

Bedminster Bridges OBC

Quantitative Risk Assessment Report

Bristol City Council

December 2024

Quality information

<u>Prepared by</u>	<u>Checked by</u>	<u>Verified by</u>	<u>Approved by</u>
Helen Holm Associate Director	Stephen Payne Associate Director		

Revision History

<u>Revision</u>	<u>Revision date</u>	<u>Details</u>	<u>Authorized</u>	<u>Name</u>	<u>Position</u>

Distribution List

<u># Hard Copies</u>	<u>PDF Required</u>	<u>Association / Company Name</u>

Prepared for:

Bristol City Council

Prepared by:

AECOM Limited
3rd Floor, Portwall Place
Portwall Lane
Bristol BS1 6NA
United Kingdom

T: +44 117 901 7000
aecom.com

© 2024 AECOM Limited. All Rights Reserved.

This document has been prepared by AECOM Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM.

Table of Contents

1.	Introduction.....	5
2.	Risk Model Inputs	5
	Baseline Capital Expenditure	5
	Risk Identification and Categorisation	5
	Risk Quantification	5
3.	Risk Model Outputs	6
	Risk Value	6
	Highest Ranked Risks.....	6
	Appendix A Document copies.....	7
A.1	@Risk Output	7
A.2	Risk Register	9
	Error! Bookmark not defined.

1. Introduction

A Quantitative Risk Assessment (QRA) was undertaken on the Bedminster Bridges project. This technical report briefly outlines the risk identification (risk register) and the QRA processes and presents the QRA outputs as run on the 47 active risks within the register, and a listing of the top ten risks at the time of this revision.

The main purpose of the QRA is to support the scheme costing by predicting the level of risk contribution, having a defined level of confidence, to cover the construction of the scheme. QRA allows for uncertainty in unplanned additional cost items that cannot be included in the project costs.

The project is currently at OBC Design stage. With further design work and ongoing risk management, the level of confidence in further reviews of the QRA will be enhanced through greater certainty around specific risks and costs.

The QRA process involves four steps. Step 1 is identification of all risks affecting the project through risk workshops and risk reviews resulting in a risk register (the risk register will be continually reviewed and updated). Step 2 is analysis of the various risks by defining their distributions in terms of probabilities, impacts and knock-on effects. This information is also gathered through abovementioned workshops and other interactions. Step 3 is undertaking the risk modelling using Monte Carlo simulation (in this project @Risk® software was used). Step 4 is analysing the results against required contingency needs for the project.

The risk model has been constructed by AECOM using Microsoft Excel and @Risk® software packages. The model used the Monte-Carlo simulation theory by replicating 10,000 iterations of likely project risk scenarios. Confidence levels relating to the cost of the scheme are obtained from the distribution of the averaged results produced by the simulations.

2. Risk Model Inputs

Baseline Capital Expenditure

The current estimated capital cost of the scheme is approximately £12.3M at Quarter 2 2024 prices and this has been considered in determining the extent of risks used in the QRA analysis.

Risk Identification and Categorisation

A risk register is developed through risk workshops. This revision of the Risk Register and this iteration of the QRA is referred to as "Bedminster Bridges Risk Register AECOM". The current version of the Risk Register is included in Appendix 1.

The risks that are input into the QRA are taken directly from the risk register for the scheme. Each risk is assessed for its Financial Risk and Delay risk.

Risk Quantification

Individual risks were defined in terms of their distributions, likelihood/probabilities, impacts and knock-on effects, etc., through a workshop which took place on the 8th of November 2024 and was attended by Bristol City Council Officers as well as AECOM Project Team members.

For each risk, the key inputs recorded to use in the QRA model are Cost Impact Estimate (Minimum, Maximum, and Likely), Delay Impact Estimate (Minimum, Maximum, and Likely), and Likelihood (in broad categories of Almost Certain, Likely, Possible, Unlikely, or Rare).

These values are then used in the model to determine a Mean Outcome and a Risk Exposure for each risk and for each iteration. The Monte Carlo simulation ran 10,000 iterations to achieve the results.

3. Risk Model Outputs

Risk Value

The table below shows the Grand Total Risk value (Financial + Delay) for the project; the @Risk output is shown in Appendix 1. Both 50th Percentile risk value and 80th Percentile risk value (referred to as P(50) and P(80) respectively) are shown in the table below.

