to be lifted above 1 in 100 year flood level to achieve Environment Agency consent, leading to approximately 15m long approach ramps being required.

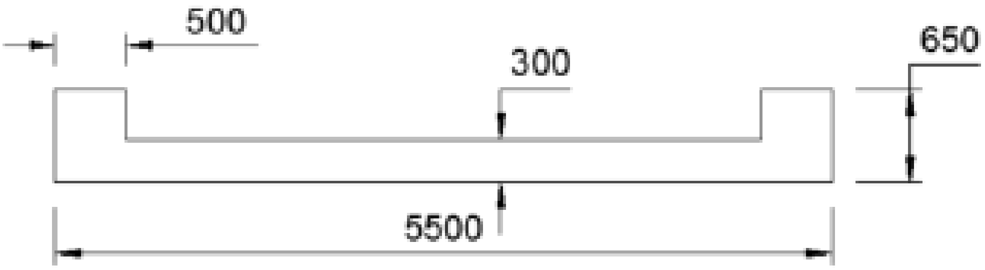

Figure 3 - Option 3 – ECI report Indicative cross section.

4.3 Construction

Methodology

See Option 1 for demolition of existing structures.

The proposed construction method is to install cofferdams at numerous locations in order to construct scour aprons, new abutments and new piers. The piles forming the foundations for the new in-situ concrete piers and abutments would be installed. Starter bars would be continued from foundations in order to form supports (columns) and remainder of abutments from foundations. Further starter bars would be continued from the column tops in order to form crosshead supports. The location and scale of the proposed new substructure is substantial and therefore will likely have an impact on programme and cost. Reprofiling of the riverbed would be required.

Bearings would be installed on crossheads and at abutments. The precast deck panels would then be craned into position and landed. There are potential access restrictions for the large cranes required for these lifts. The individual precast deck sections would then be stitched using in-situ concrete pours. Drainage would be installed. Parapets would be installed and anti-graffiti paint applied, and finishes to the deck (waterproofing, surfacing, white lining, signage) applied.

The approach ramps would be constructed by firstly constructing retaining structures using in situ concrete and then applying and compacting imported fill material before finishing with surfacing. Topsoil would then be imported and graded to finish levels to provide finishing around new abutments and approach ramps.

Due to the limited space available, there may be a requirement for a significant retaining structure on the approach ramps to retain the existing highway and access on the west approach.

Delivery of pre-cast bridge deck segments requires further assessment of routes and geometric route constraints and may not be possible.

Health & Safety

The main hazards identified for this option are:

- Working over and in watercourse - construction works within the watercourse to access the riverbed for piling operations, pile cap construction, pier and abutment installation.
- Craneage activities, including site geometric constraints.
- Excavations at Abutments - destabilisation/ground collapse at river banks, also construction of scour aprons for affected options.
- Demolition of existing bridge – potential to cause pollution of watercourse
- Public interface – Proximity of residential properties to the worksite – access, noise, dust and potentially vibrational damage to local residential property foundations, accidental damage to garden walls, vehicles etc.

For full Designer's Risk Assessment, refer to Appendix A.

Traffic Management

The impact on traffic throughout construction will be temporary, with the bridge closure necessary for the removal of the medium-term structure and during the construction of the new bridge. The extent of these works will disrupt the local residential area, with pedestrian and vehicle routes requiring diversions, likely via Handyside bridge for pedestrians and the A38 crossing for vehicles.

With the need for heavy plant and equipment and extensive works to construct the new bridge, areas surrounding the site may be closed off to the public due to required construction vehicle access, site set up and safety precautions surrounding the works.

Once the construction work is complete, bridge access will be granted to pedestrians, cyclists and vehicles. This would reinstate the vehicle access that is currently closed.

4.4 Environmental Considerations

During construction

Reconstructing the bridge will require replacement of the existing piers, which will temporarily disrupt the watercourse. Additional measures will be necessary to prevent water pollution during the process. The reinstatement of piers in the river will retain the barrier to river flow and causing debris build up.

There is the possible requirement for the removal of mature trees located along the west bank of the river near the current west abutment. Once construction is complete, the approaches will be reinstated including trees.

Plant and equipment associated with in-situ reinforced concrete construction can generate high levels of noise. In-situ concrete construction can also generate high levels of waste where single-use bespoke shuttering is used.

Concrete is highly alkaline and can alter the pH levels of watercourses when accidental spillages occur.

Refer to Option 1 for environmental considerations during the demolition and removal of medium-term and disused structures.

Post construction

By reintroducing piers into the river, the existing issues resulting from disruption to flow will remain.

The reinstatement of a single-lane carriageway across the structure will reduce the current long-term diversion and restore traffic flow to previous levels before closure of the bridge.

Carbon Assessment

Estimated embodied carbon assessment for the new bridge is **387 tCO2e.**

4.5 Capital Costing

The estimated Capital Cost for Option 3 is £15,156,785 exc. VAT. This is broken down as follows:

Table 12 – Option 3 Capital Costs

CAPITAL COST ESTIMATE	
Item	**Re-construct existing structure in same alignment**
	£15,156,785
Mobilisation/demobilisation	£924,897
Enabling works	£527,500
Removal of Medium term structure	£118,300
Removal/Demolition of existing bridge	£1,640,000
Foundations and substructure	£2,074,000
Bridge Fabrication and Installation	£1,126,760
Finishes (incl electrical and lighting)	£360,000
Landscaping	£75,000
Sub Total (Capital Cost)	£6,846,457
Preliminaries	£4,140,574
Design, Checking and Planning, 15%	£1,026,969
MHA4 fee (including Overheads and Profit) - 6% assumed	£799,801
Contractor's Risk and Contingency, 7% assumption, optimism bias not included	£1,648,055
Inflation, assuming 5.5% assumed over 2 years to Feb 2027, to be revised against BCIS indices	£694,930
Total Cost	**£15,156,785**

4.6 Whole Life Costing

The whole-life costing for Option 3 assumes the following:

- Principal inspections scheduled at 6 yearly intervals, and general inspections at 2 yearly intervals.
- Initial Year 0 capital cost £15,156,785.
- Future maintenance and inspection estimated costs are included. The assumed main maintenance activities and assumed outline schedule of these maintenance activities is supplied in Section 1.4, Table 6.

The value supplied is the PV (Present Value) calculated after discount factors are applied based on Appendix B of CD 355.

Please refer to section 1.4 of this report for assumptions, exceptions and limitations which have been applied in the derivation of whole life costs.

The future maintenance and inspection cost for Option 3 is £187,785.30.

Table 13 – Option 3 Future Maintenance and Inspection Costs

Future Maintenance and Inspection Costs (£)							
Options	**Future Inspection Costs (£)**	**Joint Replace (£) (Yr 26)**	**Bearing Replace (£) (Yr 40)**	**Resurface/ Re-waterproof bridge deck (£) (Yr 50)**	**Parapet Replace (£) (Yr 50)**	**Traffic Management (Exc VAT) (£)**	**Total Future Maintenance & Inspection (Exc. VAT) (£)**
3	49,503.51	51,397.81	42,470.77	17,987.34	20,517.85	5,905.02	187,785.30

Table 14 – Option 3 Whole Life Cost

Overall Cost (£)			
Options	Total Future Maintenance & Inspection Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
3	30	15,156,785	**15,344,570**

Total whole life cost for option 3 is £15,344,570.

4.7 Construction Programme

The estimated construction schedule for Option 3 comprises a 206 week programme which runs between from 14/04/2027 to 26/03/2031. The long duration is due to the extensive works needed in the river which would need to be phased to minimise the impacts.

4.8 Project Risk Assessment

Table 15 – Option 3 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Limitations on vehicular access to Darley Abbey Mills including for emergency vehicles, nearest crossing is A38 bridge 1.5km to the north.	**3**	**5**	**15**	**High**	**DCC**	**Local emergency services to ensure suitable routes are available to access Darley Abbey Mills where over 7.5t limit**
Not meeting LTN/120 standards on some stretches of the route	**2**	**5**	**10**	**Medium**	**DCC**	**Existing bridge arrangement non-compliant**
Utilities diversion required	**3**	**3**	**9**	**Medium**	**DCC**	**Surveys sought and updated at each stage of the project's design** **Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost** **Early and ongoing engagement with utilities providers for diversion costs and timescales**
Piers remaining in River Derwent presents increased flood risk	**3**	**4**	**12**	**Medium**	**DCC**	**Scour protection and debris clearance to be undertaken. Regular monitoring and maintenance required.**
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	**3**	**3**	**9**	**Medium**	**DCC**	**Assessments required to be undertaken by engineers to support demolition methodology at early stages.**
Substructure design not considered at this stage	**4**	**3**	**12**	**Medium**	**DCC**	**Ground investigations recommended to be undertaken and shared with designers and contractors at early stages of design.**
Environmental impact: **Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings** **Loss of mature trees on approaches** **Impact on watercourse and surrounding infrastructure including during construction** **Impact of the structure on the surrounding heritage area** **Impact of structure on surrounding protected wildlife.**	**3**	**5**	**15**	**High**	**DCC**	**Reinstatement of trees at approaches. Heritage structures to be preserved either on or off site. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering permanent and temporary works.**

Pollution of watercourse	**4**	**4**	**16**	**High**	**DCC**	**Early contractor involvement required to determine demolition methodology. Early stakeholder engagement to gain required approvals**
Temporary works in watercourse **In-river works to construct substructure including multiple areas of river in use at one time Risk of damage to permanent works during stand-down due to flooding**	**4**	**4**	**16**	**High**	**DCC**	**Early stakeholder engagment to gain required approvals. Early contractor involvement to determine construction process.**
Limited access site eg crane or access from river, site access for plant and deliveries. Including impact on neighbouring properties.	**4**	**5**	**20**	**High**	**DCC**	**Early contractor involvement throughout design process.**
Approach ramps impact on local land ownership	**3**	**3**	**9**	**Medium**	**DCC**	**Early engagement with stakeholders throughout design process.**
Flood risk impact on construction programme	**4**	**4**	**16**	**High**	**DCC**	**Early engagement with Environment Agency and early contractor involvement throughout design process.**
Engineering difficulty of solution	**4**	**4**	**16**	**High**	**DCC**	**Early contractor involvement required.**
Not securing funding	**5**	**3**	**15**	**High**	**DCC**	**Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services.**
Unsupportive public response to consultation. Lack of long term support from local community groups and affected businesses leading to reduced public perception of realised benefits. **Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.**	**2**	**4**	**8**	**Medium**	**DCC**	**Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can't be incorporated**
Safety audit may raise concerns which require changes to the scheme design	**3**	**1**	**3**	**Low**	**DCC**	**Designers' response will be prepared to identify which are critical changes and which are points of detail to be considered in the next stage of design for the preferred option**
Cost increases as design develops due to inflation on	**3**	**5**	**15**	**High**	**DCC**	**Risk modelling and optimism bias are used within cost estimates at each stage and these are redefined as**

materials, changes in the required design or programme prolongation i.e. fluctuations in Steel price over multi-year construction programmes.						**design/ cost matures to reflect greater certainty. Early Contractor Involvement during detailed design/ FBC**
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	**3**	**2**	**6**	**Low**	**DCC**	**Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts Consider the importance of non-quantifiable benefits/ wider impacts of scheme**
Delays and cost over-spend due to missed approvals and approval deadlines.	**3**	**2**	**6**	**Low**	**DCC**	**Understand fully the requirements, timescales and deadlines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig. Delegate clearly in The Contract and onward communication who is responsible for each.**
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets on the West side of the River Derwent may promote increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.	**4**	**4**	**16**	**High**	**DCC**	**The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).**
Increased risk of flooding downstream due to removal of the existing bridge	**4**	**1**	**4**	**Low**	**DCC**	**Carry out hydrological study to assess the flood impact.**
Not securing Environment Agency Consent for the design	**5**	**4**	**20**	**High**	**DCC**	**Consult with EA and ensure that design solutions for any new crossing limit restrictions to the watercourse e.g by reducing the number of piers and placing the deck above 1 in 100 year flood levels plus allowance for climate change and freeboard.**
Delisting of Derwent Valley Mills UNECSO world heritage site	**5**	**3**	**15**	**High**	**DCC**	**Avoid prolonged use of Option 2, consult with all stakeholders and obtain architectural input to ensure any new bridge crossing will complement the site and ensure its current status.**

Financial impact on local businesses during construction	**5**	**4**	**20**	**High**	**DCC**	**Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.**
Works affecting private land owners cannot be agreed through negotiation	**4**	**4**	**16**	**High**	**DCC**	**Identify any affected private land owners and commence early consultation**
Existing substructure remaining in riverbed - potential to cause clashes with new substructure works.	**4**	**4**	**16**	**High**	**DCC**	**Surveys to be conducted to determine the full extent of substructure. Extent of substructure to be removed to be decided at later design stage.**

4.9 Summary Table

Table 16 – Option 3 Summary Table

Option description	Remove medium-term structure and demolish disused existing bridge. Re-construct the existing concrete bridge deck and substructure on the same horizontal alignment to match the current carriageway and footway width.
Design	37m 6 -span precast bridge deck supported by piled in-situ reinforced concrete abutments and piers. The 7.5T loading restriction would result in permanent loss of access for Fire Engines and cyclists would be required to share the carriageway with vehicles.
Construction	Demolition of existing bridge as per Option 1 Construction summary. Construction of the new supports in watercourse will require extensive temporary works, resulting in an extended programme of construction and higher costs. Casting of in-situ concrete crossheads and supports in watercourse, and reprofiling of riverbed will be difficult. Large cranes will be required for the heaviest pre-cast concrete lifts, potential access restrictions during lift. Possible requirement for significant temporary works retaining structures to be constructed to support the existing highway and accesses during works (due to proximity to river). Delivery of wide elements (pre-cast bridge deck segments) requires further assessment of routes and geometric route constraints and may not be possible.
Environmental	Reinstatement of piers in the watercourse remain a barrier to river flow. Potential clearance of mature trees however reinstatement will be undertaken upon completion of new structure. Increases in vehicle emissions due to longer detours to alternative river crossing points during construction. Reinstatement of single lane vehicle access across Darley Abbey Bridge will reduce the long-term diversion as is currently in place. Embodied carbon: 387 tCO2e
Capital Costing	£15,156,785
Whole life Costing	£15,344,570
Programme	From: 14/04/2027 To: 26/03/2031 (206 Weeks)
Risk	Refer to Section 4.8 – risk table for Option 3. Total Risk score - 335

5 Option 4 – 4m Wide Bridge (Active Modes Only)

5.1 Option Description

The option for installing a new river crossing would involve removal of the existing structures and establishing a new crossing on a new alignment. This option has access for pedestrians and cyclists only, providing no vehicle crossing facility.

