Cadent

Your Gas Network

Appendix 09.18

Mersey Tunnel Access Refurbishment

RIIO-2 Spend: XXXX

Investment Decision Pack Overview

This Major Project Engineering Justification Framework outlines the scope, costs and benefits for our proposals. We have prepared a Major Project Justification Paper (MPJP) and a Cost-Benefit Analysis (CBA) for these assets [CBA 9.18_Mersey_CBA].

Overview

We have a 24" steel intermediate-pressure (IP) pipeline, within the Mersey crossing road tunnel and an associated access shaft (Bibby's shaft). This pipeline provides critical network resilience to the Birkenhead areas: without the Mersey Tunnel, the Woodchurch PRS becomes a single feed and in the event of loss of this site, XXXX customers would be without gas. In retaining these assets to provide network resilience, we have a general obligation to maintain the safety and reliability of the network and must comply with specific obligations under the Pipeline Safety Regulations (PSR) and Health and Safety and Work Act 1974. In short, success for these assets is measured by ensuring that there are no compliance failures and the integrity of these assets are maintained cost-effectively.

We have identified a number of asset-health issues associated with the Mersey tunnel pipeline assets. The primary issue is associated with Bibby's shaft, which provides access into the tunnel for ongoing pipeline inspection and maintenance. The access stairway is unsafe and requires remediation. In addition, actuators on four strategic valves in the shaft have failed, preventing remote operation of the valves in an emergency. There are also issues with lighting and ventilation and pipeline corrosion has been observed.

We have considered a number of initial options for investment, including decommissioning the gas assets in the Mersey tunnel, doing nothing, or replacement.

We rejected the option of decommissioning the gas pipeline due to the valuable network resilience it provides.

Proactively maintaining the pipeline assets in the Mersey tunnel is the only feasible option to manage our health and safety obligations to our staff and the road users, and it is an obligation under our Deed of Agreement with the Mersey Tunnel Authority.

A further set of in project options were considered around how best to achieve safe entry and egress from the tunnel. CBA was carried out to demonstrate that providing a permanent access stairway in the Bibby's shaft is the optimal long-term solution for this element of the project.

Our preferred option is therefore to install a new permanent access stairway into the Bibby's shaft and carry out proactive maintenance to valves, pipework, lighting and ventilation systems within the Mersey Road Tunnel. This requires XXXX of expenditure in RIIO-2. We have tested the efficiency of this expenditure through comparison of out-turn costs on historic projects and through liaison with our frameworks' suppliers for future remediation.

Summary of preferred option	£m
RIIO-2 Expenditure	Redacted due to commercial sensitivity
Project NPV*	

* For those RIIO-2 costs subject to CBA

Material Changes Since the October Submission

Document updated to an 18/19 price base.

Table of Contents

2. Summary Table

Name of Project	Mersey Tunnel Access Refurbishment		
Scheme Reference	Cadent investment line reference 41		
Primary Investment Driver	Security of Supply, Asset Health, Health and Safety		
Project Initiation Year	2020		
Project Close Out Year	2025		
Total Installed cost estimate (£)	XXXX		
Cost Estimate accuracy (%)	+ or – 20%		
Project Spend to date (£)	XXXX		
Current Project Stage Gate	N/A		
Reporting Table Ref	3.05 Other Capex/Other Capex/Other Capex		
Outputs included in RIIO-1 Business Plan	No		
Spend apportionment	**RIIO-1**	**RIIO-2**	**RIIO-3**
	XXXX	XXXX	XXXX

Table 1: Summary Table for Mersey Tunnel Access Refurbishment

3. Project Status and Request Summary

A review of the need to retain the Mersey Tunnel pipeline was carried out in 2019. This document covers the findings from that review and forms conclusions on the long-term need for the Mersey tunnel to support resilience. This document also discusses the different options for maintaining the Mersey tunnel pipeline to enable a safe and resilient network.

This document sets out the necessary investment required to maintain or decommission the Mersey tunnel pipeline and associated assets.

The capex and opex investment proposed for the future inspection and scheduled maintenance activities of the Mersey Tunnel pipeline is not covered within this document.

All project work and required funding is expected to start and finish within RIIO-2.

Other interventions on the Bibby's shaft access cover and water pumping system are planned for delivery in RIIO-1 (the design is underway now and the works will be completed by 2021). This is a separate investment project from that described here and is therefore not included in the summary Table above.