	P(50) (000's)	P(80) (000's)
Grand Total Risk (Financial + Delay)	£ 2,573	£3,446

Highest Ranked Risks

The top 9 risks (Grand Total Risk: Financial + Delay) identified by the sensitivity testing are listed below.

Rank	Risk Ref	Description
1	BDB022	The costs for the maintenance of bridge structures (re-waterproofing) are pushed onto the CRSTS project, rather than the Challenge fund budget.
2	BDB028	The roundabout is a major junction for the region, where the A38 and A370 intersect. It is very busy with people across all modes of transport. Construction will be very challenging, as any constraints on the network are likely to cause congestion and re-routing onto alternative routes, causing complaints.
3	BDB017	High degree of complexity with number of strategic utilities running through the area, particularly Bedminster Parade, Bedminster old bridge, and Redcliffe Hill. This increases time and cost.
4	BDB020	The York Road stabilisation works (or other stabilisation work) may place considerable constraints during the construction period, removing one of the nearby diversion roads. The York Rd closure would have a considerable diversion route if it is still on site after the proposals for Bedminster bridges are completed. This will have considerable PR impacts.
5	CCO001	Cost of materials increase due to inflation, meaning construction costs are higher than anticipated during OBC & FBC submissions.
6	BDB023	After commencement of works (once digging commences), it is discovered that the condition of assets in the area, many of which are very historic, are poor and this causes additional delays and cost to rectify.
7	BDB018	The sewer authority may object to the proposals and require surface water to discharge into the New Cut. This may be requested even where no additional non-permeable areas are proposed.
8	BDB002	Funding in the CRSTS budget is not sufficient and does not cover all the work required.

Appendix A Document copies

A.1 @Risk Output

The key outputs of the QRA are shown next highlighting the P(20), P(50) and P(80) risk values.

Results

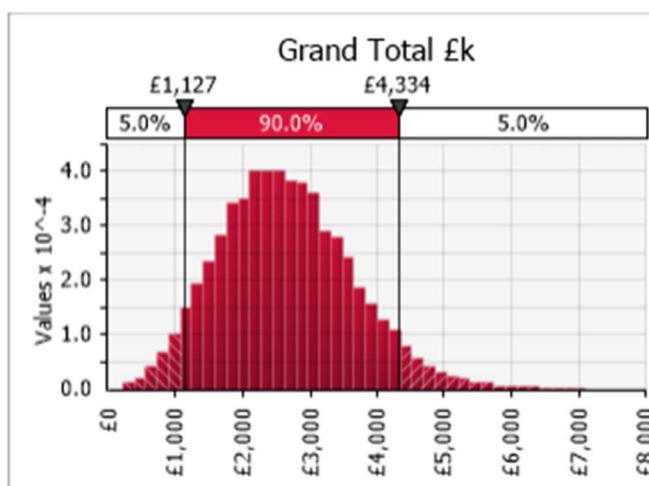


Grand Total £k

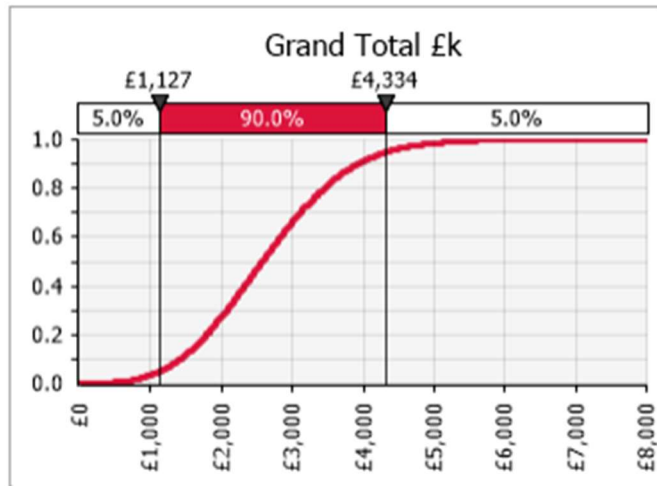
Report: **Compact Output Report**

Performed By: **helen.holm**

Date: **01 December 2024**



Summary Statistics	
Statistic	Value
Minimum	£200.37
Maximum	£7,113.05
Mean	£2,635.70
Std. Deviation	£980.70
Variance	961,773
Skewness	0.3798
Kurtosis	3.1013
Median	£2,572.73
Mode	£2,895.50
Left X	£1,127.08
Left P	5%
Right X	£4,334.40
Right P	95%