5.2 Design

The structure will be a 4m wide footbridge and cycle bridge. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing. Approximately 15m long 1 in 20 gradient approach ramps with permanent bollards and associated tie-ins to the adjacent areas are to be provided at each end of the bridge.

The new structure would be a 48m single-span steel structure formed of weathering steel and supported by in-situ concrete new abutments on piled foundations.

The final form of construction is either a perforated U-Beam deck profile formed of weathering steel plate (sub-option 2), or asymmetric arch formed of square hollow sections also in weathering steel (sub-option 3b). Refer to document 30194918-ARC-SBR-XX-RP-CE-00002 Preliminary Design Options report - by Arcadis and Knights Architects in November 2023.

Figure 4 – Option 4(2) – Perforated U-Beam bridge deck cross section.

Figure 5 – Sub-option 4(3b) – Asymmetric arch bridge deck cross section

5.3 Construction

Methodology

See Option 1 for demolition of existing structures.

The proposed construction method for the new structure involves the installation of a large pontoon in the river. This would be formed with trestles from which the footbridge would be assembled from.

Cofferdams would be installed at each abutment area and from which the new in-situ concrete abutments are constructed. Bearings would then be installed on the new abutments.

The new structure would then be lifted by crane and landed on bearings. Bridge deck finishes would then be applied. Preliminary assessment conducted by Galliford Try indicates potential geometric constraints for superlift tray that is required, clashing with garden walls of neighbouring properties. Galliford Try recommends early ECI engagement with bridge fabricator to identify construction and buildability options and risks.

The approach ramps would be constructed by firstly constructing retaining structures using in-situ concrete and then applying and compacting imported fill material before finishing with surfacing.

Topsoil would then be imported and graded to finish levels to provide finishing around new abutments and approach ramps.

Health & Safety

The main hazards identified for this option are:

- Working over/in watercourse - additional temporary works including propping in the watercourse which will need to be designed by the contractor in later design stages.
- Craneage activities, including site geometric constraints.
- Hot works - At this design stage, welded connections for the deck plates to the transverse members have been proposed

- Excavations at abutments - destabilisation/ground collapse at river banks, also construction of scour aprons for affected options.

Traffic Management

This option will permanently eliminate vehicle access and temporarily restrict pedestrian access to cross the River Derwent. As a result, individuals will need to use alternative crossings, with the nearest pedestrian crossing located at Handyside, while the closest vehicle crossing is the A38 Bridge.

During construction disruption can be expected to the local residential area, including obstructions near to the site which may affect vehicle access to the Midlands Canoe Club, and parking beside Darley's Restaurant & terrace on the opposite side of the river.

Following the bridge construction, crossing access will be re-opened to the public for pedestrian and cycle access, with all vehicle access remaining denied.

5.4 Environmental Considerations

During Construction

Vehicle diversions will be required and will result in greater pollution emissions due to extended travel distances. Without the reinstatement of vehicular access over the structure, there will be a long-term increase in carbon emissions from the permanent diversion of traffic.

Removing piers from the original bridge structure may temporarily disturb the river's established watercourse. This option could bring notable benefits including reducing flood risks by eliminating backflow and minimising sediment buildup, enhancing the river's flow dynamics. A hydrological assessment would be required at the next stage to fully determine the effects on flooding at the site and also downstream.

The removal of the existing structures and the delivery of materials for the construction of a new crossing will require transportation to access the site, resulting in the generation of additional pollution through vehicle use.

There is the possible requirement for the removal of mature trees and fauna located along both east and west banks of the river. Once construction is complete, the approaches will be reinstated including trees and fauna.

Post Construction

The existing vehicle diversions will remain in place leading to longer-term increased emissions due to continued use of longer diversions.

Carbon Assessment

The embodied carbon burden for these options, proportionally per tonne of overall tonnage of the superstructure is higher than that for the other concrete options. This is due to steel having a higher embodied carbon factor than concrete within the ICE (v4.0) database.

Estimated carbon assessment for the new bridge (both sub-options) are outlined below:

$4_{(2)}$: 502 tCO_2e

$4_{(3b)}$: 496 tCO_2e

5.5 Capital Costing

The estimated Capital Cost for Option $4_{(2)}$ is £10,180,045 exc. VAT.

The estimated Capital Cost for Option $4_{(3b)}$ is £10,449,361 exc. VAT.

These are broken down as follows:

Table 17 – Option 4 Capital Costs

CAPITAL COST ESTIMATE		
Item	**Perforated through beam**	**Asymmetric half-through arch**
	£10,180,045	**£10,449,361**
Mobilisation/demobilisation	£431,020	£431,020
Enabling works	£198,000	£198,000
Removal of Medium term structure	£118,300	£118,300
Removal/Demolition of existing bridge	£1,490,000	£1,490,000
Foundations and substructure	£539,000	£539,000
Bridge Fabrication and Installation	£2,645,390	£2,845,390
Finishes (incl electrical and lighting)	£251,400	£251,400
Landscaping	£65,000	£65,000
Sub Total (Capital Cost)	£5,738,110	£5,938,110
Preliminaries	£2,050,187	£2,050,187
Design, Checking and Planning, 15%	£860,716.50	£890,716.50
MHA4 fee (including Overheads and Profit) - 6% assumed	£527,509	£541,055
Contractor's Risk and Contingency, 7% assumption, optimism bias not included	£545,181	£559,181
Inflation, assuming 5.5% assumed over 2 years to Feb 2027, to be revised against BCIS indicies	£458,341	£470,111
Total Cost	**£10,180,045**	**£10,449,361**

5.6 Whole Life Costing

The whole-life costing for Option 4 assumes the following:

- Principal inspections scheduled at 6 yearly intervals, and general inspections at 2 yearly intervals.
- Initial Year 0 capital costs of:

  (i) $4_{(2)}$ - £10,180,045

  (ii) $4_{(3b)}$ - £10,449,361

- Future maintenance and inspection estimated costs are included. The assumed main maintenance activities and assumed outline schedule of these maintenance activities is supplied in Section 1.4, Table 6.

The value supplied is the PV (Present Value) calculated after discount factors are applied based on Appendix B of CD 355.

Please refer to section 1.4 of this report for assumptions, exceptions and limitations which have been applied in the derivation of whole life costs.

The future maintenance and inspection cost for Option 4 $_{(2),\ (3b)}$ is £164,223.37.

Table 18 – Option 4 Future Maintenance and Inspection Costs

Future Maintenance and Inspection Costs (£)							
Options	**Future Inspection Costs (£)**	**Joint Replace (£) (Yr 26)**	**Bearing Replace (£) (Yr 40)**	**Resurface/ Re-waterproof bridge deck (£) (Yr 50)**	**Parapet Replace (£) (Yr 50)**	**Traffic Management (Exc VAT) (£)**	**Total Future Maintenance & Inspection (Exc. VAT) (£)**
$4_{(2)}$	49,503.51	43,626.31	35,939.36	22,341.15	7,159.88	5,653.16	164,223.37
$4_{(3b)}$	49,503.51	43,626.31	35,939.36	22,341.15	7,159.88	5,653.16	164,223.37

Total whole life cost for Option 4 is:

(i) $4_{(2)}$ - £10,344,268

(ii) $4_{(3b)}$ - £10,613,584

Table 19 – Option 4 Whole Life Cost

Overall Cost (£)			
Options	Total Future Maintenance & Inspection Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
$4_{(2)}$	164,223.37	10,180,045	**10,344,268**
$4_{(3b)}$	164,223.37	10,449,361	**10,613,584**

5.7 Construction Programme

The estimated construction schedule for Option 4 comprises of a 102-week programme which runs between from 14/04/2027 to 28/03/2029.

5.8 Project Risk Assessment

Table 20 – Option 4 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Limitations on vehicular access to Darley Abbey Mills including for emergency vehicles, nearest crossing is A38 bridge 1.5km to the north.	4	5	20	High	DCC	Local emergency services to ensure suitable routes are available to access Darley Abbey Mills.
Utilities diversion required	3	3	9	Medium	DCC	Surveys sought and updated at each stage of the project's design Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost Early and ongoing engagement with utilities providers for diversion costs and timescales
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	3	3	9	Medium	DCC	Assessments required to be undertaken by engineers to support demolition methodology at early stages.
Substructure design not considered at this stage	4	3	12	Medium	DCC	Ground investigations recommended to be undertaken and shared with designers and contractors at early stages of design.
Archaeological works recommended to be undertaken in areas of proposed alignment	4	3	12	Medium	DCC	Archaeological survey is recommended in areas of proposed new alignments early in the project development.
Environmental impact: Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings Loss of mature trees on approaches Impact on watercourse and surrounding infrastructure including during construction Impact of the structure on the	3	4	12	Medium	DCC	Reinstatement of trees at approaches. Heritage structures to be preserved either on or off site. Single span limits works in watercourse. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering permanent and temporary works.

surrounding heritage area Impact of structure on surrounding protected wildlife.						
Pollution of watercourse	**4**	**3**	**12**	**Medium**	**DCC**	**Early contractor involvement required to determine demolition methodology. Early stakeholder engagement to gain required approvals**
Temporary works in watercourse **In-river works to construct substructure including multiple areas of river in use at one time Risk of damage to permanent works during stand-down due to flooding**	**2**	**4**	**8**	**Medium**	**DCC**	**Early stakeholder engagment to gain required approvals. Early contractor involvement to determine construction process. Reduced risk as only abutment works in watercourse.**
Limited access site eg crane or access from river, site access for plant and deliveries. Including impact on neighbouring properties.	**4**	**5**	**20**	**High**	**DCC**	**Early contractor involvement throughout design process.**
Approach ramps impact on local land ownership	**3**	**3**	**9**	**Medium**	**DCC**	**Early engagement with stakeholders throughout design process.**
Flood risk impact on construction programme	**4**	**3**	**12**	**Medium**	**DCC**	**Early engagement with Environment Agency and early contractor involvement throughout design process.**
Engineering difficulty of solution	**3**	**3**	**9**	**Medium**	**DCC**	**Early contractor involvement required.**
Lack of political support to invest in walking and cycling routes and behavioural changes initiatives.	**3**	**3**	**9**	**Medium**	**DCC**	**Effective communication with stakeholders to obtain buy in of the proposals**
Not securing funding	**5**	**3**	**15**	**High**	**DCC**	**Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services.**
Unsupportive public response to consultation. Lack of long term support from local community groups and affected businesses leading to reduced public perception of realised benefits.	**2**	**4**	**8**	**Medium**	**DCC**	**Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can’t be incorporated**

Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.						
Permanent removal of existing crossing for vehicles compromises journey times for local residents and businesses	**3**	**4**	**12**	**Medium**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Providing measures which enhance the journey time could have an adverse effect on active travel modes severance or bus journey time /experience	**3**	**2**	**6**	**Low**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Safety audit may raise concerns which require changes to the scheme design	**3**	**1**	**3**	**Low**	**DCC**	**Designers' response will be prepared to identify which are critical changes and which are points of detail to be considered in the next stage of design for the preferred option**
Cost increases as design develops due to inflation on materials, changes in the required design or programme prolongation i.e. fluctuations in Steel price over multi-year construction programmes.	**3**	**4**	**12**	**Medium**	**DCC**	**Risk modelling and optimism bias are used within cost estimates at each stage and these are redefined as design/ cost matures to reflect greater certainty. Early Contractor Involvement during detailed design/ FBC**
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	**3**	**2**	**6**	**Low**	**DCC**	**Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts Consider the importance of non-quantifiable benefits/ wider impacts of scheme**
Delays and cost over-spend due to missed approvals and approval deadlines.	**3**	**2**	**6**	**Low**	**DCC**	**Understand fully the requirements, timescales and deadlines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig. Delegate clearly in The Contract and onward communication who is responsible for each.**
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets	**4**	**2**	**8**	**Medium**	**DCC**	**The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).**

on the West side of the River Derwent may promote increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.						
Increased risk of flooding downstream due to removal of the existing bridge	4	2	8	**Medium**	**DCC**	**Carry out hydrological study to assess the flood impact.**
Not securing Environment Agency Consent for the design	**4**	**3**	**12**	**Medium**	**DCC**	**Consult with EA and ensure that design solutions for any new crossing limit restrictions to the watercourse e.g by reducing the number of piers and placing the deck above 1 in 100 year flood levels plus allowance for climate change and freeboard.**
Delisting of Derwent Valley Mills UNECSO world heritage site	**3**	**2**	**6**	**Low**	**DCC**	**Avoid prolonged use of Option 2, consult with all stakeholders and obtain architectural input to ensure any new bridge crossing will complement the site and ensure its current status.**
Financial impact on local businesses during construction	**3**	**4**	**12**	**Medium**	**DCC**	**Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.**
Works affecting private land owners cannot be agreed through negotiation	**4**	**3**	**12**	**Medium**	**DCC**	**Identify any affected private land owners and commence early consultation**
Existing substructure remaining in riverbed - potential to cause clashes with new substructure works.	**4**	**3**	**12**	**Medium**	**DCC**	**Surveys to be conducted to determine the full extent of substructure. Extent of substructure to be removed to be decided at later design stage.**

5.9 Summary Table

Table 21 – Option 4 Summary Table

Option description	Pedestrian and cyclist footbridge
Design	Single-span structure formed in weathering steel. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing resulting in an increased span length of 48m.
Construction	Demolition of existing bridge as per Option 1 Construction summary. Cofferdams required at abutments. Significant bridge-lift operations required to install bridge decks. Preliminary assessment indicates potential geometric constraint for superlift tray required, clashing with garden walls of neighbouring properties. Galliford Try recommends early ECI engagement with bridge fabricator to identify construction and buildability options and threats.
Environmental	Increased vehicle emissions from permanent diversion. Potential change in flow from removal of existing piers. Additional pollution through vehicle use due to transportation to site of material. Potential clearance of mature trees with reinstatement to be undertaken upon completion of new structure. Continued raised emission levels from vehicle diversions. The Embodied Carbon for both sub-options: $4_{(2)}$: 502 tCO_2e $4_{(3b)}$: 496 tCO_2e
Capital Costing	$4_{(2)}$ - £10,180,045 $4_{(3b)}$ - £10,449,361
Whole life Costing	$4_{(2)}$ - £10,344,268 $4_{(3b)}$ - £10,613,584
Programme	From 14/04/2027 To: 28/03/2029 (102 weeks)
Risk	Refer to Section 5.8 – risk table for Option 4. Total Risk score - 291

6 Option 5 – 4m Wide Bridge (Active Modes and Emergency Vehicle Access Only)

6.1 Option Description

This option for installing a new river crossing would involve removal of the existing structures and establishing a new crossing on a new alignment. This option has access for pedestrians, cyclists and emergency vehicle access for 26T Fire Engines. Access would be restricted by the use of retractable bollards.