4. Problem Statement

We have a strategic, intermediate-pressure (IP) gas pipeline, with critical M1 strategic IP isolation valves, located in the Mersey road tunnel, and in the associated Bibby's Shaft. The pipeline provides a link across the Mersey between large groups of customers in Liverpool and Birkenhead. More information on the assets and their configuration is explained below.

We must either maintain this pipeline and associated assets, for safety and security of supply reasons, or we must decommission the asset and manage the impact this has on our network resilience.

The problems associated with decommissioning the asset

Our options assessment has explored the need to retain the Mersey Tunnel pipeline and the opportunities to permanently decommission the asset. If the Mersey Tunnel is permanently decommissioned, then Woodchurch Pressure Reduction Station becomes the sole feed to two further pressure reduction stations (PRSs): Morton Road and Wallasey. During an annual winter demand (October to May), a failure at Woodchurch PRS, would cause a failure of Morton Road and Wallasey, impacting XXXX customers on the MP network in the Birkenhead area.

Mersey tunnel also provides important resilience and operational flexibility to deal with other network issues. For example, we could not have cost-effectively rebuilt the Mickle Trafford Offtake in RIIO-1 (2014) without the resilience that the Mersey Tunnel provided.

The option to permanently decommission the Mersey tunnel pipeline is discussed in more detail later in this paper.

Background to Mersey Tunnel pipeline

We have a strategic pipeline located in one of the Mersey road tunnels (Kingsway). The 24-inch internal diameter, 7-bar steel pipe connects two IP systems; the Wirral to the west which is fed by Woodchurch PRS and the Liverpool South Manchester IP system to the east, which is fed by Garston, Kirkby and Maghull PRSs. The loss of the Mersey tunnel pipelines results in the Woodchurch PRS becoming a single feed to the medium-pressure (MP) network in Birkenhead. A failure at Woodchurch PRS could then impact our customers if it were to occur during winter months.

The Mersey Kingsway Tunnels, comprised of two identical tunnels side-by-side (Mersey and Kingsway), were constructed in the 1960s from bolted pre-cast concrete segments and are owned by the Mersey Tunnel Authority. Both tunnels have two 12 ft (3.7 m) traffic lanes and carry on average XXXX vehicles a day between Secombe in the west and Vauxhall in the east. The Mersey Tunnel includes an access shaft to the pipeline referred to as The Bibby's Shaft (Figure 1) – owned by Cadent Gas. The tunnel then runs for approximately 1,500m under the River Mersey, with an upper deck used by vehicles.

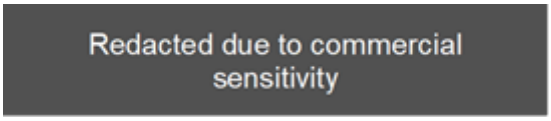

Figure 1: Mersey Tunnel and surrounding network, ESRI ArcMap Extract

The problems associated with maintaining the asset

To keep the Mersey tunnel pipeline and associated assets safe and operating reliably we carry out routine inspections and maintenance on the pipelines, strategic M1 IP valves, gas detection and associated assets. Our routine inspections have identified a number of material deficiencies that need to be remediated in RIIO-2.

The primary problem, if we are to retain the asset, is the need to provide a safe access method to facilitate our planned inspection and maintenance schedules and in the event of a gas-related emergency.

It is imperative that we can provide:

- A safe method of entering and exiting the Bibby's shaft and the pipeline sections below the road deck
- An adequate method of lighting the area; this method should be safe to operate even in the event of a gas leak (intrinsically safe)
- Suitable ventilation and gas detection, to ensure a safe working environment for operators. Ventilation will ensure that in the event of a gas leak the gas can be dispersed quickly to reduce any fire or explosion risk. Ventilation and gas detection also enable gas leaks to be detected quickly, which in turn protects the road users from any resulting fire and explosion risk.

During the detailed survey of the tunnel and the Bibby's shaft in 2016, asset integrity issues were identified, including several issues with access and the working environment in the shaft and tunnel.

The issues identified during these inspections were:

- The Vertical Pipework in the Bibby's shaft has suffered corrosion, posing an immediate risk to pipework integrity. This has been resolved in RIIO-1.
- Access cover and the water pumping system failure leading to flooding of access route. This will be resolved in RIIO-1.

