Northern Gas Networks

A23.F - NGN RIIO-2

Investment Decision Pack

TransPennine

we are the network

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2. Summary Table

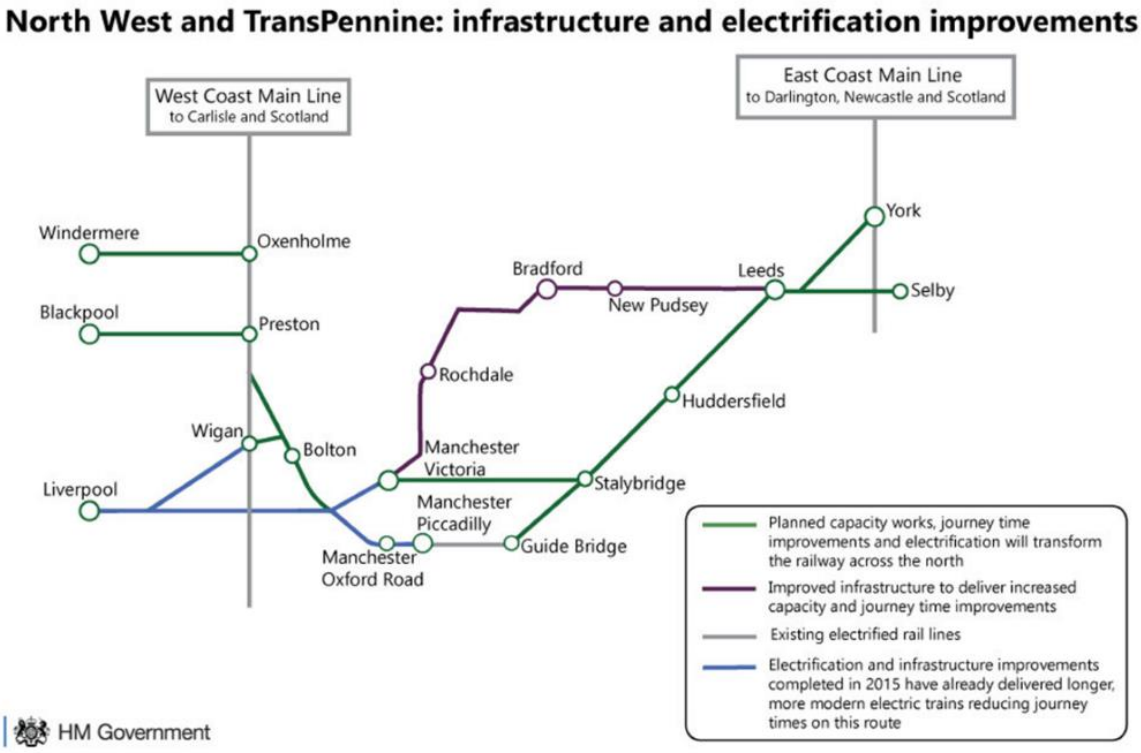
Name of Project	TransPennine Electrification		
Scheme Reference	-		
Primary Investment Driver	Third party with additional asset health drivers		
Project Initiation Year	RIIO-1		
Project Close Out Year	RIIO-2		
Total Installed Cost Estimate (£)	£21m		
Cost Estimate Accuracy (%)	84%		
Project Spend to date (£)	£800k		
Current Project Stage Gate	Detailed design complete (Leeds – York / Selby)		
Reporting Table Ref	3.01		
Outputs incl. in RIIO-1 Business Plan	Price Control Deliverable		
Spend apportionment	**T1/GD1**	**T2/GD2**	**T3/GD3**
	7%	93%	0%

3. Project Status and Request Summary

The UK GOV transportation plan calls for a new high-speed rail network, linking London / to Birmingham and then on to Leeds and Manchester. In order to link Manchester / Leeds / York, Network Rail are currently in progress with electrification upgrades, generally referred to as the TransPennine Electrification programme, able to deliver faster journey times and significantly more capacity between the three cities.

The upgrade comprises several methods to increase rail capacity and reduce journey times, the primary method being electrification of rail lines to allow use of faster electric or hybrid trains. Overhead lines must be installed as part of the electrification, this poses a considerable challenge due to the Victorian architecture of most rail bridges in the area not providing enough clearance for cabling. In addition to this, large sections of track are dual lane which limits faster services from

passing slower local services therefore a programme to install 2 more tracks along most of the route, doubling the capacity, is also proposed.



As part of the Network Rail TransPennine project, our network will be impacted by significant works along the length of the rail line. Lifting of clearance levels above the rails to allow installation of electrification infrastructure will require the raising or demolition of all above rail infrastructure such as our pipeline overcrossings or mains within bridge structures, while widening of the tracks will impact below ground crossings or parallel mains through heavy construction and encroachment on minimum proximity distances of our pipelines.

During RIIO-1 we received formal removal notifications from Network Rail regarding two high pressure overcrossings in West Yorkshire, set between Leeds and York on the TransPennine rail line. These overcrossings had been determined as preventative infrastructure for the planned TransPennine Electrification upgrade works.

There are two aspects to this element of the TransPennine Electrification. Ridge Road, diversion and removal of a 38bar 36" freestanding overcrossing, has already been designed and some long lead items have been procured, such as steel pipework and fittings. Austhorpe Lane, network reconfiguration to allow the removal of a 17bar 18" freestanding overcrossing, requires land acquisition prior to detailed design being undertaken. Negotiation is on-going regarding the necessary land parcel, after which design will commence targeting design completion prior to the end of RIIO-1.

Due to restrictive timescales, both overcrossing projects will have undergone full detailed design throughout RIIO-1 to allow for expedited mobilisation ensuring the removal works are completed within the 12-month timeframe as designated in the removal notices.

In addition to the removal notices, a consultation has been opened regarding the line between Dewsbury and Huddersfield to assess the impact on the environment and infrastructure of Network

Rails scope of works. These works impact a couple of key assets in the Yorkshire Central and Western system, most notably 2 high pressure pipelines crossing a complex 3 track junction and a high-pressure spur to Thornhill Power station.

Funding being requested is to manage the risks associated with having to undertake non-rechargeable works as a direct result of the TransPennine Electrification upgrade scheme during RIIO-2.

4. Problem / Opportunity Statement

a) Why are we doing this work and what happens if we do nothing?

Easements between utility infrastructure operators and Network Rail state any asset impacting the operability, maintenance or upgrade of rail infrastructure is subject to a 'lift and shift clause', specifically: paragraph 6.4.1.3(b) of Annex 1 - Standard Wayleave Conditions 2012 - of the licence for gas pipelines and agreement for standard conditions dated 7 March 2014 entered into between (1) Network Rail and (2) Northern Gas Networks Limited (NGN) (the Licence). In practice this states that if any gas infrastructure impacts a Network Rail project, they can request removal of the asset and the utility operator must comply at its own cost. In the instance a removal notice is served, we have a period of 12 months to remove the asset at our own cost.

In RIIO-1 we have received official notice from Network Rail to remove two overcrossings from the TransPennine route west of Leeds within a 12-month timescale. Under the notice we are required to divert our apparatus.

Due to the continued uncertainty, both financial and political, surrounding this project, we contacted Network Rail to request further clarification on project status to ensure the diversionary works were still necessary prior to further expenditure.