<i>Percentiles</i>	
Percentile	Value
1%	£670.31
2.5%	£898.32
5%	£1,127.08
10%	£1,407.62
20%	£1,787.61
25%	£1,931.16
50%	£2,572.73
75%	£3,271.24
80%	£3,446.04
90%	£3,932.57
95%	£4,334.40
97.5%	£4,714.40
99%	£5,197.87

A.2 Risk Register

Risk ID	Description	Mitigation (may be more than one)	Probability	Impact	Priority	Cost Impact estimate				Time Impact estimate		
						Min (€K)	Max (€K)	Likely (€K)	Likelihood	Min (months)	Max (months)	Likely (months)
<p>Please note this a Work package specific risk register and so only contains work package specific risks. There is also a City Centre Project wide register which covers higher level risks.</p>												
BDB001	Bedminster Bridges Work Package cannot secure assigned funding through the WECA Grant Assurance & Business Case process.	1. Risk due to suitability of TAG guidance is not within project's control. 2. Risk due to project's business case not showing enough benefits to meet WECA GA requirements - mitigation is splitting the submission of the Strategic & Economic Cases out early to identify and address issues asap. 3. A BCR below 2 does not necessarily preclude the project.	1	6	6	€10	€25	€17	13%	0.5	2	1
BDB002	Funding in the CRSTS budget is not sufficient, and does not cover all the work required.	1. Close liaison with WECA and value engineering some aspects across the programme whilst still retaining transport benefits. 2. Move into CRSTS 2.	2	2	4	€50	€1,000	€75	25%	2	18	3
BDB003	Taxi forum and taxi drivers may object to the plans, forcing taxis into the bus infrastructure causing delays	1. Early liaison with taxi forum regarding the project - warn that taxis may not be permitted. Communicate general traffic movements. 2. Modelling to ascertain if taxis can be accommodated without causing unacceptable delay to buses (avoid the risk).	2	3	6	€0	€0	€0	25%	0	0	0
BDB004	The general public and the press object to the banned turns for general traffic. The project has to try and find ways to keep these turns retained, compromising efficiency for buses, cycles, and pedestrians.	1. Reduce by explaining that easy alternative routes exist, and for many this will not add to journey time. Everyone will still be able to drive to any location they do now. Some local residents will have specific longer journeys in some cases. Champion benefits to the project - speed and convenience to sustainable modes and environmental improvements. 2. Accept the risk by relying on political willpower to support the project, and champion the numerous benefits for sustainable modes. 3. Fallback by trying to allow some banned turns to remain, but this is likely to heavily compromise benefits to sustainable modes.	2	5	10	€20	€50	€35	25%	1	4	3
BDB005	Disability Groups, carers and the general public may object to the plans due to banned turns and concerns over local access. Pressure to retain some of the banned movements compromising efficiency for buses, cycles, and pedestrians.	1. Reduce by explaining that easy alternative routes exist, and for many this will not add to journey time. Everyone will still be able to drive to any location they do now. Some local residents will have specific longer journeys in some cases. 2. Reduce by explaining that many people with limited mobility use buses, and some may cycle as a mobility aid. The project therefore has benefits which can be balanced against possible longer routes for private vehicles. 3. Consider adding some banned turns into the design which do not materially impact buses, peds, cycles or core benefits.	3	4	12	€20	€50	€35	50%	1	4	3
BDB006	Disability Groups and carers may object to the plans due to removal of parking spaces. Pressure to create disabled spaces.	Provide the same number of disabled spaces as those that will be displaced.	1	1	1	€2	€2	€2	13%	0.25	0.25	0.25
BDB007	The Bristol Walking and Alliance may object to the proposals, stating they need more space or provision for people walking or wheeling. Some limited areas would fall below recommended comfort levels.	Some areas are likely to be at the minimum specified ATE guidance, or even below this. If these groups raise this, explain to them that the desired provision could not be provided everywhere due to space constraints, which would require a large budget to resolve e.g. building into the New Cut.	2	2	4	€20	€50	€35	25%	2	4	3
BDB008	The cycle route at York Rd is unlikely to meet minimum LTN 1/20 design standards, and there is no cycle route on Bedminster Parade. ATE and/or the Cycling Campaign group object to this. There is not space for better provision, except to recover space from the New Cut.	1. If these groups raise this, explain to them that the desired provision could not be provided everywhere due to space constraints, which would require a large budget to resolve e.g. building into the New Cut or one-way for traffic on strategic routes. A cycle route on Whitehouse Lane and Whitehouse Street exists to serve parallel routes. 2. Introduce a light controlled crossing at the York Rd / Whitehouse St junction, which would remove shared use provision.	2	4	8	€20	€50	€35	25%	2	4	3
BDB009	Respondents object to the cycle route on Coronation Road being only in one direction, and respondents state this should be in two directions.	Remove the median island between Bedminster Bridges and St John's Road to provide more cycle provision. Could be delivered as part of SBLN project (transfer).	2	3	6	€0	€0	€0	0%	0	0	0
BDB010	Local shoppers and local shops object to the plans for remove pay and display spaces.	There are good alternative places to park nearby, which are under-utilised and free (accept). Explain this during the consultation (reduce)	3	3	9	€0	€0	€0	50%	0	0	0