6.2 Design

The structure will be a 4m wide footbridge, cycle and emergency vehicle access bridge only. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing. Approximately 15m long 1 in 20 gradient approach ramps with permanent bollards and associated tie-ins to the adjacent areas are to be provided at each end of the bridge.

The new structure shall be a 48m single-span steel structure formed of weathering steel and supported by in-situ concrete new abutments on piled foundations. The only design differences between Option 4 and 5 are the finishes to the structure including vehicle parapets and retractable bollards or an alternative traffic management system.

The design loading for pedestrian and cyclist only compared to a single emergency vehicle is broadly similar. Providing that a traffic management arrangement is put in place to ensure that pedestrians and cyclists are cleared from the bridge before the emergency vehicle gains access, there are no structural differences between options 4 and 5. Refer to Option 4 for details on Option 5.

6.3 Construction

Refer to Option 4 for construction considerations.

6.4 Environmental Considerations

Refer to Option 4 for environmental considerations.

6.5 Capital Costing

The estimated Capital Cost for Option 5 is £10,220,442 - Option $_{(2)}$ and £10,489,759 – Option $_{(3b)}$ exc. VAT.

These are broken down as follows:

Table 22 – Option 5 Capital Costs

CAPITAL COST ESTIMATE		
Item	**Perforated through beam**	**Asymmetric half-through arch**
	£10,220,442	**£10,489,759**
Mobilisation/demobilisation	£431,020	£431,020
Enabling works	£198,000	£198,000
Removal of Medium-term structure	£118,300	£118,300
Removal/Demolition of existing bridge	£1,490,000	£1,490,000
Foundations and substructure	£539,000	£539,000
Bridge Fabrication and Installation	£2,645,390	£2,845,390
Finishes (incl electrical and lighting)	£281,400	£281,400
Landscaping	£65,000	£65,000
Sub Total (Capital Cost)	£5,768,110	£5,968,110
Preliminaries	£2,050,187	£2,050,187
Design, Checking and Planning, 15%	£865,217	£895,217
MHA4 fee (including Overheads and Profit) - 6% assumed	£529,541	£543,087
Contractor's Risk and Contingency, 7% assumption, optimism bias not included	£547,281	£561,281
Inflation, assuming 5.5% assumed over 2 years to Feb 2027, to be revised against BCIS indices	£460,107	£471,877
Total Cost	**£10,220,442**	**£10,489,759**

6.6 Whole Life Costing

The whole-life costing for Option 5 assumes the following:

- Principal inspections scheduled at 6 yearly intervals, and general inspections at 2 yearly intervals.
- Initial Year 0 capital costs for the 2 sub-options:

  (i) Option 5$_{(2)}$ – £10,220,442

  (ii) Option 5$_{(3b)}$- £10,489,759

The value supplied is the PV (Present Value) calculated after discount factors are applied based on Appendix B of CD 355.

Please refer to section 1.4 of this report for assumptions, exceptions and limitations which have been applied in the derivation of whole life costs.

The future maintenance and inspection cost for Option 4 (per sub option) is £164,223.37.

Table 23 – Option 5 Future Maintenance and Inspection Costs

Future Maintenance and Inspection Costs (£)							
Options	**Future Inspection Costs (£)**	**Joint Replace (£) (Yr 26)**	**Bearing Replace (£) (Yr 40)**	**Resurface/ Re-waterproof bridge deck (£) (Yr 50)**	**Parapet Replace (£) (Yr 50)**	**Traffic Management (Exc VAT) (£)**	**Total Future Maintenance & Inspection (Exc. VAT) (£)**
5 (2)	49,503.51	43,626.31	35,939.36	22,341.15	7,159.88	5,653.16	164,223.37
5 (3b)	49,503.51	43,626.31	35,939.36	22,341.15	7,159.88	5,653.16	164,223.37

Total whole life cost for Option 5 is:

(i) 5(2) - £10,384,665

(ii) 5(3b) - £10,653,982

Table 24 – Option 5 Whole Life Cost

Overall Cost (£)			
Options	Total Whole Life PV Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
5 (2)	164,233.37	10,220,442	**10,384,665**
5 (3b)	164,233.37	10,489,759	**10,653,982**

6.7 Construction Programme

The Construction schedule for Option 5 is the same as Option 4 comprising a 102-week programme which runs between from 14/04/2027 to 28/03/2029.

6.8 Project Risk Assessment

Table 25 – Option 5 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Utilities diversion required	**3**	**3**	**9**	**Medium**	**DCC**	**Surveys sought and updated at each stage of the project's design**

						Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost **Early and ongoing engagement with utilities providers for diversion costs and timescales**
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	**3**	**3**	**9**	**Medium**	**DCC**	**Assessments required to be undertaken by engineers to support demolition methodology at early stages.**
Substructure design not considered at this stage	**3**	**3**	**9**	**Medium**	**DCC**	**Ground investigations recommended to be undertaken and shared with designers and contractors at early stages of design.**
Archaeological works recommended to be undertaken in areas of proposed alignment	**4**	**3**	**12**	**Medium**	**DCC**	**Archaeological survey is recommended in areas of proposed new alignments early in the project development.**
Environmental impact: **Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings** **Loss of mature trees on approaches** **Impact on watercourse and surrounding infrastructure including during construction** **Impact of the structure on the surrounding heritage area** **Impact of structure on surrounding protected wildlife.**	**3**	**4**	**12**	**Medium**	**DCC**	**Reinstatement of trees at approaches. Heritage structures to be preserved either on or off site. Single span limits works in watercourse. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering permanent and temporary works.**
Pollution of watercourse	**4**	**3**	**12**	**Medium**		**Early contractor involvement required to determine demolition methodology. Early stakeholder engagement to gain required approvals**
Temporary works in watercourse **In-river works to construct substructure including multiple areas of river in use at one time** **Risk of damage to permanent works during stand-down due to flooding**	**2**	**4**	**8**	**Medium**	**DCC**	**Early stakeholder engagment to gain required approvals. Early contractor involvement to determine construction process. Reduced risk as only abutment works in watercourse.**
Limited access site eg crane or access from river, site access for plant and	**4**	**5**	**20**	**High**	**DCC**	**Early contractor involvement throughout design process.**

deliveries. Including impact on neighbouring properties.						
Approach ramps impact on local land ownership	**3**	**3**	**9**	**Medium**	**DCC**	**Early engagement with stakeholders throughout design process.**
Flood risk impact on construction programme	**4**	**3**	**12**	**Medium**	**DCC**	**Early engagement with Environment Agency and early contractor involvement throughout design process.**
Engineering difficulty of solution	**3**	**3**	**9**	**Medium**	**DCC**	**Early contractor involvement required.**
Lack of political support to invest in walking and cycling routes and behavioural changes initiatives.	**3**	**3**	**9**	**Medium**	**DCC**	**Effective communication with stakeholders to obtain buy in of the proposals**
Not securing funding	**4**	**5**	**20**	**High**	**DCC**	**Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services., education, healthcare, and leisure services.**
Unsupportive public response to consultation. Lack of long term support from local community groups and affected businesses leading to reduced public perception of realised benefits. **Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.**	**2**	**4**	**8**	**Medium**	**DCC**	**Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can't be incorporated**
Permanent removal of existing crossing for vehicles compromises journey times for local residents and businesses	**3**	**4**	**12**	**Medium**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**
Providing measures which enhance the journey time could have an adverse effect on active travel modes severance or bus journey time /experience	**3**	**2**	**6**	**Low**	**DCC**	**Design and model development to balance these compromises to maximise the opportunities for all road users. DCC to consult technical stakeholders at an early stage to inform and get inputs into the optimal design layout**

Safety audit may raise concerns which require changes to the scheme design	**3**	**1**	**3**	**Low**	**DCC**	**Designers' response will be prepared to identify which are critical changes and which are points of detail to be considered in the next stage of design for the preferred option**
Cost increases as design develops due to inflation on materials, changes in the required design or programme prolongation i.e. fluctuations in Steel price over multi-year construction programmes.	**3**	**4**	**12**	**Medium**	**DCC**	**Risk modelling and optimism bias are used within cost estimates at each stage and these are redefined as design/ cost matures to reflect greater certainty. Early Contractor Involvement during detailed design/ FBC**
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	**3**	**2**	**6**	**Low**	**DCC**	**Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated** **Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts** **Consider the importance of non-quantifiable benefits/ wider impacts of scheme**
Delays and cost over-spend due to missed approvals and approval deadlines.	**3**	**2**	**6**	**Low**	**DCC**	**Understand fully the requirements, timescales and deadlines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig.** **Delegate clearly in The Contract and onward communication who is responsible for each.**
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets on the West side of the River Derwent may promote increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.	**4**	**2**	**8**	**Medium**	**DCC**	**The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).**
Increased risk of flooding downstream due to removal of the existing bridge	**4**	**2**	**8**	**Medium**	**DCC**	**Carry out hydrological study to assess the flood impact.**
Not securing Environment Agency Consent for the design	**4**	**3**	**12**	**Medium**	**DCC**	**Consult with EA and ensure that design solutions for any new crossing limit restrictions to the watercourse e.g by reducing the number of piers and placing the deck above 1 in 100**

						year flood levels plus allowance for climate change and freeboard.
Delisting of Derwent Valley Mills UNECSO world heritage site	**3**	**2**	**6**	**Low**	**DCC**	**Avoid prolonged use of Option 2, consult with all stakeholders and obtain architectural input to ensure any new bridge crossing will complement the site and ensure its current status.**
Financial impact on local businesses during construction	**3**	**4**	**12**	**Medium**	**DCC**	**Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.**
Works affecting private land owners cannot be agreed through negotiation	**4**	**3**	**12**	**Medium**	**DCC**	**Identify any affected private land owners and commence early consultation**
Existing substructure remaining in riverbed - potential to cause clashes with new substructure works.	**4**	**3**	**12**	**Medium**	**DCC**	**Surveys to be conducted to determine the full extent of substructure. Extent of substructure to be removed to be decided at later design stage.**

6.9 Summary Table

Table 26 – Option 5 Summary Table

Option description	Pedestrian, cyclist and emergency vehicle-access only bridge.
Design	Single-span structure formed in weathering steel. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing resulting in an increased span length of 48m.
Construction	Demolition of existing bridge as per Option 1 Construction summary. Cofferdams required at abutments. Significant bridge-lift operations required to install bridge decks. Preliminary assessment indicates potential geometric constrains for superlift tray required, clashing with garden walls of neighbouring properties. Galliford Try recommends early ECI engagement with bridge fabricator to identify construction and buildability options and threats.
Environmental	Increased vehicle emissions from permanent diversion of non-emergency vehicles. Potential changes to river flow caused by the removal of existing piers. Potential clearance of mature trees with reinstatement to be undertaken upon completion of new structure. Carbon assessment for materials: Continued raised emission levels from vehicle diversions. The Embodied Carbon for Option 5 (both sub-options) is: $5_{(2)}$:502 tCO2e $5_{(3b)}$:496 tCO2e
Capital Costing	$5_{(2)}$ – £10,220,442 $5_{(3b)}$- £10,489,759
Whole life Costing	$5_{(2)}$ - £10,384,665 $5_{(3b)}$ - £10,653,982
Construction	From 14/04/2027 To: 28/03/2029 (102 weeks)
Risk	Refer to Section 6.8 – risk table for Option 5. Total Risk score - 273

7 Option 6 – Highway Bridge

7.1 Option Description

An option for a new bridge to facilitate traffic at all times would provide an all modes crossing. Construction costs for this option are the highest of the options listed as the bridge would need to accommodate vehicles and active modes and works to enable this access at both sides of the river would be required.

7.2 Design

This proposed option of the new 48m long multi-span, 8m wide bridge will be designed to support pedestrian/cyclists and single lane vehicle traffic. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing. The abutments of the existing disused bridge will need to be demolished to accommodate the wider deck option. The approaches will require embankment stabilisation to support new abutments and the structure will also require the construction of new piers. The deck will need to be positioned above the required flood level and the deck construction depth will be greater than Option 3. Therefore, this option will require longer ramped approaches of approximately 30m to ensure these constraints are met. This may be very challenging to achieve given the constraints at each approach.

The structural form of this option has not been fully investigated at this stage but is assumed to be a 5 span structure formed of precast concrete deck and beams and supported by 4 no. intermediate crosshead supports and 2 abutments. The intermediate crossheads are ach supported by 3 no. columns which, in turn are located on piled ground beam foundations.