We have been informed that we need not adhere to the 12 months' notice period, however the documents have not been rescinded and as such a legal removal notice remains in in place on both crossings. We require design completing so we can begin construction at the earliest opportunity due to the complex nature and timescales involved in high pressure pipeline diversions.

In September 2019, a separate consultation was opened for proposed electrification and track widening works between Dewsbury and Huddersfield. Due to the short timescales prior to the RIIO-2 submission a desktop review of gas infrastructure impacted has been undertaken. A notable section of the consultation is the proposed widening of tracks at Heaton Lodge Junction, this is currently a 3-lane junction in which 2 high pressure pipelines cross underneath the rail lines. The installation of overhead cabling and widening of tack corridor may impact the safety and operability of these two pipelines, therefore consideration needs to be given to the full impact of the works.

Failure to adhere to a removal notice puts us in breach of easement regarding utilities infrastructure over Network Rail assets. There are several legal avenues available to network rail to ensure no detriment to their ability to operate, such as enforcement of the notice or revoking of the easement. Additionally, breaching the national agreement in either of these instances would allow Network Rail to prevent use of any gas infrastructure over network rail assets, significantly impacting the remainder of the network.

b) Under what circumstances would the need or option change for this project?

At present we have two removal notices served on high pressure overcrossings however the 12 months' notice period within which to complete the works has been put on hold until further notice. We also have a consultation in place which states that Network Rail will apply to the Secretary of State for Transport in autumn for a Transport and Works Act Order (TWAO) for the powers to construct the Huddersfield to Westtown (Dewsbury) scheme and we know these works will impact our gas infrastructure.

We expect between now and the end of RIIO-2, in seven years' time, that Network Rail proposed upgrades to other sections of their railway line that will impact our assets and we will be required to intervene on them at our own cost.

We are requesting funding for any costs incurred during RIIO-2 due to the 'lift and shift' clauses in our pipeline easement agreements and will take the risk on the volume and cost of work required during this price control period. However, to protect our customer's interests, due to the uncertainty over the timing of the Electrification project, we are proposing to include funding for these works under a Price Control Deliverable on a 'use it or lose it' basis to ensure our customers do not bear any costs if we don't incur any.

c) What are we going to do with this project?

Through the remainder of RIIO-1 we aim to complete detailed project design on both Ridge Road and Austhorpe Lane works, allowing the project to commence with minimal lead times. Until Network Rail instruct us to commence with the removal works, we will not undertake any further procurement nor construction works. As an element of procurement has been completed the lead times for the Ridge Road diversion have been reduced, allowing for a project phasing of both projects across two years. Long-lead items (26+ weeks) for Austhorpe can be procured during construction of Ridge Road.

A full assessment will be completed of the impact of the electrification and track widening works between Huddersfield and Dewsbury and risk mitigation and diversionary works will be scoped.

d) What makes this project difficult?

The nature of high-pressure overcrossings and Network Rail infrastructure presents various construction difficulties with diversion and removal. High pressure pipelines provide critical feeds and cannot be simply decommissioned and removed without reinforcement to retain supply. Additionally, where the pipelines are single feed supplies, a temporary decommissioning is not viable and hot tap / stopple operation on live high-pressure pipelines is the only means of diversion.

Any works involving rail infrastructure add a new dimension to major construction projects. As we will be undertaking works on one of the major transportation lines in the UK, there is additional difficulty in acquiring licences and track possessions and Network Rail will impose windows during which works can be undertaken, however closing a major transportation route to facilitate an overcrossings removal or bore tunnelling operation can add significant difficulty.

Ridge Road railway line in the existing easement is the most cost-effective solution. There are several risks associated with diversion under rail lines, primarily the requirement of ensuring there is no detrimental impact to line integrity. The bore tunnelling methodology being applied is an industry

accepted means of diversion under rail, and continual monitoring as the operation is underway will ensure the diversion is completed safely.

Austhorpe Lane is more complex, Network Rail standards specify any under-rail crossing must be perpendicular to the track direction and due to the urban location of the crossing and the domestic properties surrounding it, the Phase 1 methodology to tunnel under the rail track is unfeasible. Therefore, we must liaise with the local council to find a mutually beneficial solution to ensure successful delivery of the project.

Due to the Dewsbury – Huddersfield scoping process commencing within recent months, a full comprehension of the impact and potential complexities has not been fully explored. What is clear is the placement of a complex rail junction with 2 high pressure crossings in proximity that will be significantly impacted by the proposed widening of the Network Rails land corridor. In addition to the below ground crossings, the 17bar Dewsbury – Hartshead moor pipeline runs parallel to the tracks for up to 100m in the location of the proposed track widening. NGN, IGEM TD/1 and Network rail engineering standards state that a pipeline must cross traffic routes at a perpendicular angle and cannot run in parallel within a minimum proximity distance. This complicates the necessary diversion routing as more than just the crossing point must be addressed. Additionally, pipeline standards state for any major upgrade works to traffic route a minimum pipe wall thickness of 11.9mm must be used. Of the two pipelines within the works boundary only one meets this requirement, necessitating the diversion and re-installation of the second.

e) What are the key milestone dates for project delivery?

No date has been formally set for the project delivery as it is dependent on Network Rail's TransPennine Electrification project which is expected at some time during RIIO-2. At present Network Rail have stated an application will be made to the Secretary of State in Autumn 2020. The diversionary works act as enabling works to Network Rail and must be completed in advance to avoid a delay to their Electrification project.

We know from the removal notices on two of our high-pressure pipelines that once triggered we will only have 12 months to complete the necessary works which when dealing with high pressure provides extremely tight timescales.

Due to the uncertainty around the timing of the project we have included our project as a Price Control Deliverable.

f) How will we understand if the project has been successful?

The project will be a success if delivered to the timescales set out by Network Rail, and the most beneficial solution is sought for our customers.

Success of the TransPennine Electrification works will depend on several factors:

- Communication – Effective communication between Network Rail and ourselves is required to ensure each party understands what is required of each other and by when.

- Cost – As these are third party requested works, the onus is on us to deliver the projects and meet our objectives in the most cost-efficient way possible. Efficiency of projects of this scale does not solely constitute selecting what is initially seen as the cheapest option but undertaking a full optioneering process to determine best value over the life of the assets and local network.

- Programme – These works require adherence to a strict programme to ensure completion prior to Network Rails electrification and civils works, and therefore avoiding legal and financial implications of delays.

- Health and Safety – the scope of works across the TransPennine Electrification involves several high-pressure diversions. These pipelines are critical infrastructure that can pose a serious risk to life if mismanaged or installed / maintained in a way that deviates from current engineering standards. For this reason, we are progressing with designs of 2 high pressure diversions / crossing removals to ensure that Network rail timescales are still achievable while maintaining the correct standard of engineering.

4.1. Related Projects

The TransPennine Electrification is independent of other projects in our RIIO-2 capital expenditure plan.