BDB011	Local residents object to the plans to remove RPS bays, asking for these to be retained when there is little space to provide this.	Convert combined P+D and RPS bays to RPS only, so permit holders are not competing with P+D users. Increase parking elsewhere where possible.	3	3	9	€2	€2	€2	50%	0.25	0.25	0.25
BDB012	The tree forum and general public object to the plans due to loss of ten trees. Pressure to retain some of the trees, severely compromising the design and benefits.	1. It is impossible to deliver the scheme without the loss of 6 trees which obstruct visibility and the road layout. 4 trees need to be removed for structural / maintenance reasons. Accept this risk. 2. Reduce the risk by greatly increasing the count of trees, which over time would greatly increase the tree cover. 40 new trees are proposed. 3. Increase the number of trees above 40.	3	3	9	€30	€350	€100	50%	2	5	2
BDB013	Local bus operators do not support the plans, and prefer the existing layout.	Liaise with the bus operator. There are good benefits to the majority of services, and enormous benefits for the M2. The 24 service will see no benefit, but this would not be significantly different to the existing situation.	1	3	3	€2	€6	€2	13%	1	3	1
BDB014	Local business and shops may object to the changes in loading proposals, requiring more loading to be installed, compromising the scheme design and the flow of buses.	Provide alternative loading locations, which are conveniently located. Establish to what extent people can load at the rear of their properties.	2	4	8	€2	€2	€2	25%	0.25	0.25	0.25
BDB015	Business West, the Temple and Redcliffe BID and Bedminster Town Team do not support the plans, or object.	Meet with them to discuss the designs and outline benefits. Provide data showing economic benefits of active travel.	1	3	3	€2	€6	€2	13%	1	3	1
BDB016	The Redcliffe Forum and Redcliffe Residents' Association object to the plans for Redcliffe Hill. They Request further greening and reduction in the number of traffic lanes.	Meet with them and explain the benefits of the project e.g. to sustainable travel, and to the environment at Redcliffe Hill (subway infilling)	3	5	15	€20	€100	€35	50%	2	6	3
BDB017	High degree of complexity with number of strategic utilities running through the area, particularly Bedminster Parade, Bedminster old bridge, and Redcliffe Hill. This increases time and cost.	Instruct 3D GPR utility survey, and spend ample time scrutinising this. Try to avoid interacting with utilities where necessary e.g. keep existing kerb lines or only build out the kerb into the road. Avoid road widening.	3	6	18	€250	€1,500	€500	50%	2	9	3
BDB018	The sewer authority may object to the proposals, and require surface water to discharge into the New Cut. This may be requested even where no additional non-permeable areas are proposed.	Try to engage with the sewer authority ASAP, although be aware that lead times can be extensive. Provide an incentive to engage by offering to discharge additional surface water runoff into the New Cut. Undertake surface water drainage survey.	2	6	12	€150	€750	€350	25%	2	9	3
BDB019	Structural engineers may deem the new design may change the structural loading characteristics on the existing structures - the New Cut embankments and the two bridges. This may exceed tolerances for these structures.	The new design endeavours to maintain the existing structural loading characteristics.	1	4	4	€0	€250	€0	13%	0	6	0
BDB020	The York Road stabilisation works (or other stabilisation work) may place considerable constraints during the construction period, removing one of the nearby diversion roads. The York Rd closure would have a considerable diversion route if it is still on site after the proposals for Bedminster bridges are completed. This will have considerable PR impacts.	Continuous liaison between the two projects to manage phasing and mitigate where possible by keeping general traffic lanes open. Night time working	3	5	15	€250	€1,500	€350	50%	2	24	4
BDB021	The bridge deck of the eastern bridge (new bridge) must be refurbished and re-waterproofed. This is either to happen as part of this project, or just before under a different contractor. This may overrun, and cause delays to the layout changes in this project.	Complete the refurbishment work as part of the same civils contract as the layout changes. Overruns on the former would avoid compensation events on the latter, and there would be co-benefits e.g. not re-installing the old bridge deck design.	2	7	14	€100	€200	€150	25%	2	4	3
BDB022	The costs for the maintenance of bridge structures (re-waterproofing) are pushed onto the CRSTS project, rather than the Challenge fund budget.	This is a considerable additional cost from a budget for sustainable transport improvements, and will impact the BCR. Liaise and negotiate with colleagues to try to retain the maintenance works to be paid for by the Challenge fund or other maintenance budgets.	1	2	2	€0	€1,750	€1,500	13%	4	8	6
BDB023	After commencement of works (once digging commences), it is discovered that the condition of assets in the area, many of which are very historic, are poor and this causes additional delays and cost to rectify.	Both bridges are undergoing a structural survey, and the GPR survey will also provide intelligence about the ground composition.	2	4	8	€0	€750	€500	25%	4	8	6
BDB024	BCC drainage network under maintained in recent history, hence risk of higher than normal drainage survey & construction costs.	A drainage survey will be undertaken so this can be assessed, and remedial works built into the main project construction works and budget.	1	3	3	€40	€350	€100	13%	0	4	2