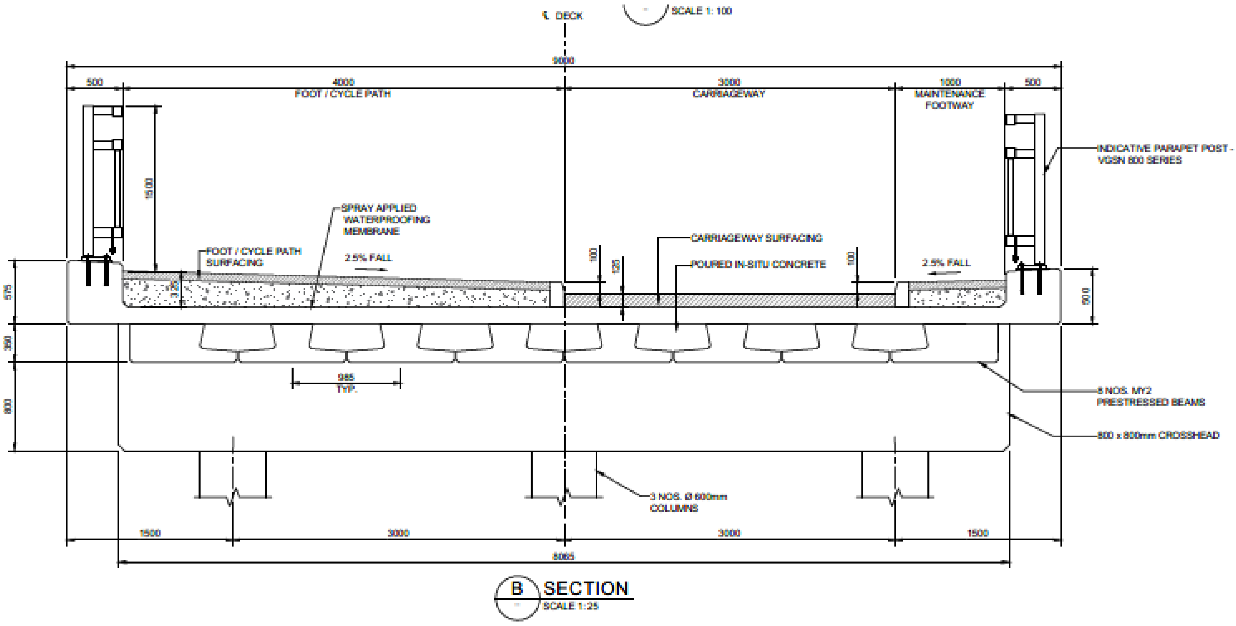

Figure 6 – Option 6 – ECI report indicative cross section

7.3 Construction

Methodology

See Option 1 for demolition of existing structures.

The proposed construction method is to install cofferdams at numerous locations in order to construct scour aprons, new abutments and new piers. The piles forming the foundations for the new in-situ concrete piers and abutments would be installed. Starter bars would be continued from foundations in order to form supports (columns) and remainder of abutments from foundations. Further starter bars would be continued from the column tops in order to form crosshead supports. The location and scale of the proposed new substructure is substantial and therefore will likely have an impact on programme and cost. Reprofiling of the riverbed will be required.

Bearings would be installed on crossheads and at abutments. The precast beams would then be craned into position and landed. There are potential access restrictions for the large cranes required for these lifts

The individual precast deck sections would be stitched as in-situ concrete pours and would be required to complete the deck construction. Drainage would be installed. Parapets would be installed and anti-graffiti paint applied, and finishes to the deck (waterproofing, surfacing, white lining, signage) applied.

The approach ramps would be constructed by firstly constructing retaining structures using in-situ concrete and then applying and compacting imported fill material before finishing with surfacing. Topsoil would then be imported and graded to finish levels to provide finishing around new abutments and approach ramps.

Due to the limited space available, there may be a requirement for a significant retaining structure on the approach ramps to retain the existing highway and access on the west approach.

Delivery of pre-cast bridge beams requires further assessment of routes and geometric route constraints and may not be possible. There is the additional challenge of maintaining access for local residents due to geometric constraints of site and temporary occupation may be required.

Health & Safety

The main hazards identified for this option are:

- Working over and in watercourse - working within the watercourse to access the riverbed for piling operations, pile cap construction, pier and abutment installation.
- Excavations at abutments - destabilisation/ground collapse at river banks, also construction of scour aprons for affected options.
- Craneage activities, including site geometric constraints.
- Public interface – Proximity of residential properties to the worksite.

Traffic Management

The extraction of the medium-term structure, demolition of the original structure and construction of a new bridge will result in travel route disruption for both pedestrians and vehicles when crossing the river, resulting in diversions elsewhere. The nearest pedestrian crossing is Handyside, while the closest vehicle crossing is the A38 Bridge.

During construction disruption can be expected to the local residential area, this includes obstructions near to the site which may affect vehicle access to the Midlands Canoe Club and parking beside Darley’s Restaurant & terrace on the alternate side of the river.

Following construction, vehicle and combined pedestrian and cyclist access will be opened to the public.

7.4 Environmental Considerations

The environmental impacts are regarded as follows:

During Construction

Vehicle diversions will be required and will result in greater pollution emissions due to extended travel distances.

Constructing within the river will lead to increased risk of polluting the watercourse. With preventative measures and waste management needed to prevent possible chemical contamination by machinery, and actions in place to limit habitat disturbance.

The removal of the existing structures and the delivery of materials for the construction of a new crossing will require transportation to access the site, resulting in the generation of additional pollution through vehicle use.

The need for new materials will add to the project's environmental impact, with particular attention given to the embodied carbon of the materials being used.

Post Construction

By reintroducing piers into the river, the existing issues resulting from disruption to flow will remain.

There is the benefit of increased permeability and connectivity to Darley Abbey Mill from Old Lane by opening up the access route to vehicles as well as pedestrians and cyclists. However, by opening up access there is likely to be an increase to traffic flows which would lower the air quality (via emissions) through residential areas.

Carbon Assessment

The embodied carbon for Option 6 is 582 tCO_2e.

7.5 Capital Costing

The estimated Capital Cost for Option 6 is £21,576,870 exc. VAT. This is broken down as follows:

Table 27 – Option 6 Capital Costs

CAPITAL COST ESTIMATE	
Item	**Precast concrete deck**
	£21,576,870
Mobilisation/demobilisation	£1,050,611
Enabling works	£653,107
Removal of Medium-term structure	£118,300
Removal/Demolition of existing bridge	£1,640,000
Foundations and substructure	£3,030,000
Bridge Fabrication and Installation	£2,595,580
Finishes (incl electrical and lighting)	£1,059,000
Landscaping	£85,000
Sub Total (Capital Cost)	£10,231,598
Preliminaries	£4,703,371
Design, Checking and Planning, 15%	£1,534,740
MHA4 fee (including Overheads and Profit) - 6% assumed	£1,134,460
Contractor's Risk and Contingency, 7% assumption, optimism bias not included	£2,986,994
Inflation, assuming 5.5% assumed over 2 years to Feb 2027, to be revised against BCIS indices	£985,708
Total Cost	**£21,576,870**

7.6 Whole Life Costing

The whole-life costing for Option 6 assumes the following:

- Principal inspections scheduled at 6 yearly intervals, and general inspections at 2 yearly intervals.
- Initial Year 0 capital costs of £21,576,870.
- Future maintenance and inspection estimated costs are included. The assumed main maintenance activities and assumed outline schedule of these maintenance activities is supplied in Section 1.4, Table 6.

The value supplied is the PV (Present Value) calculated after discount factors are applied based on Appendix B of CD 355.

Please refer to section 1.4 of this report for assumptions, exceptions and limitations which have been applied in the derivation of whole life costs.

The future maintenance and inspection cost for Option 6 is £272,427.95.

Table 28– Option 6 Future Maintenance and Inspection Costs

Future Maintenance and Inspection Costs (£)							
Options	**Future Inspection Costs (£)**	**Joint Replace (£) (Yr 26)**	**Bearing Replace (£) (Yr 40)**	**Resurface/ Re-waterproof bridge deck (£) (Yr 50)**	**Parapet Replace (£) (Yr 50)**	**Traffic Management (Exc VAT) (£)**	**Total Future Maintenance & Inspection (Exc. VAT) (£)**
6	81,960.08	64,157.98	70,412.80	23,055.55	25,779.47	7,056.07	272,421.95

Total whole life cost for Option 6 is £21,849,292

Table 29 – Option 6 Whole Life Cost

Overall Cost (£)			
Options	Total Future Maintenance & Inspection Cost (Exc. VAT) (£)	Total Capital Cost (Exc. VAT) (£)	**Overall Whole Life Cost (Exc. VAT) (£)**
6	272,421.95	21,576,870	**21,849,292**

7.7 Construction Programme

The Construction schedule for Option 6 comprises of a 234-week programme which runs between from 14/04/2027 to 10/10/2031. The long duration is due to the extensive works needed in the river which would need to be phased to minimise the impacts.

7.8 Project Risk Assessment

Table 30 – Option 6 Risk Assessment

Risk	Impact (1-5)	Probability (1-5)	I x P	I x P RAG Rating	Owner	Mitigation
Utilities diversion required	3	3	9	Medium	**DCC**	Surveys sought and updated at each stage of the project's design Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost Early and ongoing engagement with utilities providers for diversion costs and timescales
Piers remaining in River Derwent presents increased flood risk	3	3	9	Medium	**DCC**	Surveys sought and updated at each stage of the project's design Cost estimate for diversions prepared at each stage of design with risk values modelled and updated as part of this process to provide realistic, robust contingency for utilities cost Early and ongoing engagement with utilities providers for diversion costs and timescales
Uncontrolled collapse of existing bridge during demolition/ validation of demolition sequence.	3	3	9	Medium	**DCC**	Assessments required to be undertaken by engineers to support demolition methodology at early stages.
Substructure design not considered at this stage	3	3	9	Medium	**DCC**	Ground investigations recommended to be undertaken and shared with designers and contractors at early stages of design.
Archaeological works recommended to be undertaken in areas of proposed alignment	4	3	12	Medium	**DCC**	Archaeological survey is recommended in areas of proposed new alignments early in the project development.
Environmental impact: Working within an UNESCO site and adjacent to Grade 1& 2 listed buildings Loss of mature trees on approaches Impact on watercourse and	4	5	20	High	**DCC**	Reinstatement of trees at approaches. Heritage structures to be preserved either on or off site. Monitor vibrations during construction works. Consultation with Environment Agency at early design stages considering permanent and temporary works.

surrounding infrastructure including during construction Impact of the structure on the surrounding heritage area Impact of structure on surrounding protected wildlife.						
Pollution of watercourse	4	4	16	High		Early contractor involvement required to determine demolition methodology. Possible optimisation of spans in project development. Early stakeholder engagement to gain required approvals
Temporary works in watercourse In-river works to construct substructure including multiple areas of river in use at one time Risk of damage to permanent works during stand- down due to flooding	4	4	16	High	**DCC**	Early stakeholder engagment to gain required approvals. Early contractor involvement to determine construction process.
Limited access site eg crane or access from river, site access for plant and deliveries. Including impact on neighbouring properties.	4	5	20	High	**DCC**	Early contractor involvement throughout design process.
Approach ramps impact on local land ownership	4	5	20	High	**DCC**	Early engagement with stakeholders throughout design process.
Flood risk impact on construction programme	4	4	16	High	**DCC**	Early engagement with Environment Agency and early contractor involvement throughout design process.
Engineering difficulty of solution	4	4	16	High	**DCC**	Early contractor involvement required.
Not securing funding	5	5	25	High	**DCC**	Effective communication and development of a robust business case to highlight the importance of this route in providing a key connection to employment, education, healthcare, and leisure services.
Unsupportive public response to consultation. Lack of long term support from local community groups and	2	4	8	Medium	**DCC**	Early engagement, include suggestions wherever viable and proportionate, transparency in responding where suggestions can’t be incorporated

affected businesses leading to reduced public perception of realised benefits. Construction delays may reduce support from local businesses, particularly those operating from Darley Abbey Mill.						
Safety audit may raise concerns which require changes to the scheme design	3	1	3	Low	**DCC**	Designers' response will be prepared to identify which are critical changes and which are points of detail to be considered in the next stage of design for the preferred option
Cost increases as design develops due to inflation on materials, changes in the required design or programme prolongation i.e. fluctuations in Steel price over multi-year construction programmes.	4	5	20	High	**DCC**	Risk modelling and optimism bias are used within cost estimates at each stage and these are redefined as design/ cost matures to reflect greater certainty. Early Contractor Involvement during detailed design/ FBC
Uncertainty relating to costs and benefits as scheme develops could result in scheme having a lower Value for Money category at a later stage	3	2	6	Low	**DCC**	Commission full traffic surveys to get existing pedestrian, cycling, bus as well as traffic counts so a more detailed economic forecast can be estimated Update economic case to use PRISM model outputs at OBC and FBC stage for strategic traffic impacts Consider the importance of non-quantifiable benefits/ wider impacts of scheme
Delays and cost over-spend due to missed approvals and approval deadlines.	3	2	6	Low	**DCC**	Understand fully the requirements, timescales and deadines for necessary work permits i.e. TTRO, licenses from Environmental Agency to work in watercourse, permits to dig. Delegate clearly in The Contract and onward communication who is responsible for each.
Disabled access impacts - Positioning of heavy plant and equipment in or around the residential streets on the West side of the River Derwent may promote	5	4	20	High	**DCC**	The potential for this situation to occur is to be considered when planning the location of site compounds, equipment drops, setting out areas etc. in local streets (where applicable).

increases in pavement parking from vehicle users. This in turn may increase pressure on access for disabled members of the public i.e. lack of space on pavements, lack of dropped kerbs for crossings.						
Increased risk of flooding downstream due to removal of the existing bridge	4	1	4	Low	**DCC**	Carry out hydrological study to assess the flood impact.
Not securing Environment Agency Consent for the design	5	4	20	High	**DCC**	Consult with EA and ensure that design solutions for any new crossing limit restrictions to the watercourse e.g by reducing the number of piers and placing the deck above 1 in 100 year flood levels plus allowance for climate change and freeboard.
Delisting of Derwent Valley Mills UNECSO world heritage site	5	3	15	High	**DCC**	Avoid prolonged use of Option 2, consult with all stakeholders and obtain architectural input to ensure any new bridge crossing will complement the site and ensure its current status.
Financial impact on local businesses during construction	5	5	25	High	**DCC**	Consult with local business owners, limit site working hours and ensure access at all times at sensitive times as far as possible.
Works affecting private land owners cannot be agreed through negotiation	4	4	16	High	**DCC**	Identify any affected private land owners and commence early consultation
Existing substructure remaining in riverbed - potential to cause clashes with new substructure works.	**4**	**4**	**16**	**High**	**DCC**	**Surveys to be conducted to determine the full extent of substructure. Extent of substructure to be removed to be decided at later design stage.**