In addition:

- Severe corrosion with the access stairway in the Bibby's shaft; this staircase, owned and maintained by Cadent, has been assessed as unsafe by our structural engineering consultant (WSP PB).
- Many electrical items in the tunnel and Bibby's shaft have suffered severe corrosion and are unsafe. As a result, the lighting, ventilation systems and gas detection systems have been disconnected and are therefore inoperable.
- Pipework in the Bibby's shaft has suffered corrosion at the inverts, posing a risk to pipework integrity.
- Three critical isolation valves are in poor condition; their actuators are unreliable and do not open and close the valves remotely, therefore manual operation from within the tunnel is the only way they can be used. In the event of the gas leak, this will result in a critical delay to isolating the pipelines and reducing any fire and explosion risk. We will need to enter the tunnel to isolate the leak.

Investment drivers

The primary investment drivers are:

- **Security of supply:** We need to ensure that our network in the Birkenhead area has sufficient resilience and operational flexibility to maintain security of supply.
- **Health and safety** of employees and the general public (road users and people in the surrounding area)
    - **Our employees** must be able to inspect and maintain our assets safely; we must provide them with a safe working environment (safe access, lighting, safe atmosphere).
    - **Safety of the general public.** Without adequate ventilation, gas detection and remote-operating isolation valves, road users and other members of the public nearby could be exposed to an increased risk of fire and explosion as a result of a gas leak within the tunnel.

Key challenges

To decommission the assets, a detailed negotiation with the Mersey Tunnel Authority (MTA) would be required. There is a high degree of uncertainty around the likely scope of decommissioning; this could range from disconnecting the pipes and leaving the pipe in situ to disconnecting the pipes and removing all the assets, which would be very costly. Initial discussions with the MTA (Jan 2018) suggest that they would enforce our original lease agreement and ask us to remove the pipeline.

Ongoing maintenance of the assets also presents a number of key challenges:

- The MTA has stated that any works in the tunnel must be undertaken overnight between 12 am and 6 am, as the road tunnel will need to be closed to road users.
- It should also be noted that all work within the confined spaces of the shaft and tunnel is 'confined space working' which adds to the complexity and costs of activities.

Key milestone dates

The work will be planned for delivery in early RIIO-2. The first phase will be to ensure there is safe access, to then facilitate other remediation during years three to five. A more detailed project plan is contained in Section 8.

Understanding project success

Success will result in the delivery of a robust set of measures, which will reduce the risks posed by unsafe access and egress and an unsafe working environment, securing the safe and reliable supply to our customers in the Liverpool city region.

4.1. Related Projects

There are no related projects.

4.2. Project Boundaries

This project includes any expenditure on refurbishment or decommissioning for the Mersey Tunnel pipeline, the tunnel and its associated ancillaries.

Any expenditure related to routine inspections or scheduled maintenance is not included within this investment case – this is opex funded.

5. Project Definition

5.1. Supply and Demand Scenario Discussion and Selection

The future demand for gas in the Manchester and Liverpool area has informed this investment case.

While the long-term trend for gas annual consumption is, on average, continuing to decline, we are not seeing any appreciable indication of a decline in peak demand. Our licence requires us to design our network to meet the 1-in-20 peak condition (i.e. we must be able to supply gas to our customers when they need it most). We are also observing increases in demand in particular parts of our network – driven by new housing and industry increasing demand beyond the reductions seen from increased efficiency

The latest 2019 National Grid Future Energy Scenarios (FES) show an increase in national demand in the Steady Progression and Consumer Evolution scenarios in the short to medium term. The ENA Common RIIO-2 Scenario looking out to 2030, agreed by all the networks and informed by FES 2018, shows a UK gas peak demand of 5,000 GWh in 2030, which is only marginally lower than the last peak published by National Grid in their Winter Outlook Report for 2018/19.

We have found no scenarios that show a sufficiently large change in demand over the RIIO-2 period that would justify an alteration to this asset-health/resilience investment case (i.e. a change in demand equivalent to XXXX customers).

As we move into delivery, we will routinely check the latest demand forecasts to ensure that decisions made as part of our strategic planning process are still valid.

The variability in forecast demand is within the engineering tolerance of our designed solutions; that is to say, changes are not large enough to trigger a stepping up or down in component size. We have therefore not conducted detailed scenario analysis for this project.