BDB025	St Mary's conduit runs through the project area. This is an uncharted spring water pipe with historic significance. It's presence may present additional challenges.	Provide historic records to the contractor, and treat as any other uncharted service and manage accordingly. Any strikes must be repaired as if it were a functioning asset.	2	2	4	£5	£30	£15	25%	0.5	1	1
BDB026	St Mary Redcliffe Secondary school and Temple School, and St Mary Redcliffe 6th sixth form college may require specific access requirements for coaches, and the banned turns require longer routing.	Engage with the school to understand routes, and explain alternative routing if necessary. The project has been designed such that coaches should still be able to pull into the northern side of Clarence Rd as they do now from most directions, or by turning around at Redcliffe roundabout.	2	1	2	£20	£50	£35	25%	1	4	3
BDB027	A centre for the Guide Dogs for the Blind association is located less than a 1 minute walk away from the project area, and this may have specific demands on the scheme design.	Engage with them, explain the design, and take on board any concerns for the design. Measures for blind and partially sighted people would be installed across all constructions projects in any case.	2	4	8	£10	£25	£17	25%	0.5	2	1
BDB028	The roundabout is a major junction for the region, where the A38 and A370 intersect. It is very busy with people across all modes of transport. Construction will be very challenging, as any constraints on the network are likely to cause congestion and re-routing onto alternative routes, causing complaints.	1. The construction tender will be essential to ensuring that relevant minimum standards throughout construction are laid out for the travelling public across all modes. E.g. space for cycling and pedestrians, and number of traffic lanes going to/from various directions. 2. Clearly communicate delays and restrictions to the public.	3	5	15	£250	£1,500	£350	50%	0	0	0
BDB029	Moving or altering bus shelters may require planning permission - not currently reflected in programme and duration unknown	Extent of planning work to be identified and added to programme. The planning permissions can be run concurrently with other processes e.g. TROs / construction tender. This process is likely to be run by the bus shelter installing company (to confirm).	4	1	4	£0	£50	£30	95%	0	0	0
BDB030	Some of the trees outlined as replacement trees (40) cannot be installed due to ground conditions or utilities. This is always a risk until spades are put in the ground to check conditions.	Explain this is a risk to consultees, and identify alternative places to plant trees in the vicinity to keep the number of replacement trees up to 40.	2	2	4	£30	£350	£100	25%	0	0	0
BDB031	The left turn from Bedminster Parade towards Cornation Road (banned) is frequently violated, as the geometry does not completely exclude this movement.	1. This is not a particular risk as another set of traffic signals exists within plain view to prevent conflict with the pedestrian crossing (accept). 2. Reduce the risk by installing an enforcement camera to prevent the movement, with enforcement camera signs. 3. Simply enable the turn, so this risk is fully mitigated.	2	2	4	£0	£30	£30	25%	0	0	0
BDB032	Additional safety and security measures will be required when working near and above a water course. There is increased risk of injury.	Ensure the contractor is well aware of the water courses and the structures above them. Provide all knowledge held in this regard. The risk is transferred to the contractor as per the CDM regulations so long as the client has provided all information they hold about the risk.	1	4	4	£0	£0	£0	13%	0	0	0
CC0001	Cost of materials increase due to inflation, meaning construction costs are higher than anticipated during OBC & FBC submissions.	Use of BCC framework with fixed price contract (risk is transferred to the supplier). However suppliers can choose not to bid.	3	5	15	£31	£1,000	£500	50%	0	0	0