7.9 Summary Table

Table 31 – Option 6 Summary Table

Option description	8m wide pedestrian, cycle and vehicle bridge.
Design	5-span structure formed of a prestressed concrete beam and slab deck and in-situ reinforced concrete substructure.. The new alignment will be skewed in plan with respect to the existing structure with the east abutment to the north of existing and west abutment south of existing resulting in increased span length of 48m. The abutments of the existing disused bridge will need to be demolished to accommodate this option. Longer approach ramps and tie-ins with the existing highway are required compared with Options 3, 4 and 5.
Construction	Demolition of existing bridge as per Option 1 Construction summary. Construction of the new supports in watercourse will require extensive temporary works, resulting in an extended programme of construction and higher costs. Casting of in-situ concrete crossheads and supports in watercourse, and reprofiling of riverbed will be difficult. Large cranes will be required for the heaviest pre-cast concrete lifts, potential access restrictions during lift. Possible requirement for significant temporary works retaining structures to be constructed to support the existing highway and accesses during works (due to proximity to river). Challenges with maintenance of access for local residents due to geometric constraints of site, temporary occupation may be required. Delivery of long beam elements (pre-cast bridge beams) requires further assessment of routes and geometric route constraints and may not be possible.
Environmental	Changes and disruption to original flow by removal of existing piers. Polluting the river during demolition and construction. Increased traffic flows through residential areas. The Embodied Carbon is 582 tCO2e.
Capital Costing	£21,576,870
Whole life Costing	£21,849,292
Construction	From 14/04/2027 To: 10/10/2031 (234 weeks)
Risk	Refer to Section 7.8 – risk table for Option 6. Total Risk score - 356

8 Options Summary

Table 32 – Options Summary

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Design	Demolition of disused existing bridge. Removal of medium-term footbridge. Reinstatement of approaches.	Maintaining the current medium-term footbridge with future demolition of disused existing bridge.	Reconstruction of 37m 6 span concrete bridge matching existing width on same alignment. Deck requires lifting above flood level with provision of new approx. 15m approach ramps. 7.5T weight limit excludes Fire Engines. No dedicated cycling facilities.	Replace existing structure with 48m single span 4m wide pedestrian and cyclist steel footbridge on new alignment. Deck positioned above flood level with provision of new approx. 15m approach ramps.	Replace existing structure with 48m single span 4m wide pedestrian, cyclist and emergency vehicle steel bridge on new alignment. Deck positioned above flood level with provision of new approx. 15m approach ramps.	Replace existing structure with 48m long multi-span 8m wide pedestrian, cyclist and vehicle prestressed concrete bridge on new alignment. Deck positioned above flood level with provision of new approx. 30m approach ramps.
Construction	Existing footbridge craned out by crane positioned on public highway at the west abutment. Floating temporary works and use of robotic demolition equipment for disused bridge demolition. Cranes will support deck sections as they are removed. Existing pier supports in watercourse removed	See Option 1 for future disused bridge demolition. See Option 1 for future maintenance/ replacement of medium-term footbridge.	See Option 1 for demolition activities. Extensive temporary and permanent works in watercourse and riverbed, extended programme, higher costs. Large cranes with access restrictions. Possible requirement for significant temporary works retaining structures. Delivery of wide elements to site requires further assessment.	See Option 1 for demolition activities. Cofferdams required at abutments. Significant bridge-lift operations Potential clash with lifting equipment and local residences. ECI recommended with bridge fabricators at next stage.	See Option 4	See Option 1 for demolition activities. Extensive temporary and permanent works in watercourse and riverbed, extended programme, higher costs compared with other options. Large cranes with access restrictions. Possible requirement for significant temporary works retaining structures. Temporary land occupation may be required.
Key Health and Safety Risks	Working from or adjacent to the watercourse. Stabilisation of structure during demolition. Access constraints for cranes and plant.	Deterioration of disused leading to instability/collapse. Climbing and unauthorised access on to disused structure.	Working over and in watercourse. Craneage activities. Excavations at abutments and piers. Potential to cause pollution of watercourse Public interface.	Working over and in watercourse. Craneage activities Hot works Excavations at abutments	See Option 4	Working over and in watercourse. Craneage activities. Excavations at abutments and piers. Potential to cause pollution of watercourse Public interface.
Environmental Considerations	Pollution of the watercourse. Potential removal of mature trees. Potential damage to Grade II listed Weir	Pollution to the watercourse due to further deterioration. Continued visual impact on the UNESCO site.	Reinstatement of piers in the watercourse remain a barrier to river flow. Potential clearance of mature trees with	Increased vehicle emissions from permanent diversion. Potential change in flow from removal of existing piers. Removal of barrier	See Option 4	Reinstatement of piers in the watercourse remain a barrier to river flow. Additional clearance of mature trees compared with other options with

	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
	Potential change in flow from removal of existing piers. Removal of barrier to flow reduces debris build up and maintenance. Vehicle-emission increases due to permanent removal of existing crossing point. Potential reductions in local parking and noise. Potential greater level of privacy for local residents and increased security. No carbon assessment.	No effect on existing trees and fauna. Vehicle-emission increases due to permanent removal of existing crossing point. Existing piers are barriers to river flow until demolished. No carbon assessment.	reinstatement on completion. Increases in vehicle emissions due to longer detours to alternative river crossing points until completion. Additional pollution through vehicle use due to transportation of materials to site. Reinstatement of single lane vehicle access across Darley Abbey Bridge. Increased traffic flows through residential areas. Embodied Carbon 387 tCO2e	to flow reduces debris build up and maintenance. Additional pollution through vehicle use due to transportation of materials to site. Potential clearance of mature trees with reinstatement on completion. Embodied Carbon (both sub-options) : 4 $_{(2)}$: 502 tCO2e 4 $_{(3b)}$: 496 tCO2e		reinstatement on completion. Increases in vehicle emissions due to longer detours to alternative river crossing points until completion. Additional pollution through vehicle use due to transportation of materials to site compared with other options. Reinstatement of single lane vehicle access across Darley Abbey Bridge. Increased traffic flows through residential areas. The Embodied Carbon is 582 tCO2e.
Capital costs	£3,081,756	N/A	£15,156,785	4$_{(2)}$ - £10,180,045 4$_{(3b)}$ - £10,449,361	5$_{(2)}$ - £10,220,442 5$_{(3b)}$ - £10,489,759	£21,576,870
Whole Life Cost	£3,081,756	£2,414,967.34	£15,344,570	4$_{(2)}$ - £10,344,268 4$_{(3b)}$ - £10,613,584	5$_{(2)}$ - £10,384,665 5$_{(3b)}$ - £10,653,982	£21,849,292
Programme	24 weeks	See Option 1 (future demolition)	206 weeks	102 weeks	See Option 4	234 weeks
Risk Score	202	299	335	291	273	356

9 Conclusion & Recommendation

Arcadis were commissioned to undertake an Options Report to investigate 6 design options for removal and replacement of Darley Abbey Mills Bridge with input from Galliford Try to provide buildability advice and costings. The options considered and the optioneering exercise was undertaken in compliance with the instructions set out within the Darley Abbey Mills Bridge ECI Scope document in Appendix B.

Of the 6 options, 4 options consider the construction of new bridge crossings. An initial option considers demolition only, and a further option considers maintenance-only of the existing medium-term footbridge. All 6 options require demolition of the now disused bridge structure since it is beyond economic repair and its condition will continue to deteriorate requiring future intervention.

Option 1 removes many of the benefits afforded by a historic fixed link in the area and reduces connectivity to Darley Abbey Mills over the River Derwent. This reduction in connectivity is considered to impact negatively on the local community.

Option 2 involves prolonging the use of the current footbridge as a medium-term solution. It should also be considered that Option 2 will likely incur significant future costs as the existing disused structure deteriorates further and will eventually require demolition. It is assumed that the medium-term structure currently in service would also require replacement every 30 years. Since this option has a negative visual impact on the world heritage site and will incur significant future costs, it is recommended to limit to ongoing use of this existing arrangement as far as possible.

Of the four ‘construction’ options it was found that the multi-span vehicle access options, 3 and 6, to be constructed using primarily precast concrete elements were significantly more expensive than the single span steel options 4 and 5. This is due to the requirement for significant volumes of additional construction of piers in the watercourse. The complexity of construction involved is also reflected in the designer’s Health and Safety and Project Risk Assessments tables, with high impact, high probability scores attributed to these options in various risks relating to approvals from the Environmental Agency, to impacts on local businesses, due to multi-year construction programmes.

Option 3 would restore the previous bridge crossing but would not improve pedestrian and cycling facilities or allow Fire Engines to cross the river. Option 6 is the most expensive option and provides dedicated pedestrian and cycling facilities while also providing full one-way vehicle access, but the long approach ramps needed at represent a significant design challenge at this constrained site and may not be feasible. Allowing vehicles to regain access to the bridge also promotes increased throughput of traffic from the west side of the river which creates many disadvantages to those who reside here through increased noise, littering and air pollution. Secondary effects of this are thought to also be increased parking and pavement-parking, affecting disabled user access.

Options 4 and 5 which would be primarily formed from steel were found to be most cost-effective. This was due to these options being single span only and therefore eliminating the requirement for extensive construction in the watercourse.

The most cost-effective option is $4_{(2)}$ which is the single-span steel perforated U-Beam option which carries pedestrians and cyclists only. The single span steel options are considered to best compliment the surroundings and offer the most pleasing visual aesthetic. This is an important factor for the continued listing of Darley Abbey Mills as a Grade I listed structure within the UNESCO world heritage site. This is reflected in the Project Risk Assessment which also afford the single-span steel options with beneficial scores compared with the multi-span concrete bridge options 3 and 6, the demolition-only Option 1 and the maintenance-only Option 2.

It is important to note however that the recommended option should not consider lowest-cost only, and the eventual selection of a preferred option should balance value-for-money, aesthetic value, functionality and practicality, multi-use cases and connectivity to users and visitors.

Option 5 $_{(2)}$ is the variation of the single-span steel perforate U-Beam option carrying pedestrians, cyclists and also be designed to accommodate emergency-vehicle access by means of suitable traffic management system possibly involving retractable bollards. The capital and whole-life cost uplift vs Option 4 $_{(2)}$ (non-emergency vehicle access) is marginally more expensive; however, this facilitates important emergency access when required from the west side of the River Derwent at the bridge location which may provide time-savings for emergency vehicles, critical to this intended use-case.

Such emergency-only vehicular access also provides improved connectivity when needed but also ensures that residents who live locally on the west side of the river are not exposed to increased vehicular throughput and the negative effects associated with this.

The asymmetric half-though-arch Option 5 $_{(3b)}$ was compared against Option 5 $_{(2)}$ also, however costs for this are slightly higher, providing less value-for-money. Additionally, the arch construction of the bridge deck is more complex versus the regularity of the perforated U beam option 5 $_{(2)}$. The arch option 5 $_{(3b)}$ would also have the west-end of the arch section submerged during the potential 1:100-year flood event. This would not be the case for the perforated U-beam option 5 $_{(2)}$, therefore offering a future maintenance disadvantage versus Option 5 $_{(2)}$ and a constraint to river flows.

The recommendation of this Options Report therefore is to carry forward Option 5 $_{(2)}$ which provides the best balance of value-for-money, connectivity, aesthetic value in keeping with the local environment, site heritage, and usage requirements.

Appendix A

Appendix A – Designer's Risk Assessment

Design Risk Register

NOTE:
The Project Combined Design Health and Safety Risk Register must be commenced and maintained by the Principal Designer throughout the design phase to record and communicate the unusual and significant health and safety risks associated with the project and the control measures implemented during the Design Phase of the project to reduce and control the level of risk.

Individual organisations carrying out 'Design' functions are responsible for establishing and implementing their own design risk management processes and communicating unusual and significant risks to the Principal Designer who will include the information received from each individual designer in the combined register for the project.

The Risk Register must be included in the Pre Construction Information provided to the Principal Contractor and Contractors to communicate to them health and safety hazards and risks identified that they must control during the construction phase.

At completion of the construction phase, the Principal Designer must identify any residual health and safety risks associated with the occupation and operational use, cleaning, maintenance, alteration or demolition of the building and associated services, together with the control measures that must be adopted in order to effectively control the level of risk.

The final Risk Register containing residual risks must be included in the Health and Safety File.