5.2. Project Scope Summary

This major project covers the following scope:

- New access staircase or access method within the Bibby's shaft
- New gas detection system within the Bibby's shaft and the tunnel under the tunnel road deck
- New lighting system within the Bibby's shaft and the tunnel under the tunnel road deck
- Repairing the external corrosion on 100m section of 24-inch diameter steel pipework within the Bibby's shaft (Recoating)
- Replacing four actuators and associated control systems on four 24"-diameter Cameron/Cort Ball valves within the Bibby's shaft

The opex costs associated with the routine inspection and scheduled maintenance of the tunnel are not included within the investment case.

6. Options Considered

Prior to carrying out any detailed options assessment, we carried out a review of the network resilience in the Manchester and South Liverpool area to assess the possibility of decommissioning the Mersey tunnel pipeline assets. The finding from this review is discussed under the Options summary as 'Initial option'.

We however confirmed through this analysis that the Mersey tunnel assets should be retained for network resilience, and therefore the detailed options within this investment case look at the optimum option for maintaining the Mersey tunnel in the longer term.

We have considered two options for the access-solution into the Bibby shaft:

- **Baseline:** Provide temporary hired equipment for the purpose of access during maintenance, survey activities and for emergencies
- **Option 1:** Replace or upgrade existing access and ancillaries, to provide permanent access arrangements.

Both of the above options are also comprised of a number of general asset-health issues set out below. We have not assessed options for these elements given their low cost:

- **For the pipework corrosion,** we have included an allowance for repairing 100m of corroded pipework
- **For the failed actuators**, no viable repair option exists; therefore, we have included for replacement of the actuator and associated electrical and control items so that these valves can be operated remotely from our Distribution Network Control Centre (DNCC), for day to day control and for isolation in the event of an emergency.

We have undertaken a CBA on the two access-options for the Bibby shaft; our approach, basis of calculation and results are included in Appendix 1.

6.1. Decommissioning Option: confirming the long term need for the Mersey tunnel pipeline assets

We have carried out a review of our Network Resilience in 2019, based on demand forecasts, for the Manchester and South Liverpool area.

If the Mersey Tunnel is permanently decommissioned, then Woodchurch PRS becomes the sole feed to two further PRSs: Morton Road and Wallasey.

During an annual winter demand (50% of a 1-in-20 peak demand), which occurs during the October to May period, a failure at Woodchurch PRS, would cause a failure of Morton Road and Wallasey PRSs, impacting XXXX customers on the MP network in the Birkenhead area. Using our willingness-to-pay figures for a 3- to 24-hour supply interruption, avoiding this risk would bring XXXX of benefit. If the interruption to supply was more than 24 hours, the benefit would rise to XXXX. While the probability of a failure at Woodchurch PRS is low, it is clear that the benefits of avoiding this failure are very large.

In conclusion, if we remove the Mersey tunnel pipeline, we create a single point of failure with a potential impact on XXXX customers in the event of failure.

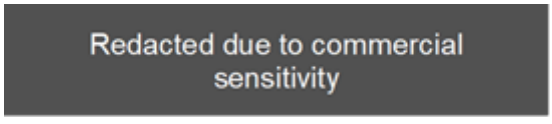

Figure 2: Network configuration in the Birkenhead area.

Mersey also provides important resilience to support our ILI internal pipeline safety inspections. An internal inspection using low cost 'pigging' is only possible when gas in the pipeline has a sufficient flow rate and pressure. During 2018, Cadent undertook a trial to understand the effect of the loss of Mersey on our capability to perform high quality and effective ILI pipeline inspections. The operations team found that under normal flow conditions these surveys were not effective, and the duration of the surveys was increased significantly. The flow from the Mersey tunnel pipeline will enable more robust and shorter-duration pipeline inspections at any time of the year, providing greater operational flexibility.

We have therefore concluded that in the short term (during RIIO-2), decommissioning the pipeline will have a material impact on our network resilience and operational flexibility.

We have therefore not carried out a detailed option study or review of costs to decommission this asset.

6.2. Baseline: Temporary solution; hire equipment when access is required

This option involves minimal capital investment and so forms the minimum investment Baseline option. We would look to hire and erect access scaffolding, gas detection, ventilation systems and temporary lighting on each occasion when we need to access the Bibby's Shaft.