CC0002	BCC resource for whole project	Project to supply information to the Programme Manager & TDT resource planning work - additional resource has been brought in (PMO and Procurement), but further recruitment is needed and underway.	4	3	12	£38	£113	£75	95%	0	0	0
CC0003	Insufficient funding for whole project (currently £43m allocated in CRSTS)	1. More accurate Cost Forecasts have been compiled, and close scope management is underway to ensure that current cost estimates are within the £43m. 2. Change request to be submitted to WECA to increase the overall budget.	2	5	10	£0	£0	£0	25%	3	12	6
CC0004	Insufficient capacity in the supply chain for the whole project	Mitigation within the project's control - project has been split up in to packages which should spread out the demand for resources. Hold regular discussion with Lot 5 and Lot 6 civils contractors - including those not at the cheapest end of the spectrum.	2	5	10	£63	£500	£250	25%	3	9	6
CC0005	BCC resource for current project stage	Risk realised - Engineering Design were not able to resource initially. Project has hit delay as a result. But ED are now fully on-board as of July 2024. Risk Remains for Project Management - TDT team currently recruiting	2	3	6	£0	£0	£0	0%	0	0	0
CC0006	Project programme longer than funding window (Funding is CRSTS 2022 – 2027)	1. To minimise likelihood, project has been split in 5; tasks are being undertaken in parallel and at risk and strong Schedule adherence techniques to be utilised. 2. To minimise the impact, programme to be kept up to date and WECA informed of overall end dates regularly.	2	3	6	£63	£500	£250	25%	0	0	0
CC0007	Project cannot secure assigned funding through the WECA Grant Assurance & Business Case process	Now that project has been split in to 5 - see work package specific risk register for specific risks & mitigations.	2	3	6	£0	£0	£0	0%	0	0	0
CC0008	Project is made up of lots of infrastructure changes, a new service and bus re routing. Not all are reliant upon each other and there is a risk that some harder / more controversial parts could slow down other parts.	Project has been split in 5 work packages, with their own business case, work package lead and are being progressed individually.	1	3	3	£0	£0	£0	13%	0	0	0
CC0009	Tender outcome is challenged - delay awarding contract to start construction	Work closely with BCC Transport dedicated Procurement resource to ensure procurement exercise is carried out correctly	1	3	3	£3	£8	£5	13%	1	3	2
CC0010	Insufficient funding for current project stage	PM to maintain overarching Spend Tracker and Cost Forecast for current stage.	1	3	3	£0	£0	£0	13%	1	3	2
CC0011	Political approval process might take longer than allowed for in the programme.	Initial experience of new administration implies this risk is low. Nevertheless. CLRs to be kept up to date with project progress and potential issues flagged early.	1	3	3	£0	£0	£0	13%	2	6	4
CC0012	Insufficient capacity in the supply chain for the current project stage	Risk low as resource already secured. No additional mitigation	1	3	3	£0	£0	£0	0%	0	0	0
CC0013	If other projects are considered to have a higher political priority, then all sorts of internal and external resources could be taken away from this project.	Escalate to BCC and WECA politicians	1	5	5	£63	£500	£250	13%	3	12	6
CC0014	If there is significant adverse weather, then delays could be caused to the construction works	Programme as much work as possible into seasons where weather is likely to be more clement, provide plenty of float for winter construction.	1	3	3	£0	£0	£0	13%	1	3	2
CC0015	If local media adopt a negative stance to the scheme, then media enquiries and public complaints could occupy officer time	Clear communications strategy, early media engagement, try to identify supportive members and businesses.	1	3	3	£1	£3	£1	13%	0	0	0

aecom.com