Please note that Options 4 and 5 each contain two sub-options - sub-option 2 and sub-option 3b. Sub-option 2 is a single-span U-beam structure with perforated solid-panel parapets. Sub-option 3b is a single-span assymetric arch structure formed from SHS sections with vertical bar infill parapets. 4 refers to pedestrian/cycle only. 5 refers to same structural configuration as 4, but accomodating pedestrian/cycle and emergency vehicle access. Hazards identified uniquely for either are referred to with the sub-option as a suffix, for example 'Option 4 $_{(2)}$'

Project Name:	**Darley Abbey Mills Bridge**
Project Type:	**Options Report**
Period allowed for Design (weeks):	**N/A**
Period allowed for Construction (weeks):	**N/A**
Version No:	**P02**
Date	**09/05/2025**

	Discipline: Select from drop down list	**Organisation:**	**Contact Name:**	**H&S Risks Identified - Y / N**
Project Manager	Project Manager	Arcadis	Ananya Dabade	N
Principal Designer	Client	Derby City Council	Richard Giles-Grant	N
Designer	Engineer, Civil	Arcadis	Sophie Tyndall	Y
Designer	Engineer, Civil	Arcadis	Oliver Thompson	Y
Designer	Engineer, Civil	Arcadis	Zac Payne	Y
Designer	Engineer, Civil	Arcadis	Frank Quither	Y
Principal Contractor				

Designer Identifying Hazard or Unusual Operation & Responsible for Developing Controls	Details of Significant Hazard or Unusual Operation	Option	Population at Risk C Contractors V Visitors P Public / Occup er M Maintainer / C eaner	Stage at which hazard or unusual operation will occur Select from dropdown	Design Stage Action Taken to Control Level of Risk	Owner(s)	Risk Controlled or Uncontrolled	Risk Control Measures required to be adopted by Contractor during Construction	Risk Controlled or Uncontrolled4	Risk Control Measures required to be adopted by Occupier / Maintainer
Engineer, Civil	Preliminary stage - lack of information	All	C	Construction	Due to the preliminary stage of the project, key assumptions have been made on the loading, construction methodology and structural arrangements. This is for the purpose of preliminary member sizes only. The key assumptions have been documented in design statements specific to the options. These assumptions are for this stage only, and it is documented that later design stages will need to consider/review assumptions at this stage.	DCC/Designers	Uncontrolled			
Engineer, Civil	Lack of ground investigations	All	C	Construction	Designers will ensure required ground investigations are conducted to ensure the design is informed and accurate. This will occur at a later stage in the design.	DCC/Designers	Uncontrolled			
Engineer, Civil	Outline design options	3 & 6	C	Construction	No structural design has been undertaken for the pedestrian/cycle and emergency vehicles-only (Option 3) or the highway bridge (Option 6), both outlined as multi-span pre-cast concrete bridge decks supported by in-situ concrete supports. These will be become more defined in later design stages if these options are taken forward.	DCC/Designers	Uncontrolled			
Engineer, Civil	Existing Hazardous Materials - risk of poisoning, burns, injury. Illness.	All	C	Demolition / Decommissioning	Designer shall interrogate all available records of the (1) heritage footbridge and (2) medium term structures and supply this information to the Contractor, examples of hazardous materials are Coal Tar in old surfacing, Lead in paintwork, and ACM (Asbestos-Containing Materials) in some older taped waterproofing seam systems. Designer/client shall arrange and verify through survey/inspection the presence of hazardous materials where present and supply these within pre-demolition/construction information. There are also additional-cost implications associated with special handling and disposal of hazardous waste material.	DCC/Designers	Uncontrolled	Contractor shall translate this information in RAMS prior to exection of works, including any requirements for special handling and licensed disposal.	Controlled	
Engineer, Civil	Demolition of existing bridge - pollution of watercourse	All	C	Demolition / Decommissioning	Demolition temporary works designer must ensure through clear instruction to Contractor that mitigations must be made to prevent pollution to the watercourse from demolition activities. As an example, Hydrodemolition jetting remnant water is highly alkaline and must be pumped off structure to tankers for off-site disposal at a licensed waste facility, the structure shall be screened where required to prevent run-off also.	DCC/Designers	Uncontrolled	Contractor shall acknowledge and include mitigation measures to prevent pollution to the watercourse in RAMS.	Controlled	
Engineer, Civil	Demolition of existing bridge - temporary works stabilisation during demolition - risk of uncontrolled collapse of structure.	All	C	Demolition / Decommissioning	Demolition termporary works designer shall supply all necessary pre-construction information regarding sequencing of demolition and whether / how demolition sequence could potentially change load paths, requirements of temporary propping works to enable safe load transfer. Uncontrolled collapse can also pollute the river and may cause damage to the adjacent heritage weir. Designers to outline to Client that regular inspection and/or monitoring of the structure is required to prevent uncontrolled collapse.	DCC/Designers	Uncontrolled	Contractor shall comply and include demolition temporary works designer's requirements, i.e. temporary stabilisation works, within their demolition phase plan and include practical risk assessments surrounding manual lifting, handling and transporting parts of the structure during demolition.	Controlled	
Engineer, Civil	Removal of existing piers/columns in watercourse - Damage to listed weir.	All	C	Demolition / Decommissioning	The Easternmost pier is in close proximity to the Grade II listed Weir, designer to ensure information is communicated to Contractor that care must be taken during removal so as not to impart accidental damage to the weir. The Client shall also procure a dive survey to inspect the condition of the weir and also the existing substructure before demolition can take place.	DCC/Designers	Uncontrolled	Contractor shall acknowledge any special protection requirements and ensure compliance with designer's request to prevent accidental damage occurring.	Controlled	
Engineer, Civil	Partial removal of existing substructure	All	P	Demolition / Decommissioning	The extent of the existing substructure is not fully understood at this design stage. In later design stages, surveys are recommended to be undertaken to gain clarity. It is possible that some substructure will remain in the riverbed post demolition.	DCC/Designers	Uncontrolled	Contracotr shall ensure that when removing existing substructure all measures are taken to limit the exposure of remaining structure to the public	Uncontrolled	Regular inspections are required to monitor scour and erosion to ensure that any remaining substructure in the riverbed does not pose a safety hazard to members of the public or wildlife.
Engineer, Civil	Working in watercourse - demolition works	All	C	Construction	All proposed bridge options would require working within the watercourse to access the river bed for demolition works of piers and abutments. The associated River Derwent hazards are flooding, drowning, waterborne diseases and pollution. For all options, mitigations could be pontoons/floating scaffold, lifejackets, staging demolition works in watercourse - Designer shall provide requirement for all work measures in their documentation and drawings if required. Adopt 'ERIC' principle in first instance to try and eliminate the risk.	DCC/Designers	Uncontrolled	Contractor to determine safe method of works to allow access to river bed and mitigate risks arising from working in the watercourse.	Controlled	
Engineer, Civil	Environmental impacts protected species	All	C	Construction	The proposed site area is a UNESCO heritage site. Construction activities in the river may impact protected species dependent on the time of year these are carried out. Designer to liaise with Environmental Agency (EA) for guidance and communicate outcomes of this within pre-construction information to Contractor. The business case for Option 5 reduces the environmental impact on the watercourse compared with Options 3 and 6.	DCC/Ddesigner	Uncontrolled	Contractor shall implement recommendations made by EA and communicated by designer during construction/demolition to mitigate impacts on protective species.	Controlled	
Engineer, Civil	Access/ Egress arrangements - local resident interactions in close proximity to site vehicles/plant etc leading to injuries and/or damage to private property, vehicles.	All	C	Construction	Access and Egress must be carefully considered for local residents due to proximity of private dwellings to the West approach of the structure. Designer must pass this information to The Contractor. The boundary limits of the worksite to ensure adequate access/ egress for residents will also be shown on the drawings.	DCC/Designers	Uncontrolled	Contractor shall plan for access and egress for affected private dwellings during works. Affected dwellings shall be identified and communication with affected dwellings shall be made regarding dates and timings of work on work days. For example. The taking down of the temporary ramp to the medium term structure which exists along Old Lane. Contractor should consider a PVPMP (Pedestrian Vehicle and Plant Movement Plan).	Controlled	
Engineer, Civil	Working near services	All	C	Construction	Ensure most recent service plans are available to contractors at time of site works. At the preliminary member sizing stage, location of utilities has not been considered by designers. Utilities will be considered by designers in later design stages. The client will be responsible for diverting all live services of the existing bridge prior to commencing the works.	DCC/Designers	Uncontrolled	Contractor is responsible to carry out all required checks prior commencement of any construction works (eg. CAT & Genny) to verify the existence of any services and ensure they will not be affected during works. Contractor is responsible to liaise with service providers if any identified on site to acquire relevant approvals. Contractor shall also follow best practices provided in HSE HSG47.	Controlled	
Engineer, Civil	Control of vibrations - piled abutment foundations - Damage to nearby private properties and listed structures.	(3 to 6)	C	Construction	Designer shall contact the local authority and other stakeholders to obtain limiting criteria (if stipulated) surrounding maximum permitted ground wave velocities imparted by vibration. Promote alternative construction method such as auger-bore to eliminate impact-driving methods of pile construction. The business case for Option 5 reduces the vibrations from foundation construction compared with Options 3 and 6.	DCC/Designer	Uncontrolled			
Engineer, Civil	Control of noise - Hearing damage and nuisance to local residents	All	C	Construction	Designer shall write the local authority requirements for site working hours and noise levels into the contract specification.	DCC/Designer	Uncontrolled	Contractor shall evaluate site risks associated with dust and specify mitigations in RAMS i.e. hearing protection PPE for workers exposed to high levels of noise, noise suppression techniques such as mufflers on hand tools, screening, limitations to daytime works for certain high noise generating activities.	Controlled	