Although there have not been any directly comparable projects to this one, we have undertaken the following types of work in RIIO-1:

- PRS rebuilds and upgrade:
    - Little Burdon NTS 70-7bar Offtake rebuild
    - Wetheral NTS 70-19bar Offtake rebuild
- High pressure diversion:
    - Thorpe Park 38bar pipeline diversion
    - Aislaby 38bar pipeline diversion
- Overcrossing removal:
    - Workington Harbour low pressure
    - Tadcaster low pressure
    - Todmorden abandoned
- Pipeline installation under rail track:
    - River Eden 19bar diversion

4.2. Spend Boundaries

Costs for this project only are included within this paper. The costs include the following:

- Design, surveys, analysis
- Project and site management, inspectors, supervisors
- Materials and equipment
- Construction and demolition including all preliminaries, install and commissioning
- Record keeping, drawings, data books
- Fees, land purchase, way leaves
- Overheads
- Risk

The costs excluded from this paper include the following:

- Design costs incurred in RIIO-1
- Procurement costs incurred in RIIO-1
- Overhead and management costs incurred in RIIO-1

5. Project Definition

5.1. Supply and Demand Scenario Discussion and Selection

We have gone with the default assumption of current assumed proportion of methane CO2 in natural gas projected forwards due to uncertainties in the potential energy pathways and because this is reflective of the current gas quality legislation. However, we acknowledge that significant changes to gas demand or the allowed methane content of gas, for example due to the blending with or conversion to hydrogen, would impact the benefits of our investments.

This is a third party driven project and is therefore not due to increases in demand or large load application necessitating reinforcement of the high-pressure network. The affected high-pressure gas infrastructure provides a critical feed to the surrounding area and cannot be removed in any demand scenario.

Austhorpe Lane considers additional capacity to future proof the network in advance of the East Leeds Development Plan, an ongoing extension of domestic and commercial properties to the North East of Leeds. All reinforcement works are designed to our 10-year demand forecast model, in this instance capacity can be accounted for in detail design, preventing the need for retrospective reinforcement.

5.2. Project Scope Summary

The scope and directive for the TransPennine electrification project is to ensure all gas infrastructure has been addresses in advance of Network Rail undertaking the electrification and track widening scheme.

Ridge Road

A 610mm (24" N.B) 38bar steel overcrossing spanning 20m over Network Rail East Coast Main Line. The crossing is immediately adjacent to a road bridge but not attached.

Ridge Road 17bar 610mm overcrossing

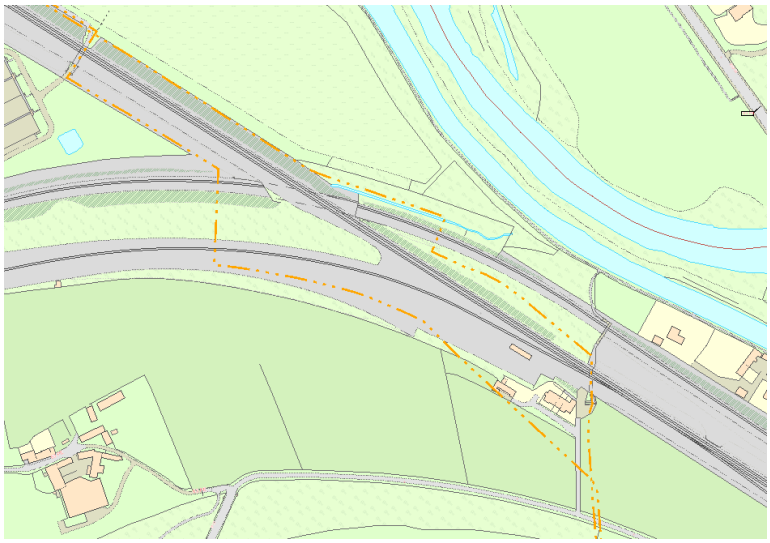
Austhorpe Lane

A 457mm (18" N.B) 17bar steel overcrossing spanning 15m over Network Rail East Coast Main Line. Supported on towers either side of the rail lines and is adjacent to a road bridge but is not attached to it. Close to residential properties at both sides of the single-track road bridge, the property boundary on the north side is 3.8m from the pipeline with building line at 8m from the pipeline.

Austhorpe Lane 17bar 457mm overcrossing

Dewsbury - Huddersfield

There are many distribution and transmission crossings along the TransPennine route between Dewsbury and Huddersfield that will be impacted by the proposed works. A key area of focus is a 3-lane junction in which a 610mm (24" N.B) 38bar and a 457mm (18" N.B) 17bar pipelines cross all tracks. Construction works and widening of the land corridor will likely have a significant impact on gas infrastructure in this area. There is an additional high-pressure spur feeding Thornhill Power station that will also be impacted by the proposed works



Rail junction with 17bar Dewsbury – Hartshead moor and 38bar Hopton Top – East Bierley pipelines

19 bar spur feeding Thornhill Power station in proximity to Ravensthorpe train station upgrade works

6. Options Considered

In general, there are several options available to us in relation to removal or diversion of a section of our pipelines. These options are detailed below.

6.1. Option Summary

6.1.1. First Option Summary – Do Nothing

A 'do nothing' option would mean the electrification project could not proceed. In addition, failure to adhere to the removal notice would be in breach of the National Agreement and we would be susceptible to legal proceedings and associated fines. A potential outcome of failure to adhere would be a negative impact on our rights under the national agreement, putting all gas infrastructure assets on Network Rail land at risk.

As the removal of the crossings is critical to the electrification project it is likely that legal proceedings would be undertaken to enforce the notice, in this event the work would need to be undertaken.

6.1.2. Second Option Summary – Diversion in existing location

This option considers a 'like-for-like' replacement of the pipeline crossing under the rail line as opposed to over. Utilising a shaft and micro-tunnel methodology with a stopple and bypass operations of the existing crossing, a localised diversion of the pipeline would allow for decommission and removal of the overcrossing without the need for a supply interruption.

6.1.3. Third Option Summary – Large Scale Diversion

If the current crossing location is not viable for any reason e.g. population density, Network Rail restrictions etc. a larger diversion may be required. This would be largely like a localised diversion in terms of crossing methodology, however installation of larger sections of pipelines would be necessary to span between the existing and new crossing points, and back. These may also be

achieved through large scale diversion between separate pipelines to provide the supply currently achieved through a rail crossing.

6.1.4. Fourth Option Summary – Network Reconfiguration

In some instances, it may be feasible to invest in new assets to remove the requirement for a rail crossing. As the network is comprised of cascading pressure reduction from offtake (70bar) to service (19mbar), there is potential to provide a new supply into an area currently fed via a rail crossing through installation of a new pressure reduction station (PRS). This option is contingent on a higher-pressure tier source being available within a reasonable proximity to the network. A new PRS would feed into the lower pressure tiers, effectively replacing the supply provided by the high-pressure rail crossing.

6.1.5. Fifth Option Summary – Protection and Mitigation

If the location pipeline or main meets all engineering standards there may be no requirement to move the asset to facilitate Network Rails' construction works. Instead protection of the existing pipeline or main may be enough. Protective assets can be wide ranging depending on the application, but often prove a cost-effective solution whilst still ensuring asset integrity. An example of asset protection is the installation of concrete slabs above a pipeline to provide additional protection against high load transports.

6.1.1. Sixth Option Summary – Removal Only

Disconnection of each overcrossing from the high-pressure network, allowing the crossings to be removed. Due to the supply criticality of high-pressure transmission pipelines this is extremely rarely a viable option, and in the event, it is feasible to isolate a crossing the impact on security of supply and network operability would be severe. In the instance of the overcrossings impacted by this scheme removal only is not a viable option and has therefore been discounted from the subsequent sections of this paper.

6.1.2. Option Summary Matrix

We have reviewed each of our assets which will be impacted by Network Rails Electrification project and developed a matrix which shows which of the above options are potential solutions to the problem.