During 2018, it was necessary to hire and erect this temporary equipment to facilitate some of the RIIO-1 remedial work on the shaft. Based on the cost to deliver these works, we estimate a one-off cost of XXXX per event is required.

As part of the provision of temporary access, the current stairway needs to be decommissioned to give a safe, clear lift space. We have estimated that this will have an opex cost of XXXX.

It is estimated that the scaffolding would take three days to erect and mobilise in the 30-metre deep, 5m diameter shaft. If this solution was the preferred option, we have assumed that Cadent would put in place an emergency call-off contract with a suitable supplier to ensure this equipment would be available in a short space of time.

Item	Estimated Cost (Opex)	% of total installed cost
Decommission the stairway	Redacted due to commercial sensitivity	
Temporary hire of scaffolding, gas detection, lighting and ventilation per event		

Table 2: Baseline: Cost estimate details: temporary access arrangements1

Based on the current inspection programme, Cadent undertakes a yearly pipeline safety inspection and a monthly gas-detection inspection and test.

6.3. Option 1: provide permanent access, ventilation and lighting

This option provides a fixed, permanent access stairway in the Bibby's shaft and a new, intrinsically safe lighting and ventilation system to facilitate safe inspections and maintenance activities. The original ventilation and lighting systems were installed in the 1970s.

The ventilation system will cover approximately 1,000m of tunnel and work to install the system can only take place while the road above is shut, between the hours of 12-midnight and 6 am.

The addition of these assets provides Cadent with rapid access to the pipeline in the event of an emergency, albeit with the necessary health and safety planning and control. The new access will take one year to install, but once installed will reduce the mobilisation time by up to three days.

The cost estimates for this option is based on historical work that has been carried out by Cadent.

Item	Estimated Cost (Opex)	% of total installed cost
Construction of new ventilation system within 1000m of tunnel	Redacted due to commercial sensitivity	
Construction of new access staircase & lighting in Bibby's Shaft.		
Cadent direct costs		
Contingency		
Total		

Table 3: Option 1: Cost estimate details: Permanent access arrangements.

Based on the proposed plan to carry out this remediation in year 1 of RIIO-2, the following table sets out the proposed capex spend profile for RIIO-2.

	2021/22	2022/23	2023/24	2024/25	2025/26
Total		Redacted due to commercial sensitivity			

Table 4: Option 1, proposed spend profile for RIIO-2[1]

6.4. General scope for all options: remediation of pipework corrosion and failed actuators

As discussed above, this investment case includes for the following remediation, irrespective of the access option selected.

This section discusses the scope and costs associated with this remediation for:

- Recoating of 100m of corroded pipework
- Replacement of four failed actuators, to enable automated operation from the DNCC.

The following table sets out the cost estimates for the above scope, derived from historical projects delivered during RIIO-1.

Scope element	Estimated cost £k	% of total installed cost	Basis and Assumptions
Pipe recoating	Redacted due to commercial sensitivity		Recoating 100m of pipe inverts in a confined space. 24-inch diameter steel pipework.
Actuator & control system replacement on M1 isolation valves			Replacement of four actuators and associated control systems (located at St Pauls Road Wallasey, Valve 32/26 and at Bibby's Shaft 32/9 and 32/16). Cost includes procurement of the actuators and the installation (actuators for four 24" Ball valves).

Table 5: Cost Estimates for pipe recoating and valve replacement

6.5. Options Cost Estimate Details

The unit costs for each option are explained in the relevant options summaries above.

[1] Note these options do not include the proposed capex investment to recoat the pipework and replace 3 No. valves (Table 5). These activities will be required regardless of the option chosen for safe access and egress.

6.6. Options Summary

This section summarises the two options that have been considered for implementation during RIIO-2. The summary only compares the access options.

	Option 1: Provide permanent access, lighting and ventilation	Baseline: Opex, temporary access, ventilation and lighting
Project start date	2020	2020
Project commissioning date	2025	N/A
Operating costs	Redacted due to commercial sensitivity	
Response time in the event of an emergency	1 Hour	2-3 days minimum 5+ days potentially during holidays
Project design life	Circa 10 to 20 yrs. dependent on component.	Nil
Total cost assessed in CBA	Redacted due to commercial sensitivity	
Cost estimate accuracy	+ or – 20%	+ or – 20%

Table 6: Options Summary

For both options, an additional XXXX should be included, to cover the pipeline coating remediation and replacement of four actuators.