Designer Identifying Hazard or Unusual Operation & Responsible for Developing Controls	Details of Significant Hazard or Unusual Operation	Option	Population at Risk C Contractors V Visitors P Public / Occup er M Maintainer / C eaner	Stage at which hazard or unusual operation will occur Select from dropdown	Design Stage Action Taken to Control Level of Risk	Owner(s)	Risk Controlled or Uncontrolled	Risk Control Measures required to be adopted by Contractor during Construction	Risk Controlled or Uncontrolled4	Risk Control Measures required to be adopted by Occupier / Maintainer
Engineer, Civil	Control of Dust - Respiratory hazards and nuisance to local residence	All	C	Construction	No design input at this stage.	DCC/Designer	Uncontrolled	Contractor shall evaluate site risks associated with dust and specify mitigations in RAMS i.e. PPE respiratory masks, dusts suppression techniques (i.e dampening with water) screening to capture dust arising from construction/demolition activities, and educate their workforce to the dangers and risks (i.e silica dust from sawing and drilling concrete) in toolbox talks and safety briefings.	Controlled	
Engineer, Civil	Presence of trees - site constraints & environmental risks.	All	C	Construction	The west riverbank of the River Derwent at the location of the structure is lined with medium height mature trees. It may be required to trim or remove these. The designer shall ensure that an environmental assessment has been undertaken (possibly by the client/local authority) in advance of construction work. All environmental concerns shall be transferred to the drawings. The level of potential tree loss varies per option. Option 5 reduces the level of tree loss compared with Option 6, for example.	DCC/Designer	Uncontrolled	Where trees are to be cleared in order to perform demolition and construction activities at the river banks, The Contractor must acknowledge and address any concerns provided within the environmental impact assessment i.e. the need to inspect for nesting protected-species birds, prior to clearance. Supply toolbox talks and briefings to staff and retain signed register of staff acknowledgement of each toolbox talk for quality assurance records, which clarify the need to perform these inspections and the need to halt work and seek further guidance if protected species are located.	Controlled	
Engineer, Civil	Risk of falls into watercourse - Abutments	(1), (3 to 6)	C	Construction	Designer shall communicate to Contractor need to edge protection for both pedestrians and construction vehicles due to proximity to watercourse. The business case for Option 5 reduces the requirements for working in close proximity to the watercourse compared with Options 3 and 6.	DCC/Designers	Uncontrolled	Contractor to comply with recommendations and incorporate into their demolition/construction plans.	Controlled	
Engineer, Civil	Working in close proximity to the public	(1), (3 to 6)	P	Construction	This hazard applies to all activities on the riverbanks i.e. approach ramp construction, craneage of new bridge elements. This will require the use of heavy plant working in close proximity to the public. Designer shall carry out the design to limit the need for large plant such as piling rigs and cranes as far as possible at the next stage.	DCC/Designers	Uncontrolled	Contractor to ensure health and safety measures in place to limit risk to public	Controlled	
Engineer, Civil	Excavations at Abutments - destabilisation/ground collapse at river banks, also construction of scour aprons for affected options.	(1), (3 to 6)	C	Construction	Designer shall ensure Geotechnical site investigation information is made available to the contractor, and existing soil and hydraulic parameters are marked on design drawings. Where required temporary works shall be specified. The removal of trees lining the eastern riverbank may also increase the risk of slope collapse to due the presence of their root system creating a natural reinforcement. Designer shall carry out the design to limit the depth of excavations, loss of existing trees and foundation construction in the watercourse as far as possible at the next stage. The level of risk varies dependent on the preferred option. Option 5 reduces the amount of excavations compared with Option 6 for example.	DCC/Designer	Uncontrolled	Contractor shall follow best practices to ensure the safety of their workforce when carrying out works in or around excavations and slopes, including the possible use of temporary works for access, cofferdam construction to eliminate drowning risks.	Controlled	
Engineer, Civil	Abutments - Toxic burns from invasive plants	(1), (3 to 6)	C	Construction	The designer shall evaluate through environmental assessment whether Giant Hogweed is present along the riverbanks and mark this on drawings if required. It may be required for the maintainer to remove instances of giant hogweed if present, for access prior to construction/demolition	DCC/Designer	Uncontrolled	Contractor shall organise toolbox talks etc to workforce to inform of dangers of handling invasive plants.	Controlled	
Engineer, Civil	Waterborne Diseases	All	C	Construction	The designer acknowledges that works at rivers pose the risk of transmission of diseases such as Leptospirosis and parasites. Option 5 reduces the requirements for working in close proximity to the watercourse compared with Options 3 and 6.	DCC/Designer	Uncontrolled	The Contractor shall brief out within team talks and safety briefings their risk mitigation straegies for risk reduction, promoting PPE, the supply of hygiene and washing facillities on site, and promoting regular hand washing. H & S ,measures such as information of local A&E locations etc should also be rolled out staff during inductions and under routine safety talks.	Controlled	
Engineer, Civil	Working in watercourse - construction works	(3 to 6)	C	Construction	Options 4 and 5 would require working within the watercourse to access the river bed for abutment installation and temporary propping as required. The associated River Derwent hazards are flooding, drowning, waterborne diseases, pollution, hydrostatic loading for Option 4 $_{(3b)}$, scour of foundations. Hydraulic loading has been considered at the preliminary member design stage for option Option 4/5 $_{(3b)}$. Scour will be considered at the next stage. Designers to raise awareness of this throughout the design, and to be considered when deciding on construction methodology. Options 4 $_{(2), (3b)}$,5 $_{(2), (3b)}$ involve additional temporary works propping in the watercourse which will need to be designed by the contractor.At a later design stage a reduced number of piers and piles may be explored to reduce requirement for works taking place within the watercourse. Designers to provide information to allow for contractors to develop safe method of works to mitigate risks. Options 3 and 6 would require working within the watercourse to access the river bed for piling operations, pile cap construction, pier and abutment installation. For Options 3 and 6, mitigations could be pontoons, lifejackets, possible staging temporary works staging platforms or cofferdams in watercourse - Designer shall provide requirement for all work measures in their documentation and drawings if required. Hydraulic loading has not been considered for these options at this stage. Option 5 reduces the requirements for working in the watercourse compared with Options 3 and 6. Adopt 'ERIC' principle in first instance to try and eliminate the risk.	DCC/Designers	Uncontrolled	Contractor to determine safe method of works to allow access to river bed and mitigate risks arising from working in the watercourse.Contractor to design temporary works for Options 4,5 involving propping in the watercourse.		
Engineer, Civil	Crane accidents - Movement and positioning of the crane	(1), (3 to 6)	C	Construction	The designer shall recognised that the availability of movement on the East approach of the structure is constrained by proximity to private dwellings. This constraint may have impacts on the manouverability of large items of plant such as cranes. This shall be marked up on drawings. Low-hanging overhead telecommunication wires are also present along the general approach into Old Lane on the west side of the structure. The designer shall mark these on drawings.	DCC/Designer	Uncontrolled	Contractor shall develop a lift plan which recognises site constraints and takes steps to mitigate risks associated with working in constrained locations. The Contractor shall ensure that the presence of overhead utilities is accomodated for when planning mobililsation and setting out routes for structure segments and items of plant which may interact/clash with overhead utilities, mitigations could include 'goalpost' system to regulate this on site. The Contractor shall outline their mitigation with the Construction Phase Plan and RAMS.	Controlled	
Engineer, Civil	Crane accidents - Lifting	(1), (3 to 6)	C	Construction	Craneage activities hazards include (but are not limited to) dropped loads, instability, etc. Risk has been mitigated for options 4 $_{(2), (3b)}$, 5 $_{(2), (3b)}$ by reducing lifting tonnage by used of welded deck plates which will be installed after the main deck sections have been erected. For Options 3 and 6, designer to liaise with Contractor to understand maximum tonnage that can be accomodated in single lift and size precast elements appropriately such that lifts are optimised and achievable. For Option 1 (demolition) Contractor shall acknowledge demolition sequencing provided by designer and liasie with them to ensure that removaed sections can be accomodated safely and within limits of crane lifting capacities. Provide information to allow for contractors to develop safe method of works to minimise risks.	DCC/Designers	Uncontrolled	Contractor to determine safe method of works to minimise risks arising due to craneage activities. Ensure controls executed i.e. all lifting and slinging equipment is LOLER-certified, lifts have exclusion zone perimeters set up.	Controlled	
Engineer, Civil	Working at height	(1), (3 to 6)	C	Construction	Options 4,5 $_{(2)}$ and $_{(3b)}$ would be designed with integral parapets to mitigate falls from height but welded deck plates to minimise crane loads increases this risk. Designers to provide detailed levels and information to contractor and to discuss benefits of welded deck plates with the contractor at a later design stage. Designer shall mark up the requirements for temporary edge protection measures as a safety risk on design drawings, taking cognisance of their preferred sequence of construction or demolition. For Demolition-only Option 1 and construction Options 3, 6, hazard information shall also be marked up on drawings for Contractor to consider mitigations, which may include robot-only demolition (Option 1) and temporary edge protection for Options 3 and 6 - during construction.	DCC/Designers	Uncontrolled	Contractor to ensure all health and safety measures are in place when working at height.	Controlled	
Engineer, Civil	Working near existing structures	All	C	Construction	Existing structures include: existing bridge, nearby listed buildings, weir and private dwellings. The selection of Alignment Option 2 from the Knight's Architect Report for options 4 and 5 reduces the risk of clashing with existing foundations and also moves the bridge further away from existing buildings on the east bank. Options 3 and 6 will be within the existing alignment and will have a greater impact on existing structures. Designers to outline the existing structure location and dimensions throughout the later design stages to ensure the contractor is fully aware of the existing structure.	DCC/Designers	Uncontrolled	Contractor to ensure no works on the new structure causes damage to existing structures	Controlled	
Engineer, Civil	Hot works	4,$_{(2), (3b)}$ 5 $_{(2), (3b)}$	C	Construction	At the design stage, welded connections for the deck plates to the transverse members have been proposed for both Options. Additionally, Option 4($_2$) has proposed welds to facilitate the connections between the bridge sections at the splice locations. This requires the risks of having hot works on site need to be considered by the contractors. At a later design stage, a bolted splice connection for Option 4$_{(2)}$ may be able to be proposed to reduce these risks.	DCC/Designers	Uncontrolled	Alternative splice connection methodology to be considered at a later design stage. Use of hot works on site to be considered by main works contractor.	Controlled	
Engineer, Civil	Temporary construction methods	3,4 $_{(2), (3b)}$,5 $_{(2), (3b)}$, 6	C	Construction	Impact of temporary construction works on superstructure has not been considered at this stage, though temporary propping would be required for staged construction of Options 4 $_{(2), (3b)}$, 5 $_{(2), (3b}$. Assumptions have been made on the construction methodology that will need to be verified at a later design stage, For Options 3 and 6, temporary works may involve the construction of cofferdams within the watercourse to enable construction of intermediary supports and support foundations. Designer shall inform on drawings and design documentation. Option 5 reduces the requirements for temporary works compared with Options 3 and 6.	DCC/Designers	Uncontrolled	Options 4 $_{(2), (3b)}$, 5 $_{(2), (3b)}$ Single-span steel options - To be considered at a later stage by temporary works contractor and main works contractor, may consider works such as pontoons for assembly of the bridge deck. Cofferdams may also be required for abutments. Options 3 and 6 Contractor to consider the temporary works required for access and construction May consider cofferdams in watercourse for construction of intermediary supports, piles and pile-caps as well as abutments. The number of cofferdams will increase over Options 4 $_{(2), (3b)}$, 5 ($_{2), (3b)}$ due to the multi-span nature of the Options 3, 6 proposals.	Controlled	
Engineer, Civil	All options - Damage to existing pavements, kerbs, gullies and roadside apparatus.	All	C	Construction	Designer shall mark on drawings where geometric constraints pose a risk to damage to existing pavements, kerbs, gullies and roadside apparatus.	DCC/Designer	Uncontrolled	Contractor shall include in RAMS provision for protection measures to be made to prevent damage.	Controlled	
Engineer, Civil	Handling in-situ concrete - Risk of burns and manual handling injury (musco-skeletal)	3,6	C	Construction	Where in-situ structural stitch details are required in order to connect precast segments, designer shall optimise the design to minimise the geometry to only as required. Option 5 which has steel superstructure reduces the requirements for handling in-situ concrete compared with Options 3 and 6.	DCC/Designer	Uncontrolled	Contractor shall adopt best practices where in-situ concrete is required by the design, regarding material handling and storage, formwork and scaffolding, mixing and placement and curing and finishing.	Controlled	

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Engineer, Civil	Use of architectural perforations in the main longitudinal beams	$4_{(2)}$, $5_{(2)}$	P	Use / Operation	Perforations to be designed to a small enough size to not be climbed - at preliminary stages assumptions will be taken and this will be finalised in detailed design. Marked as uncontrolled until design has been developed further at next stage.	DCC	Uncontrolled			
Engineer, Civil	Service vehicle collision damage to structure	$5_{(2), (3b)}$	M	Use / Operation	$5_{(2), (3b)}$ - Main members will be protected by raised trief kerbs. Marked as uncontrolled until design has been developed further at next stage.	DCC/Designers	Uncontrolled			
Engineer, Civil	Service vehicle collision with members of the public	$5_{(2), (3b)}$	P	Use / Operation	The design allows for occasional use of the structure by service vehicles limited to the GVW of a 26T Fire Engine. No allowance has been made for combined pedestrian and service vehicle use. Management arrangements will be required to ensure that pedestrians and NMUs are not occupying the structure at the same time as service vehicles.	DCC/Designers	Controlled			
Engineer, Civil	Vehicular Emergency Access	1,2	M	Use / Operation	The medium term structure is not suitable for emergency access, and emergency access to the Eastern approach is constrained by a tight thoroughfare at Haslams Lane which may prevent larger emergency vehicles from access, such as fire engines. Designer shall ensure this information is supplied on design documentation.	DCC/Designer	Uncontrolled	Contractor shall plan emergency access strategies with emergency services, regarding this wider general site constraint, which is also located within a grade 2 listed area (and therefore difficult to modify for emergency vehicle access for larger emergency vehicles). Once agreed this plan shall be included in a proposed Operation & Maintenance manual for the mainteained medium-term structure, to be prepared by the contractor.	Controlled	
Engineer, Civil	Climbing and unauthorised access	3 to 6	P	Use / Operation	Unauthorised access to level top flanges/chord areas and outside faces of bottom flanges/chords to be addressed at detailed design stage. Marked as uncontrolled until design has been developed further at next stage.	DCC	Uncontrolled			
Engineer, Civil	Climbing and unauthorised access	2	P	Use / Operation	Unauthorised access to the substandard existing structure could lead to collapse of parts of the existing weak structure and endagerment to life through drowning. Designer to mark this as safety hazard on drawings. Marked as uncontrolled until design has been developed further at next stage.	DCC	Uncontrolled		Controlled	Maintainer must consider options to the existing structure to secure and prevent unauthorised access from climbing, This could be for instance the erection of safety fencing at the abutments and landscaping to prevent access from river banks, and infill panels on the medium term bridge to prevent external access.
Engineer, Civil	Highway bridge - approaches	6	P	Use / Operation	Given the structure type that will be required for a highway bridge of this span, the approach ramps may not be the 1 in 20 required, which will not conform to required standard and may cause some issues with access for members of the public. Full understanding of the likelihood of this risk will be achieved through later design stages.	DCC/Designers	Uncontrolled			
Engineer, Civil	Maintenance schedule - Deterioration of structure/instability.	2	M	Cleaning / Maintenance	Risk of required future maintenance schedule not being followed correctly due to future budgetary pressures etc, may result in enhanced deterioration of the medium term structure. Designer shall specify required inspection and maintenance scheduling within design.	DCC/Designers	Uncontrolled		Controlled	The owner/nominated maintainer must adhere to enhanced and accelerated inspection and maintenance schedules specified by the designer.
Engineer, Civil	Maintenance - Risk of future safety-critical reactive strengthening works.	2	M	Cleaning / Maintenance	The medium term structure does not meet the required 120 yr design life and will therefore require more frequent maintenance intervals and possible accelerated strengthening works in future years vs removal and construction of a new durable permanent structure. This information shall be clearly presented by the designer.	DCC/Designer	Uncontrolled	The owner shall incur future costs in order to replace the current structure with another medium-term structure. This information shall be included in a proposed Operation & Maintenance manual for the mainteained medium-term structure, to be prepared by the contractor.	Controlled	
Engineer, Civil	Maintenance of weathering steel	$4_{(2), (3b)}$, $5_{(2), (3b)}$	M	Cleaning / Maintenance	Options $4_{(3b)}$,$5_{(3b)}$ have part of the arch structure below the flood level. Designers communicated the risk of this to the Client at preliminary member sizing stage, and a brief desk study has been completed on the water levels. At this stage, it is agreed that a hybrid option that has part painted and part weathering steel where possible, is an option. The decision on the details of the materials and maintenance plan for the chosen structure shall be considered in later design stages.	DCC/Designers	Uncontrolled	Contractor to consider the maintenance requirements during procurement of materials	Uncontrolled	Maintainer to monitor the corrosion of weathering steel if required and apply protective coating as required throughout the structure life cycle.
Engineer, Civil	Maintenance of bearings	3, $4_{(2), (3b)}$ $5_{(2), (3b)}$, 6	M	Cleaning / Maintenance	Options $4_{(3b)}$,$5_{(3b)}$ reduces the requirements of bearings by casting the deck integral with the west abutment. Consideration to the maintenance of bearings is to be undertaken at a later stage in the design for all options	DCC/Designers	Uncontrolled			
Engineer, Civil	Access for inspection from below the structure to/adjacent to watercourse for ongoing maintenance	All	M	Cleaning / Maintenance	Designers to consider this at a later stage. This has not been considered at the preliminary member sizing stage for Options 4 and 5. Designers to provide information to allow for contractors to develop safe method of works to mitigate risks. Mitigations could be pontoons, lifejackets, possible staging temporary works staging platforms - Designer shall provide requirement for all work measures in their documentation and drawings if required. Adopt 'ERIC' principle in first instance to try and eliminate the risk.	DCC/Designers	Uncontrolled	Contractor is to consider maintenance access requirements throughout the procurement of externally designed elements, where applicable.Contractor to determine safe method of works to allow access to river bed and mitigate risks arising from working in the watercourse.	Uncontrolled	Maintainer to consider the access requirements throughout structure life cycle.
Engineer, Civil	Vandalism/theft	2	M	Cleaning / Maintenance	The temporary ramp to the structure on the East side is protected by Heras-style fencing. Risk of being stolen.	DCC/Designers	Uncontrolled		Controlled	The owner/nominated maintainer shall ensure steps are taken to secure all temporary edge protection structures against the risk of thesft or vandalism.

Appendix B

Appendix B Early Contractor Involvement Scope

Assumptions Additional to Those Stated in ECI Scope

1. The proposed intermediary crosshead lengths for Option 3 are not provided, an assumption was made as to this length in the calculations.
2. Surfacing for Option 3 is assumed to be 280 mm thick at a central crown through the deck cross-section and falling at 2.5% in either direction towards the kerbs.
3. For Options 3 and 6, vehicle parapets are assumed to be VGSN 800 parapets formed from galvanised steel.
4. The ECI scope provides 10m embedment depth for the intermediary support piles only, but not those of the abutment. An assumption has been made that the abutment piles are also 10m embedment depth.
5. The abutments are assumed to be carried by 3 rows of piles.

Introduction

Derby City Council has commissioned Arcadis to prepare an Options Report to recommend a preferred long-term solution for Darley Abbey Mills Bridge which has reached the end of its serviceable life. The existing bridge has been closed to all traffic and a medium term structure has been installed on the same alignment while engineering solutions are investigated. The 6 available options for this asset are described in Table 1 and the characteristics and constraints at the site present significant engineering challenges which influence the construction costs and associated risks. Derby City Council are therefore seeking early Contractor input to assist Arcadis by providing buildability advice and estimated construction and maintenance costings in order to recommend a preferred solution for the bridge. This will allow Derby City Council to develop the business case to secure the necessary funding for the project.