Pipeline	**Option**					
	1	2	3	4	5	6
Ridge Road						
Austhorpe Lane						
Dewsbury 17bar						
Dewsbury 38bar						
Thornhill Spur 19bar						
Distribution crossings						

As this is a third party driven project, the preferred option will be that which proves most cost effective to meet the required objective, while ensuring security of supply for our network.

6.2. Option Cost Estimate Details

Cost estimates for the plausible options are detailed below:

Ridge Road: Option 2 – Diversion in existing location

Item	Description	Cost Estimate
Engineering Design	Detailed design	£71,899
	Environmental investigations	£12,110
	G17 appraisals	£5,000
Project management	Included in overhead	£0
Materials	Pipe	£280,000
	Fittings	£50,000
	Valves	£52,488
	Furminite	£110,000
Main Works Contractor	Prelims	£17,803
	Site Establishment	£514,192
	Enabling Works	£448,208
	Civils Works	£123,704
	Diversion Works (inc stopple bypass ops)	£1,020,198
	3rd Party installer assistance	£126,300
Specialist Services	Launch and reception shaft	£610,900
	Tunnel install	£437,540
	Backfill	£140,197
	Pipeline NDT	£137,078
	ILI operation post commission	£15,214
	Track monitoring	£42,212
Direct Company Costs	Direct labour costs	£10,000
	Records production	£12,000
	Land purchase	£106,000
Indirect Company Costs	Overheads	£1,050,608
Contingency		£425,384
Total Installed Cost		**£5,819,035**
Cost Estimate Accuracy		90%

Ridge Road: Option 3 - Large scale diversion

Item	Cost Estimate
Engineering Design	£230,000
Project management (incl. Indirect Company Costs)	£0
Materials	£2,737,283
Main Works Contractor	£4,285,000
Specialist Services	£831,233
Vendor Package costs	£0
Direct Company Costs	£470,000
Indirect Company Costs	£2,797,685
Contingency	£1,135,120
Total Installed Cost	**£12,486,321**
Cost Estimate Accuracy	75%

Austhorpe Lane: Option 3 - Large scale diversion

Item	Cost Estimate
Engineering Design	£110,000
Project management (incl. Indirect Company Costs)	£0
Materials	£2,050,500
Main Works Contractor	£3,600,000
Specialist Services	£316,233
Vendor Package costs	£0
Direct Company Costs	£350,000
Indirect Company Costs	£1,597,685
Contingency	£642,673
Total Installed Cost	**£8,667,092**
Cost Estimate Accuracy	75%

Austhorpe Lane: Option 4 - Network reconfiguration

Item	Description	Cost Estimate
Engineering Design	Detailed design	£145,000
	Environmental investigations	£20,000
	Post contract design support	£6,000
	Stress analysis	£3,000
	E&I Design and Approval	£90,000
	G17 appraisals	£8,500
Project management	Included in overhead	£0
Materials	Pipe	£1,050,000
	Fittings	£245,000
	Valves	£640,000
	Filters	£120,000
	Heat exchanger skid	£200,000
	Regulators	£450,000
	Metering	£150,000
	Accoustic kiosk	£50,000
	Skid units	£290,000
	Boiler package	£200,000
	Kiosks	£62,000
Main Works Contractor	Prelims	£120,000
	Construction Management	£215,000
	Fabricate & Install	£1,345,000
	Coating & painting	£190,000
	Connections	£95,000
	3rd Party installer assistance	£25,000
	Commissioning assistance	£55,000
	Holder demolition	£400,000
	Demolition of buildings	£40,000
Specialist Services	Functional Safety Assessments	£20,000
	Construction Supervisor	£70,000
	CDM	£27,000
	SPI	£28,000
	Radiography	£19,000
	Hydro testing	£18,000
	Hot tap (weld & drill inc materials)	£140,000
	Equipment disposal & waste	£120,000
Vendor Package costs	E&I Procure and Install	£330,000
	Cost control	£53,500
Direct Company Costs	Direct labour costs	£20,000
	Records production	£12,000
	Land purchase	£120,000
Indirect Company Costs	Overheads	£1,743,043
Contingency		£719,200
Total Installed Cost		**£9,654,243**
Cost Estimate Accuracy		90%

Dewsbury 17bar: Option 2 – Diversion in existing location

Item	Description	Cost Estimate
Design	Detailed design	£113,223
	Environmental investigations	£62,981
	G17 appraisals	£5,000
Project management, Supervision and Administration	MWC Project Management	£257,338
	NGN Project Management	£53,377
	Site Supervision	£170,820
Construction Works	Access Track	£121,429
	Site accommodation, welfare and security	£188,729
	Site Establishment	£112,176
	Enabling Works	£110,508
	Directional Drilling	£524,949
	Open Cut Diversion Works	£744,244
	Hot Tap	£96,890
	Minor Works	£67,901
	Grouting	£45,846
	Inline Inspection	£51,538
Other Costs	Direct Labour	£68,505
	Specialist Support	£181,683
	Records Production	£12,314
Indirect Company Costs	Overheads	£724,519
Contingency		£298,945
Total Installed Cost		**£4,012,917**
Cost Estimate Accuracy		75%

Distribution crossings: All Options

Item	Cost Estimate
Design, Procurement & Build	£1,250,000
Overheads	£275,407
Total Installed Cost	**£1,525,407**
Cost Estimate Accuracy	50%

6.3. Option Summary

Summary of all cost estimates below for simple comparison:

Ridge Road

Option	Start Date	Comm. Date	Design Life	Annual Operating Cost	Installed Cost
Option 2 - Diversion in existing location	2021/22	2022	40+ years	£0.01m	£5.8m
Option 3 - Large scale diversion	2021/22	2022	40+ years	£0.01m	£12.5m

Austhorpe Lane

Option	Start Date	Comm. Date	Design Life	Annual Operating Cost	Installed Cost
Option 3 - Large scale diversion	2022/23	2023	40+ years	£0.02m	£8.7m
Option 4 - Network reconfiguration	2022/23	2023	40+ years	£0.01m	£9.7m

Dewsbury 17bar

Option	Start Date	Comm. Date	Design Life	Annual Operating Cost	Installed Cost
Option 2 - Diversion in existing location	2021/22	2023	40+ years	£0.01m	£4.0m

Distribution Crossings

Option	Start Date	Comm. Date	Design Life	Annual Operating Cost	Installed Cost
All Options	2021/22	2023	40+ years	£0.01m	£1.5m

7. Business Case Outline and Discussion

7.1. Key Business Case Drivers Description

As the project driver is third party, driven through a legal requirement to remove the rail crossings, each option is assessed on a value for money basis.

Ridge Road

Discounted Options

Option 1 - Do Nothing – Not adhering to Network Rails removal notice would be in breach of the National Agreement between gas distributors and Network Rail, potentially leading to legal action, fines and enforcement of the notice.

Option 4 - Network Reconfiguration – Ridge Road overcrossing is a single feed high pressure pipeline with no opportunity to reinforce the network elsewhere to remove the need for the overcrossing or diversion.

Option 5 - Protection and Mitigation – An overcrossing directly impacts Network Rails ability to install overhead power cables for electrification. These is no means of protecting the asset or mitigating its impact on the electrification project while the overcrossing is in situ.