7. Business Case Outline and Discussion

As discussed in Section 6, we have undertaken a CBA to select the preferred solution for the access into the Bibby shaft. Our detailed approach and basis of calculation for our CBA is included in Appendix 1.

A number of other asset health issues have also been included in this investment case, but options and a CBA have not been produced for these elements as they are low cost routine activities.

Our approach to defining the baseline is the option where we do not invest proactively in our assets, but we do inspect and maintain assets in line with our obligations, and repair assets under a fix on fail strategy. This is the absolute minimum investment we can make in our assets. Other options are then considered which represent increments of investment over and above the baseline.

However, for areas of investment, such as this one the forecast baseline cannot be assessed due to its highly uncertain nature. In these circumstances, the baseline is set at zero and in the options the *changes* in costs are considered, i.e., we include the costs of reacting to a failure occurring as avoided costs in each option, rather than as absolute levels of anticipated costs in the baseline. This enables us to test the results for their sensitivity to the level of avoided reactive costs.

From a pure CBA point of view the two approaches are equivalent – as CBA is all about comparing differences between options.

7.1. Key Business Case Drivers Description

The choice of the preferred access-option within the CBA is driven primarily by the benefit of avoiding the ongoing costs of providing temporary access whenever a visit is required.

7.2. Supply and Demand Scenario Sensitivities

The current supply-demand scenario assumes the future gas demand does not change materially due to the introduction of alternative fuels.

As mentioned previously, Mersey provides critical resilience to the Birkenhead area during winter demands. The gas demand will not change sufficiently (i.e. a greater than 50% reduction) to negate the need for Mersey to support the network in the event of a failure at Woodchurch PRS.

7.3. Business Case Summary

The following table summarises the options considered for this investment case.

	Option 1: temporary access solution	Option 2: Permanent access solution
Remediation on Pipe coatings and valves Demolish existing redundant access way	Redacted due to commercial sensitivity	
Costs for access, lighting and ventilation to Bibby's Shaft		
Response time in event of an emergency	2 to 3 days	Hours
Total installed cost	Redacted due to commercial sensitivity	
Cost estimate accuracy	+ or – 20%	+ or – 20%

Table 7: Business case Summary

The results of the Mersey Tunnel CBA, which has assessed the optimum access-solution for the Bibby shaft, are set out in the table below.

CBA Option Name	Visits per year to Bibby's Shaft	Total NPV	Cost beneficial	Payback Year	RIIO-2 Spend	Ratio NPV to RIIO-2 spend
Baseline Option 1: Permanent Access CBA Scenario (Option 2): Permanent Access – fewer visits	Redacted due to commercial sensitivity					

Table 8: Results of Cost-Benefit Analysis for Mersey Tunnel (£m)

The approach to assessing CBA:

- All costs are discounted in line with Ofgem's recommended approach, for example financial impacts are discounted using the Spackman approach.
- A positive NPV means an option reduces the profile of costs relative to the do nothing (baseline) position and is therefore cost beneficial. The option with the highest positive NPV is the most cost beneficial option.

- Payback shows the year when the sum of costs associated with an option is lower than the baseline i.e. this is the point at which the option can be considered to be cost beneficial. This is driven by the profile of the costs and the capitalisation rate.
- The table shows the RIIO-2 proactive expenditure; the ratio of NPV to RIIO-2 spend shows how much NPV per £ spent in RIIO-2 the options generate. A positive figure means the investment is cost beneficial. The higher the figure the most cost beneficial the option is.

The table clearly shows that the option to implement permanent access is cost beneficial, with an NPV of XXXX and payback by XXXX. Current operational activities indicate that access to the tunnel is more frequent than once per year, and this is expected to continue in the future. A single emergency incident could require a rapid response, which would be more easily facilitated by a permanent access solution. The permanent solution is more flexible, more reliable and preferred for operational reasons. It is also the most cost-beneficial solution. **Engineering-option 1 is therefore our preferred option.**

CBA-option 2 tests the sensitivity of this result to the number of times that temporary access is required every year and demonstrates that the switching point is XXXX visits per year. Based on evidence from RIIO-1, it is typical for at least XXXX visits per year to be needed for various periodic inspections of pipework, ventilation, gas detection and other fixed gas-assets in the Mersey tunnel. Installation of the permanent solution is therefore the preferred option.