Table 1 Options Description

Option	Description
1	Full demolition of the existing structure including full removal of the existing piers and local reinstatement at the bridge approaches
2*	Maintain the existing bridge arrangement and medium term structure
3	Remove medium term structure and re-construct the existing bridge deck and substructure on the same horizontal alignment to match the current carriageway and footway width
4	Full demolition of the existing structure including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) pedestrian and cyclist footbridge.
5	Full demolition of the existing structure including removal of the existing piers and reconstruction with a single 48m span steel 4m wide (trafficked width) accommodating pedestrians, cyclists and emergency vehicles.
6	Full demolition of the existing structure including removal of the existing piers and reconstruction with a multi-span concrete 8m wide (trafficked width) highway bridge comprising a 4m wide combined footway/ cycleway.

* Note Option 2 is excluded from the Contractor’s scope of work

The following general assumptions can be made in relation to all options:

1. All services will be diverted in advance of construction and will be the responsibility of the client.
2. Any costs associated with securing rights and gaining access to carry out works on private land will be the responsibility of the client.
3. Costs for securing consents to undertake works in the watercourse will be the responsibility of the contractor. All other consents will be the responsibly of the client.
4. Cost for arranging any outstanding surveys and consultancy fees for developing and finalising the detailed design for the preferred option will be the responsibility of the client.
5. The location is a UNESCO World Heritage site and there are several listed structures in close proximity to the existing bridge including the downstream weir. Vibrations caused by construction activities must therefore be kept to a minimum.

The provision of the Contractors' input will be based on the following option specific assumptions:

Table 2 Option Specific Assumptions

Option	Assumption
1	1. An allowance is required for removing the medium term structure for re-use by others. 2. The existing riverbed is shown in the 2013 Dive Inspection Report. The existing cast iron and masonry piers and all associated debris shall be removed from the watercourse to provide a more uniform profile to the bed level between riverbanks.
3	1. An allowance is required for removing the medium term structure for re-use by others. 2. The existing piers are not suitable for re-use and an allowance will need to be made for a new substructure. Costings for the piers can be derived pro-rata from Option 6. Allow for debris clearance to existing bed level and provision of a 300mm thick 8m wide concrete apron to provide scour protection to suit the profile of the existing river channel. 3. The existing abutments are not suitable for re-use and an allowance will be required for new abutments. An indicative abutment cross section showing the proposed abutments at each riverbank is provided in Appendix A, Figure 2. 4. Allow for reconstruction of the existing deck to match the existing thickness, span and width dimensions. 5. Assume each span is precast in single units and delivered to site for installation. The approximate tonnage for each span and installation requirements are to be determined by the contractor. See Appendix A, Figure 1 for the indicative precast deck panel dimensions. 6. Assume that each span requires a full width insitu reinforced concrete stitch at the piers of 0.5x0.5m prior to spray waterproofing. 7. Proprietary metal pedestrian and vehicle parapets to be provided at each edge. 8. Approx 15m long 1 in 20 gradient approach ramps with permanent bollards and associated tie-ins to the adjacent areas are to be provided at each end of the bridge.
4	1. An allowance is required for removing the medium term structure for re-use by others. 2. Pedestrian access to the existing medium term structure during construction of the abutments is to be assessed by the contractor. 3. An indicative abutment cross section showing the proposed abutments at each riverbank is provided in Appendix A, Figure 2. These will be constructed adjacent to the existing abutments and will be located to the southern side at the west abutment and to the northern side at the east abutment. 4. 750mm diameter bored pile foundations are assumed with toe level at 35m AOD. 5. The existing riverbed is shown in 2013 Dive Inspection Report. The existing cast iron and masonry piers and all associated debris shall be removed from the watercourse to provide a more uniform profile to the bed level between riverbanks. 6. The new deck will be a prefabricated steel U frame deck (Sub-option 2) or Asymmetric Steel Arch (Sub-option 3B). See Table 3 information for

	details. The contractor is to provide costs for fabrication, supply and installation costs for both sub-options. 7. Approx 15m long 1 in 20 gradient approach ramps with permanent bollards and associated tie-ins to the adjacent areas are to be provided at each end of the bridge.
5	Due to similarities in loading Options 5 is assumed to be the same as Option 4. In addition there will be remotely operated retractable metal bollards located on the approach ramps to prevent unauthorised vehicle access.
6	1. An allowance is required for removing the medium term structure for re-use by others. 2. No pedestrian access is required to the existing medium term structure during the works due to the overlapping footprint. 3. The indicative abutment cross section is provided in Appendix A, Figure 2. Quantities are to be pro-rated appropriate to the deck width. 4. The existing riverbed is shown in 2013 Dive Inspection Report. The existing cast iron and masonry piers and all associated debris shall be removed from the watercourse to provide a uniform bed level full width. Allow for provision of a 300mm thick 8m wide concrete apron to provide scour protection to suit the profile of the existing river channel. 5. Abutment 750mm diameter bored pile foundations are assumed with toe level at 35m AOD. 6. Piers are each assumed to be supported on 1m x 1m x 10.5m long pilecaps on a single row of 5No. 750mm dia. 10m long bored piles. 7. 30m long 1 in 20 gradient approach ramps and associated tie-ins to the adjacent areas are to be provided at each end of the bridge. Traffic lights and pedestrian crossings are required at each end of the bridge to manage the flow of vehicles and NMUs.

The available information to assist with the pricing of each option is listed below in Table 3.

Table 3 Available Information

Document No.	Document Title/ Description
	Window Sample Logs
	Existing Bridge GA
	Inspection Report
30194918-ARC-SBR-ZZ-DR-CB-00001	Option 5 (Sub-option 2) General Arrangement Sheet 1
30194918-ARC-SBR-ZZ-DR-CB-00002	Option 5 (Sub-option 2) General Arrangement Sheet 2
30194918-ARC-SBR-ZZ-DR-CB-00003	Option 5 (Sub-option 3b) General Arrangement Sheet 1
30194918-ARC-SBR-ZZ-DR-CB-00004	Option 5 (Sub-option 3b) General Arrangement Sheet 2
30194918-ARC-SBR-ZZ-DR-CB-00005	Option 6 General Arrangement

The pricing for each option is to be calculated with an appropriate level of optimism bias/contingency appropriate to the current level of design maturity. The suggested itemisation of costings for each option is as follows:

Table 4 Capital Cost Itemisation

Item	Option (£)
Mobilisation and demobilisation	
Enabling works	
Removal of medium term footbridge	
Removal/Demolition of existing bridge	
Foundations and Substructure	
Bridge Fabrication and Installation	
Finishes	
Landscaping	
Sub Total (Capital Cost)	
Preliminaries	
Design, Checking and Planning	N/A - by Arcadis and DCC
Overheads and Profit external, 8%	
Risk and Contingency, ?%	
Inflation, assuming ?% for the next 2 years	
Total	

To complement these costings the Contractor is required to provide a buildability report outlining the construction requirements for each option and highlighting the key engineering challenges, risks and associated temporary works requirements. The contractor is also required to provide a high-level construction programme for each option identifying the estimated timescale for each activity listed in Table 4.

In addition to the construction costs there is also a requirement to consider the whole life cost for each option taking maintenance into account. The Contractor is required to provide costings for the following maintenance activities to allow Arcadis to calculate whole life costs:

Table 5 Maintenance Costs

Option	Assumption
3	1. Replacement of abutment bearings and expansion joints. Assume 4No. elastomeric bearings per abutment and Britflex NJ expansion joints. 2. Re-waterproofing and resurfacing of the bridge deck.
4 & 5	1. Replacement of abutment bearings and expansion joints. Assume 2No. steel pot bearings per abutment and Britflex NJ expansion joints. 2. Re-waterproofing and resurfacing of the deck.
6	1. Replacement of abutment bearings and expansion joints. Assume 8No. elastomeric bearings per abutment and Britflex NJ expansion joints. 2. Re-waterproofing and resurfacing of the bridge deck.

A summary of the Contractor's requirements is summarised below.

1. Attend a site visit with Derby City Council and Arcadis, review the information provided with this scope of work and advise programme for the provision of the below inputs..
2. Provide costings, buildability report and construction programme for each option as per Table 4.
3. Provide maintenance costs as per Table 5.

Appendix A

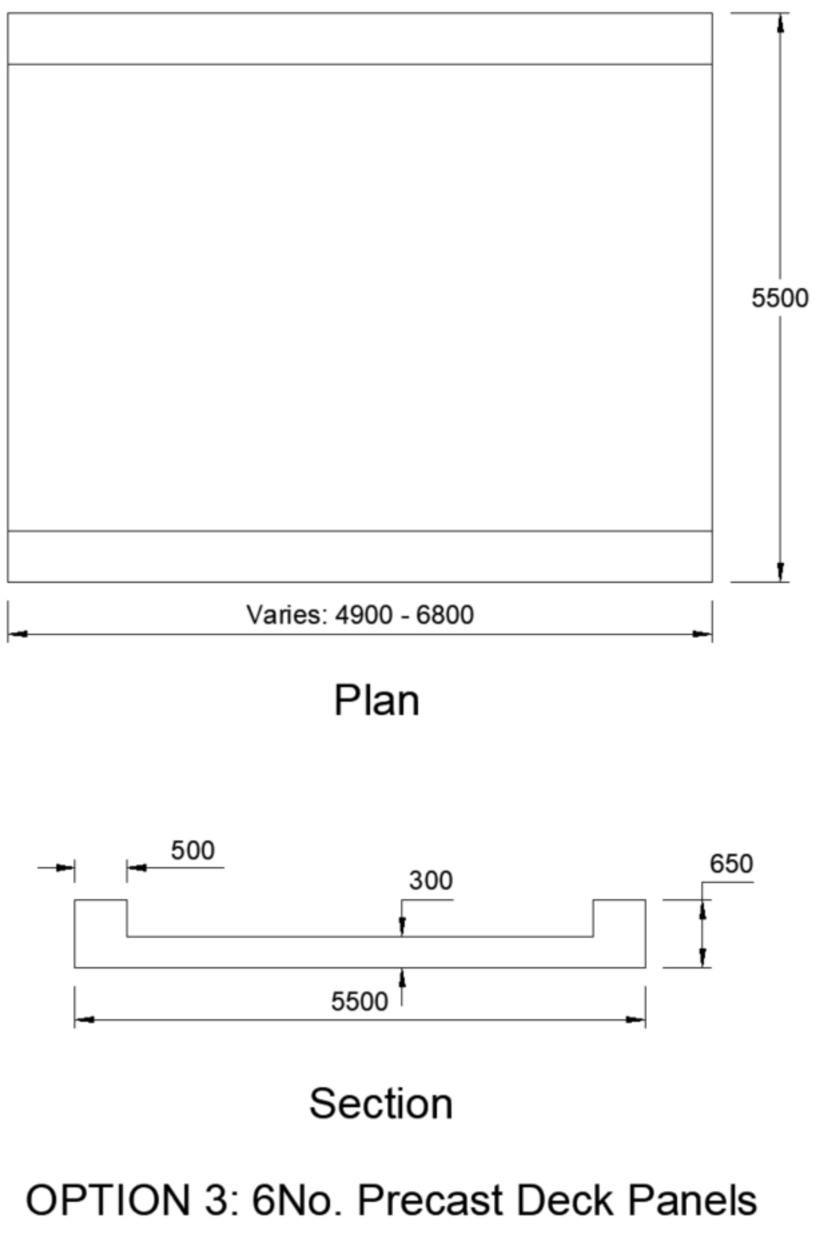

Figure 1 - Option 3 Precast deck panels

Appendix B

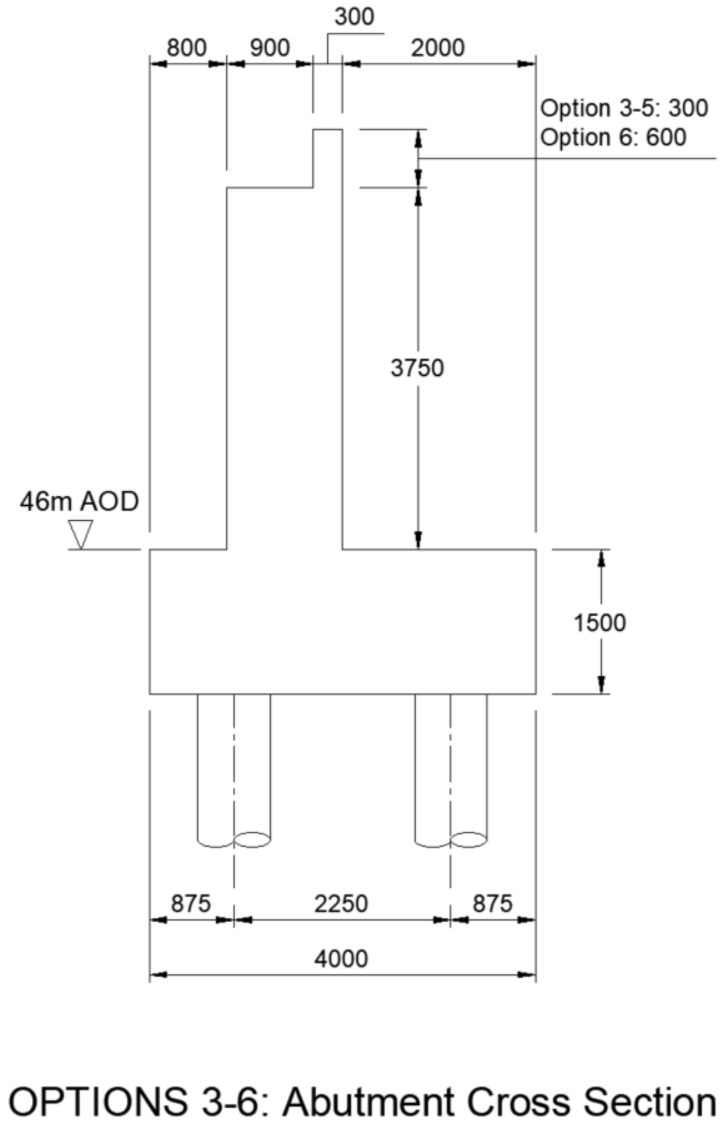

Figure 2 - Options 3-6 Abutment