Option 2 - Diversion in existing location

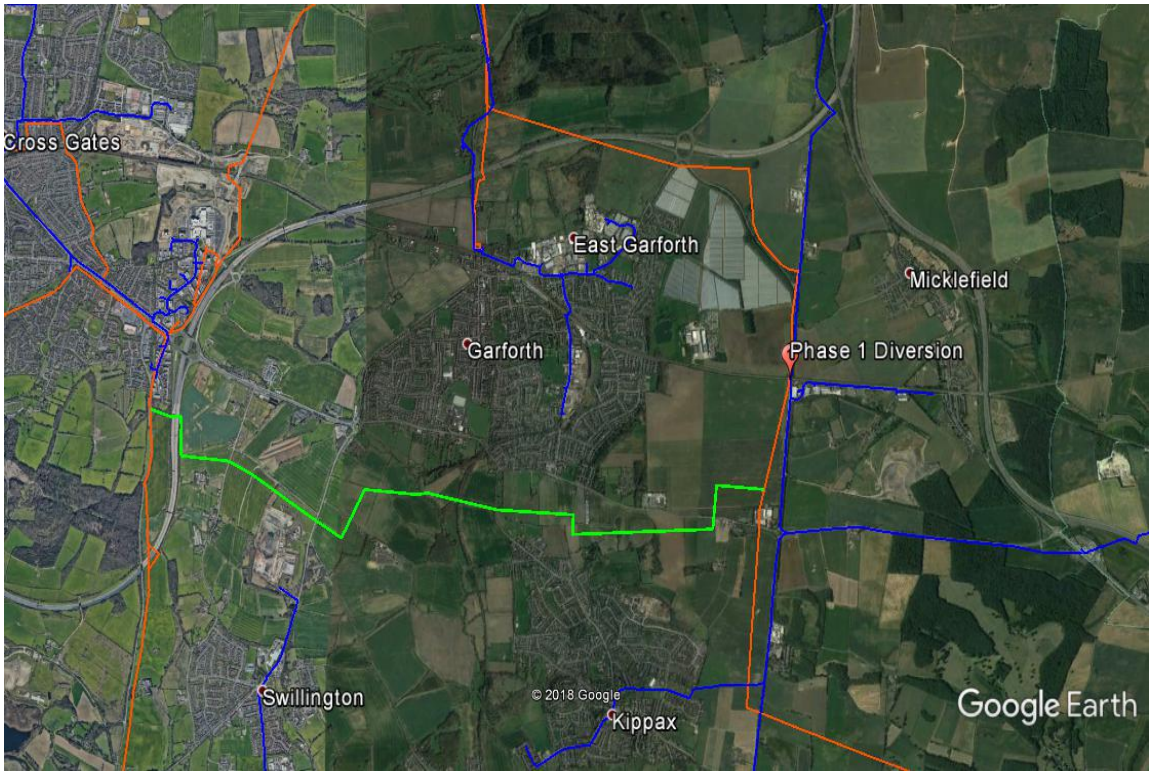
This option provides a 'like-for-like' replacement of the pipeline crossing under the rail line as opposed to over. Utilising a shaft and micro-tunnel methodology with a stopple and bypass operations of the existing crossing, a localised diversion of the pipeline would allow for decommission and removal of the overcrossing without the need for supply interruption.

The diversion would include 250m of 610mm (24" N.B) steel pipe to ensure sufficient clearance down the embankments and under the rail as per Network Rail and our standards. Launching and receiving shafts of c.14m depth would be constructed on each side of the railway, with a microbore tunnel drilled perpendicular to the rail line between the shafts. The pipeline would be installed down the shafts and through the tunnel using a pipe jacking methodology, connecting to the live pipeline through a hot tap and stopple operation. Once the new pipeline had been commissioned, the existing overcrossing can be decommissioned through a flow stop operation and removed. The surrounding area provides a suitable project lay down area that simplifies the required work and minimises the disruption caused by large construction projects.

Design and pipe procurement have already been completed for this option, reducing timescales for implementation. If the removal notices were enforced and a timescale of 12 months were given (as per the National Agreement), this project scope could be completed.

Option 3 - Large scale diversion

As the pipeline is a single feed, to remove the overcrossing, supply must be maintained either from the nearest existing offtake or nearest high-pressure pipe. The closest proximity secondary supply point would require the installation of a new high-pressure pipeline to connect to a separate high-pressure system. Routing estimates have determined that this pipeline would be a minimum of 5km of 24" 38bar steel pipeline across several major roadways and rural countryside. This option does not provide any additional benefit of security of supply as it would remain a single feed.



Approximate pipeline routing (green) between existing high-pressure pipelines (orange).

Recommendation

Diversion under the rail track in the existing location is less than half the cost of large-scale diversion project. Therefore, our preferred option is Option 2 – diversion in existing location as it provides the best value for money to deliver the project objectives.

Austhorpe Lane

Discounted Options

Option 1 - Do Nothing – Not adhering to Network Rails removal notice would be in breach of the National Agreement between gas distributors and Network Rail, potentially leading to legal action, fines and enforcement of the notice.

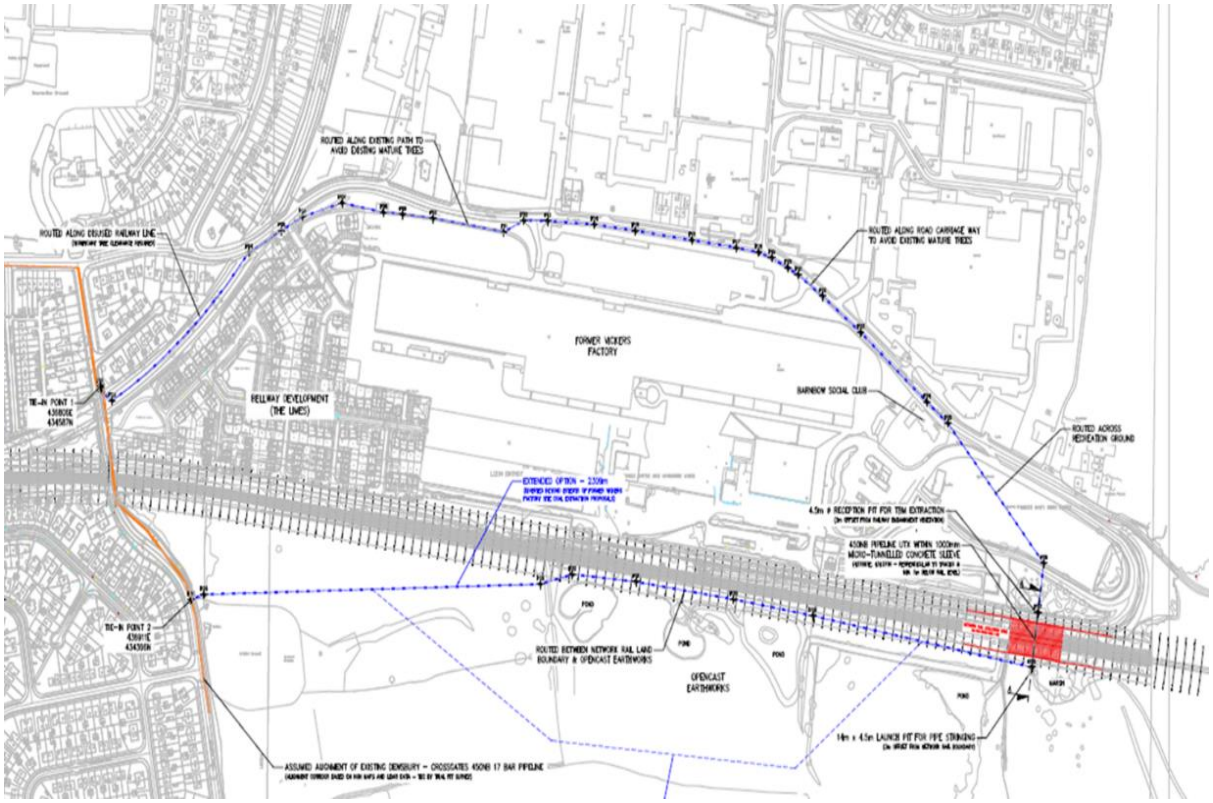
Option 2 - Diversion in existing location – Austhorpe Lane overcrossing is situated within a densely populated sub-urban area with a domestic and commercial properties within proximity of the crossing. National Rail engineering standards dictate that any below ground crossing of rail lines must be perpendicular to the tracks. Due to the location properties in the area, a crossing in the existing location is not feasible or constructible as any launch or receiving shaft would directly intersect multiple domestic properties