8. Preferred Option Scope and Project Plan

8.1. Preferred Option for this request

Our preferred option is Option 1. This option is cost-beneficial and ensures that we meet our obligations and maintain resilience in a value for money manner.

Option 1 comprises:

- Installation of permanent access, ventilation and lighting
- Recoat 100m of 24-inch diameter steel pipework
- Replace four actuators and associated control for four 24" ball valves (critical M1 IP isolation valves for the Mersey tunnel pipeline).

8.2. Project Spend Profile

The following table sets out the capex spend profile for the preferred option.

Scope of Work	Capex £k					
	Yr. 1 21/22	Yr. 2 22/23	Yr. 3 23/24	Yr. 4 24/25	Yr. 5 25/26	Total
Install new access, lighting and ventilation system within Bibby's Shaft.						
Recoating 100m of pipework within tunnel		Redacted due to commercial sensitivity				
Replace four valve actuators						
Total Capex						

Table 9: Proposed Capex spend profile for Remediation of Mersey tunnel assets during RIIO-2

The costs associated with installing new access, lighting and ventilation are subject to CBA. The other costs in this table are applicable in all options, and therefore excluded from the CBA.

8.3. Efficient cost

We are confident that costs within this investment case are efficient because they are:

- Derived from learning from past projects completed on the Mersey Tunnel assets
- Estimated from discussions with our supply chain and competent contractors
- Based on works that are competitively tendered, ensuring we achieve the best value

Due to the confined-space working, and limited working hours/environment, unit costs are significantly higher than those of other, more routine, maintenance work on our valves and pipelines.

Our RIIO-2 forecasts, as well as adjusting for workload and work mix factors, also include ongoing efficiencies flowing from our transformation activities including from updating and renewing our contracting strategies. Our initiatives are outlined in Appendix 09.20 Resolving our benchmark performance gap. For Capex activities this seeks a 2.9% efficiency improvement by 2025/26 on the end of RIIO-1 cost efficiency level.

For Mersey Tunnel our confidence is defined as being within Conceptual Design stage with a range of +/- 20%.

8.4. Project Plan

The following provides a simple project plan for the proposed remediation.

Year 1: The new access, ventilation and lighting system for the Bibby's Shaft

Year 2: Pipework Recoated (100m of 24" pipework)

Year 2: Replace four actuators and controls systems on the four 24" ball valves.

8.5. Key Business Risks and Opportunities

The key risks in the delivery of this project are:

Reference	Risk Description	Impact	Likelihood	Mitigation /Control
09.18 - 001	Supply & Demand deliverability risk of Resource availability within the Gas industry	Potential cost increases in labour / commodity markets as demand is greater than supply	Low	Intelligent procurement and market testing. Apprenticeship and Training programmes to fill skills gaps
09.18 - 002	Stretching efficiency targets may not be deliverable (unit costs increase)	Outturn costs are not met increasing overall programme costs.	Low	Established marketplace - ability to manage the known commodity market
09.18 - 003	Unforeseen outages and failures restrict access for planned work	Programme and delivery slippage due to delay of planned outages and or site access	Low	Proactive asset management with ongoing condition surveys and response plans to prevent failures
09.18 - 004	Unseasonal weather in 'shoulder months', Autumn and Spring reduce site access/outage windows	Increased demands affecting access to sites and planned outages delay and cost increases	Low	Controlled forecasting and maintenance of flexibility to react to unforeseen events. Detailed design solutions to minimise outages and reduce exposure.
09.18 - 005	Unexpected / uncommunicated obsolescence during RIIO-2 period of equipment components	Inability to maintain equipment at full capacity with risk of impact upon supply	Low	Maintain a close relationship with equipment supply chain and manage a proactive early warning system where spares / replacements become at risk.
09.18 - 006	Legislative change - There is a risk that legislative change will impact the delivery of	Potential increase in the amount of consultation and information	Med	We have established management teams to address these issues. We have also identified UMs

Reference	Risk Description	Impact	Likelihood	Mitigation /Control
	our work.	exchange required and require us to align our plans with the safety management processes operated by 3rd Party landowner / asset owners. The potential impact is more engagement and slower delivery		for key areas.
09.18 - 007	Access permissions denied and or given narrower conditions by Tunnel owners / operators	Impact upon Risk Assessments and Method Statement and potentially costs and delivery timescales	Low	Continue working relationship with Mersey Tunnel ltd and manage the contractor RAMS process to reduce potential
09.18 - 008	Tunnel owners / operators enforce deed requirements for reinstallation of Gas detector system	Cost and programme as may need to be done prior to further access being granted	Med	Continue working relationship with Mersey Tunnel ltd and manage the expectations and plan future engagements. Maintain current RAMS with mine rescue attendance etc.

Table 10: Risk Register

8.6. Outputs Included in RIIO-1 Plans

No outputs from RIIO-1 plans have been included in this project.

9. Regulatory Treatment

This investment will not be processed through the NARMs reporting tool.

Cost variance for low materiality specific projects such as this will be managed through the Totex Incentive Mechanism (TIM)

This investment is accounted for in the Business Plan Data Table 3.05 Other Capex within the Other Capex Sub Table.

Appendix 1: Approach & basis of calculation for cost benefit analysis

Introduction

We have carried out CBA analysis to assess the optimum solution for resolving the issues associated with the access into the Bibby shaft, to facilitate safe inspection and ongoing maintenance of the Mersey tunnel pipeline assets.

Our approach to cost-benefit analysis

A full cost-benefit analysis has been undertaken to ensure value for money. Our approach is compliant with HM Treasury's Green Book and the relevant Ofgem guidance. We have followed the Ofgem approach, spreadsheet and societal-benefit values and calculations.

In addition, in line with HM Treasury Green Book guidance, switching analysis has been undertaken to test the sensitivity of the results to key assumptions.

Switching analysis, as set out the in the Green Book, is a form of sensitivity analysis that identifies the input values required to change the cost-benefit analysis results.

> *'A switching value refers to the value a key input variable would need to take for a proposed intervention to switch from a recommended option to another option or for a proposal to not receive funding.'(p.33)*

This approach is particularly useful where there are future uncertainties that make the specification of accurate risk scenarios problematic.

Our approach to defining the baseline is the option where we do not invest proactively in our assets, but we do inspect and maintain assets in line with our obligations, and repair assets under a fix-on-fail strategy. This is the absolute minimum investment we can make in our assets. Other options are then considered which represent increments of investment over and above the baseline.

However, for areas of investment, such as this one the forecast baseline cannot be assessed due to its highly uncertain nature. In these circumstances, the baseline is set at zero and in the options the *changes* in costs are considered, i.e., we include the costs of reacting to a failure occurring as avoided costs in each option, rather than as absolute levels of anticipated costs in the baseline. This enables us to test the results for their sensitivity to the level of avoided reactive costs. In this case, we have included the avoided costs of hiring in temporary access equipment, against our engineering option 1.

The following table set out the CBA scenarios modelled and included in the CBA data tables 9.18 NW Mersey Tunnel.

Engineering option	Option in CBA data table	Costs used	Benefits used
Baseline: Temporary Solution	Baseline	N/A Costs of reacting to failure are included as benefits (i.e. costs avoided) in relevant Options below	N/A
Option 1: Permanent Access	Option 1: Permanent Access	RIIO-2 costs as submitted and includes staircase decommissioning and installation of permanent access facilities	Avoided costs of implementing the temporary solution assuming XXXX visits pa

Engineering option	Option in CBA data table	Costs used	Benefits used
N/A	Option 2: CBA scenario Assessing the number of visits required per year to make the permanent access option the optimum solution.	Costs as Option 1.	Avoided costs of implementing the temporary solution assuming XXXX visits pa

Table 11: Basis of Calculations in CBA Template

The detailed calculations of the benefits included in the templates are set out below.

Benefit calculation	Method/Basis of calculation
Option 1: Permanent Solution. (1 visit per year) **Annual avoided reactive costs**	Redacted due to commercial sensitivity

Table 12: Benefits Calculations

As mentioned above, the Option 2 tab, in the CBA data tables has been used to test the "switching point", to inform the number of visits needed per year for the permanent solution to be the lowest whole life cost solution for access to the Bibby shaft.

CBA Results

Our switching analysis has shown that we only need XXXX visits per annum, or XXXX visit over a 5 year period for the permanent solution to be the lowest whole life cost.

Based on evidence from RIIO-1, it is typical for XXXX visits per year to be need for various periodic inspections of pipework, ventilation, gas detection and other fixed gas-assets in the Mersey tunnel. Installation of the permanent solution is therefore the preferred option.