Option 5 - Protection and Mitigation – An overcrossing directly impacts Network Rails ability to install overhead power cables for electrification. These is no means of protecting the asset of mitigating its impact on the electrification project while the overcrossing is in situ.

Option 3 - Large scale diversion

This option considers diversion of the pipeline to an area acceptable to Network Rail for a below ground perpendicular rail crossing. A proposed 3km route gives an acceptable crossing position to

Network Rail but is subject to NRSWA restrictions for half of its length, may not be acceptable to landowners and crosses an area of previous open cast mining where ground conditions are untested but known to cause engineering difficulty.



Approximate pipeline diversion routing (blue) from existing pipeline (orange).

This project would cause major disruption to the local area in which multiple developments are programmed for the coming years, which could discount this routing as an option. This would also necessitate the installation of a new high-pressure pipeline within proximity of domestic residences, commercial properties and within the land corridor of the East Coast Main Line, all practices that are typically avoided if possible.

As is the case with the crossings under the National Agreement, any diversion that included an easement through Network Rail land would be subject to a lift and shift clause, while Network Rail also reserve the right to reject the proposed plan from the outset. As the proposed electrification works are major construction projects, it is unlikely Network Rail would allow a new pipeline within the land corridor of their works as this would constitute a significant increase in construction risk.

Option 4 - Network reconfiguration

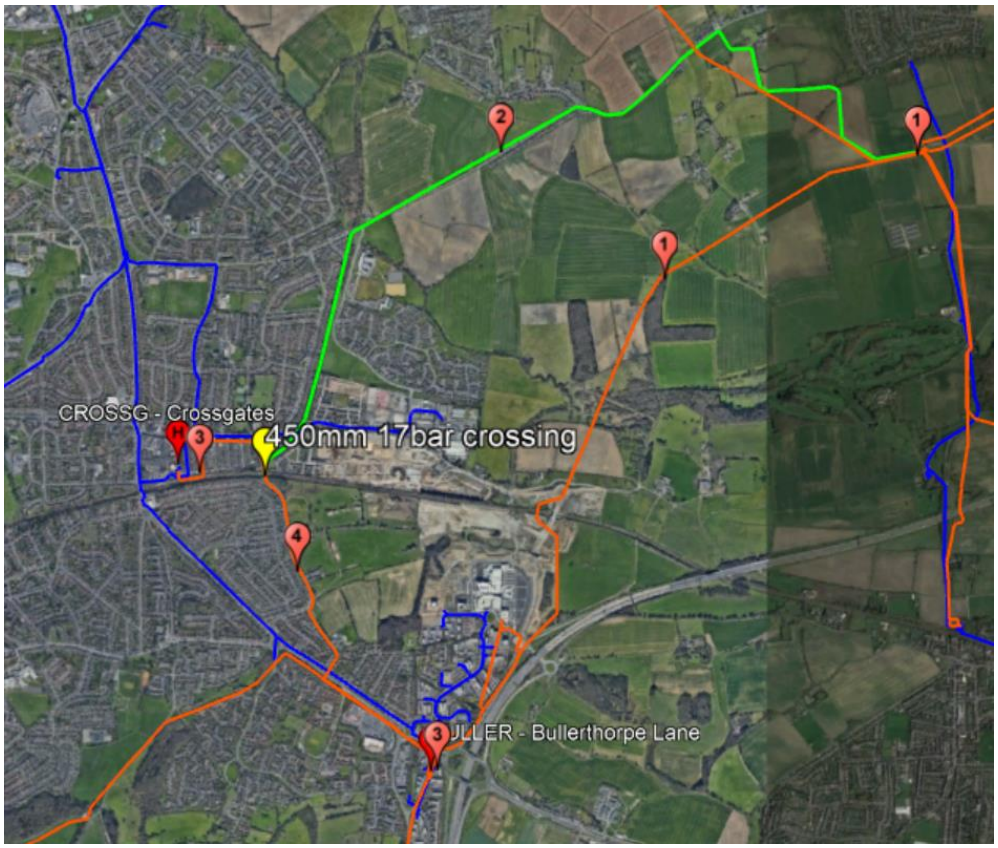
This option requires construction of a new Pressure Reduction Station (PRS) to the east of the existing crossing in a rural location with pressure reduction from 38-17bar and 17-6.9 bar. The new PRS will provide a 6.9bar feed into the area currently supplied via the overcrossing. This project will be completed across 4 phases:

1. Installation of a 38-17bar and 17-6.9bar pressure reduction station, downrating 38bar pipeline into Leeds to 17bar.

2. Intermediate pressure reinforcement into network currently fed by Crossgates PRS, downrating final section of HP pipeline into the site to limit necessary reinforcement and utilise existing assets.

3. Downrating of 38bar into Leeds (1) removes the needs for Bullerthorpe Lane PRS, this site can be decommissioned and removed (3). IP reinforcement into Crossgate (2) removes the need for Crossgates 19-2bar PRS, this site can be decommissioned and replaced with 6.9-2bar district governor.

4. The 19bar pipeline feeding Crossgates PRS is no longer necessary, this can be decommissioned and grouted (4), with the 450mm overcrossings removed



Intermediate Pressure pipeline reinforcement will allow for the decommissioning and rationalisation of two other PRS sites situated nearby in urban locations and removal of a high-pressure pipeline in a highly populated domestic area. The replacement of Crossgates PRS with a district governor will allow a complete rationalisation of the existing site footprint as the smaller pressure cut means there is no requirement for pre-heating or telemetry on site.

There are several influencing factors that have been incorporated in the assessment and development of this option:

- The East Leeds Development Plan is an on-going extension of domestic and commercial properties to the North-East of Leeds. This plan incorporates major infrastructure, commercial, social and housing improvements to the east of Leeds and again offered options to future proof the gas supply system. Provision of additional capacity whilst completing the objectives of the TransPennine rail project through this project will offset further reinforcement as the development comes to fruition. Liaising with Leeds County Council in this matter has provided a

valuable input in pipeline routing and PRS location optioneering, but also the benefits which come from local cooperation / coordination and shared vision.

- Two PRS's will be rationalised as part of this scheme, that would otherwise require further investment due to asset health. The requirement for ongoing maintenance as well as future capital investment for these two sites will be removed as part of this option.

Cost Benefit Analysis of Options 3 and 4

We have undertaken a Cost Benefit Analysis for Austhorpe Lane to consider the Net Present Value of Options 3 and 4. The baseline or 'do nothing' position has been calculated as an estimate of the legal fees, fines and project delay charges. All the assumptions and values that have been used in our Cost Benefit Analysis are derived from our Value Framework which uses industry recognised metrics and where appropriate, and there is supporting evidence, value specific to our business.

Option	Total Forecast Expenditure (£m)	NPVs (relative to baseline, £m)						Preferred Option
		2030	2035	2040	2050	2060	2070	
Option 3 - Large scale diversion	£9.8	3.1	2.4	2.0	1.5	1.3	1.3	N
Option 4 - Network reconfiguration	£9.7	3.6	3.1	2.7	2.4	2.3	2.3	Y

Option 3 retains two above ground PRS's with deteriorating asset health that will require intervention in RIIO-2 at a cost of c.£1m per site. In addition, this option considers the ongoing maintenance of both PRS's, inspection requirements for the existing 3km of high-pressure pipeline and the risk of unviability of the diversion due to Network Rail approval.

Option 4 necessitates a larger initial capital investment, when future operational and capital costs are considered the whole life cost benefit of reconfiguration outweighs the additional frontend investment, making this option the most cost effective. This option delivers a higher Net Present Value in every year when compared to Option 3.

Recommendation

Network reconfiguration necessitates a larger initial capital investment, when future operational and capital costs are considered the whole life cost benefit of reconfiguration outweighs the additional frontend investment, making this option the most cost effective.

Dewsbury 17bar

Discounted Options

Option 1 - Do Nothing – Due to the proximity in which the pipeline run parallel to the existing rail lines the tracks could not be widened without breaching both IGEM and Network Rail engineering standards stating all rail crossings must be perpendicular to track direction. The minimum wall thickness required following major upgrade works to traffic route crossings (inc rail lines) is 11.9mm, this pipeline has a wall thickness of 10.3mm and would no longer be compliant following the rail upgrade.

Option 3 - Large Scale Diversion – As it has been determined that a local diversion is a viable option there is no requirement to consider a large-scale diversion.

Option 4 - Network Reconfiguration –This pipeline contributes a critical feed within the central and western high-pressure system, there is no other feasible means of reconfiguring the network to provide a feed without crossing the rail lines at a separate location at higher cost.

Option 5 - Protection and Mitigation – Following a track extension, the lines would run directly over the top of this pipeline for c.100m, increasing risk and in contravention of IGEM standard TD/1 and National Rail guidelines. Due to the lift and shift clause applicable to pipeline within network Rails land boundary, there is no protection or mitigation that would provide a satisfactory assurance of safety.

Option 2 Diversion in existing location

This option provides a 'like-for-like' replacement of the pipelines crossing under the rail line. Due to the early stages of scoping the diversionary works the construction methodology is still to be decided however the estimate is based on horizontal directional drilling (HDD) which is Network Rail's preferred method of drilling under their tracks and is the most cost-efficient drilling method. Diversion in the existing location is seen as the most cost-effective means of protecting the assets and ensuring the electrification project can proceed.

Dewsbury 38bar

Option 1 – Do Nothing

Due to the proposed Network Rail construction works and current configuration of the 38bar East Bierley to Hopton Top pipeline, we believe intervention is not necessary. This pipeline is constructed in heavy wall pipe with enough clearance beyond the track boundaries to mitigate the need for diversion. As we have considered a do-nothing option is plausible, no further options have been considered or costed.

Thornhill Spur

Option 1 – Do Nothing

Due to the proposed Network Rail construction works and current configuration 19bar Thornhill Spur, we believe intervention is not necessary. This pipeline is constructed in heavy wall pipe with enough clearance beyond the track boundaries to mitigate the need for diversion. As we have considered a do-nothing option is plausible, no further options have been considered or costed.

Distribution Crossings

All Options

There are over 20 lower pressure crossings (intermediate, medium and low pressure) both within bridge structures crossing over the top of the TransPennine railway line and within the roads which cross below the railway line. Due to the varied nature of the distribution network, all options could be considered. Where existing crossings can be incorporated into the design for major bridgeworks along the route this will be progressed as third-party refundable projects however we would expect a cost for NRSWA discounts. Where no work is required this will be the preferred option, however as a minimum we would normally expect to have to install asset protection whilst the works are ongoing or as a permanent feature but will be dependent on agreements with Network Rail. As the lower pressure tiers offer cost effective network reconfiguration options we expect that this will form the most part of the works to facilitate the decommissioning and demolition of the rail

crossings. Where this is not an option or is more costly, we will divert the mains. As lower pressure diversions are less complicated and expensive than high pressure diversions, we will manage these works within this budget and accept the risk where the diversionary works are more extensive than expected.

7.2. Supply and Demand Scenario Sensitivities

We have gone with the default assumption of current assumed proportion of methane CO2 in natural gas projected forwards due to uncertainties in the potential energy pathways and because this is reflective of the current gas quality legislation. However, we acknowledge that significant changes to gas demand or the allowed methane content of gas, for example due to the blending with or conversion to hydrogen, would impact the benefits of our investments.

This is a third party driven project and is therefore not due to increases in demand or large load application necessitating reinforcement of the high-pressure network. The affected high-pressure gas infrastructure provides a critical feed to the surrounding area and cannot be removed in any demand scenario.

Arup conducted analysis on the potential benefits of our H21 Programme (see A13 - NGN RIIO-2 Consumer Value Proposition) that showed 45% of the gas in our network is expected to be Natural, 15% biomethane and the remaining 40% hydrogen by 2040; due to a combination of blending and sub-areas of our networks being fully converted. This is consistent with Net-zero by 2050 aligned with the ENA Navigant report.

We have not explicitly modelled changes in the methane content of gas in our CBAs, as overall gas demand and the change in C02 content of the gas is not expected to be different enough to materially impact the NPV, Payback & Option Ranking of our preferred investment programme. This is because carbon risk benefit is only one element of overall risk benefit and this will be reduced by up to 40% by 2040 across all scenarios if the ambitious but realistic ENA Navigant report pathway is chosen. Our chosen programme represents value for money over a 20-year period regardless and is mainly driven by customer benefits such as avoiding loss of supply. The investments also ensure that we are compliant with relevant legislation. Our strategy therefore represents a no regrets investment programme that is consistent with net zero and will deliver value to customers whether a hydrogen or electrification pathway is chosen.

7.3. Business Case Summary

The only scheme which was further considered via a Cost Benefit Analysis was Austhorpe Lane. The results for this analysis are shown below and discussed in section 7.1 above.

8. Preferred Option Scope and Project Plan

8.1. Preferred Option for this Request

Ridge Road: Localised diversion

The preferred option for Ridge Road is localised diversion along the existing easement. This is the most cost-effective solution to remove the high-pressure overcrossings while maintaining supply to c.100,000 customers.

Alternative options present an alternative means of meeting the project objectives, however at significantly higher cost. As this is a third party funded project the option that provides the greatest value for money or can achieve the necessary objectives for the least cost, is preferred.

Austhorpe Lane: Network reconfiguration

The preferred option for Austhorpe Lane is network reconfiguration. Installation of a new PRS and rationalisation of the surrounding network provides a significantly greater benefit and value for money than a large diversion to maintain supply.

Dewsbury 17bar: Localised diversion

The preferred option for Dewsbury 17bar and 38bar pipelines is localised diversion. This is the most cost-effective solution to mitigate the impact of our assets on the electrification project.

Dewsbury 38bar: Do nothing

Due to the construction and current routing of the 38bar East Bierley – Hopton Top pipeline a do-nothing approach is the preferred option. The construction of the pipeline meets current engineering standards around upgrade works to traffic route crossings. We are accepting of the risk that works may be required if the scope of works changes.

Thornhill Spur 17bar: Do nothing

The preferred option for Thornhill Spur is to do nothing. Based on the current scope of works and construction of the pipeline. We believe intervention will not be necessary and the current configuration of the pipelines will not impact Network Rails ability to upgrade their assets. We are accepting of the risk that works may be required if the scope of works changes.

Distribution Crossings: All Options

As all options are plausible and we have not undertaken detailed design and optioneering we are proposing a lump sum to cover the risk of undertaking any works on these crossings.

8.2. Project Spend Profile

Project (£m)	RIIO-1 Total	2021/22	2022/23	2023/24	2024/25	2025/26	RIIO-2 Total	Total Project Cost
Ridge Road	**£0.6**	£1.0	£1.5	£1.6	£1.1	£0.0	**£5.2**	**£5.8**
Austhorpe Lane	**£0.5**	£0.5	£2.0	£3.5	£2.3	£0.9	**£9.2**	**£9.7**
Dewsbury 17bar	**£0.2**	£0.5	£1.5	£1.4	£0.4	£0.0	**£3.8**	**£4.0**
Dewsbury 38bar	**£0.0**	£0.0	£0.0	£0.0	£0.0	£0.0	**£0.0**	**£0.0**
Thornhill Spur	**£0.0**	£0.0	£0.0	£0.0	£0.0	£0.0	**£0.0**	**£0.0**
Distribution Crossings	**£0.2**	£0.4	£0.5	£0.4	£0.0	£0.0	**£1.3**	**£1.5**
Total	**£1.5**	**£2.4**	**£5.5**	**£6.9**	**£3.8**	**£0.9**	**£19.5**	**£21.0**

The total forecast capital expenditure for TransPennine can be referenced back to the following documents:

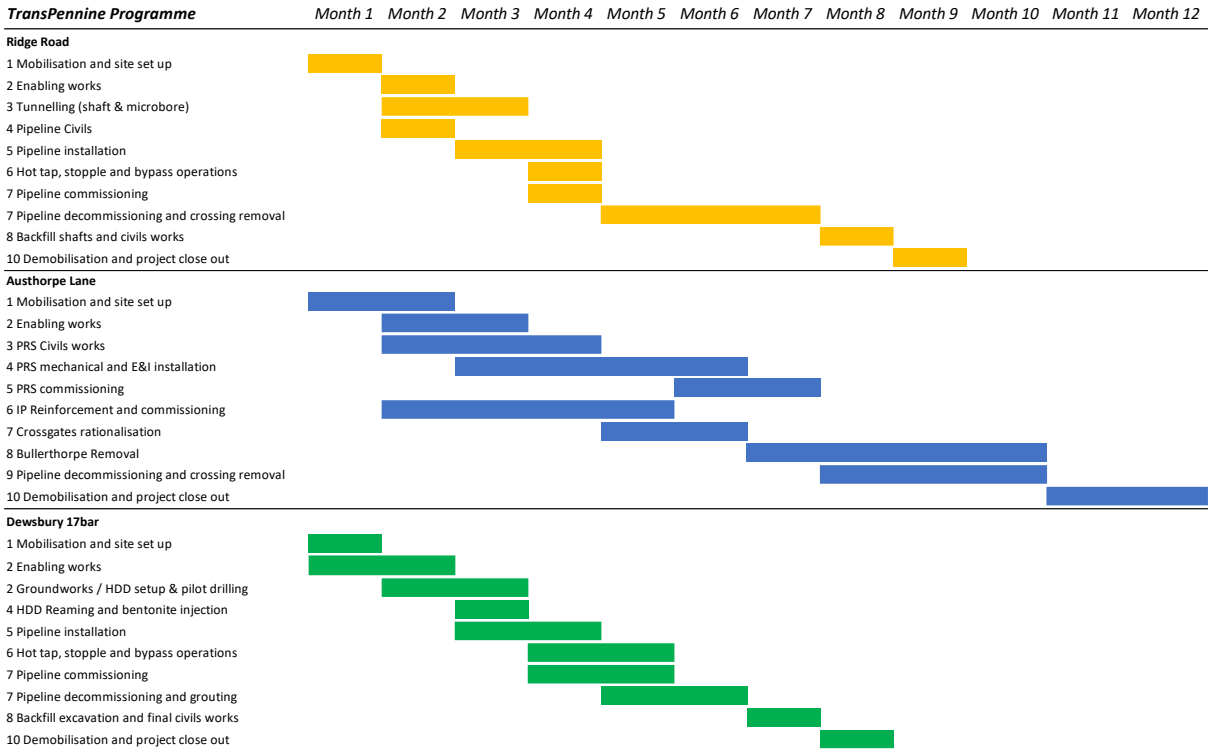
- RIIO-2 Business Plan – Tables 6.3
- RIIO-2 Business Plan Data Tables – Table 3.01
- A23.F - NGN RIIO-2 Investment Decision Pack – TransPennine - CBA

8.3. Efficient Cost

We have a high performing procurement team who follow best practice in market tendering as set out in our Procurement Policy. We have a framework of main works contractors who have experience of working within the gas industry and on our assets and a supplier database where we can request quotes for goods and services. All purchases over £10,000 are market tested.

If contracts are not managed effectively then efficiencies delivered from the procurement process can soon be eroded, service standards diminished, and outputs not delivered. We have a well established and experienced team including project managers, quantity surveyors, programme managers, health & safety and environmental managers who ensure the project is delivered on time, to standard and within cost.

8.4. Project Plan



8.5. Key Business Risks and Opportunities

a) What changes to the system operation or supply/demand scenario are required to alter the outcome of this justification paper?

Due to the nature of the pipelines only a significant and immediate reduction in demand levels would alter the requirement for high pressure reinforcement to remove the crossings. A range of alternative system arrangements have been explored to determine alternate feed options, due to the closed nature of these systems no viable alternative was found.

Ridge Road – Risk Register

A detailed design has been completed however prior to issuing a construction tender we have not developed a risk register. At this stage as the scope has not been finalised, we have included a 10% risk provision in the costings. This percentage is an industry excepted risk figure at this stage of the project.

Austhorpe Lane – Risk Register

As we do not currently have a detailed design for this stage of project, we have not developed a risk register. At this stage as the scope has not been finalised, we have included a 10% risk provision in the costings. This percentage is an industry excepted risk figure at this stage of the project.

Dewsbury 17bar – Risk Register

As this element of the TransPennine Electrification has recently been developed as project scope and risk register have not been completed. At this stage as the scope has not been finalised, we have included a 10% risk provision in the costings. This percentage is an industry excepted risk figure at this stage of the project.

8.6. Outputs included in RIIO-1 Plans

As a third-party driven project this scheme was not incorporated in the RIIO-1 business plan and no outputs are associated with delivery. As timescales for delivery of the project from initiation to construction are determined through a removal notice pending negotiation, early project stages are being complete in advance of RIIO-2.

Detailed design of both phases will be complete as well as partial procurement of certain long-lead items for Ridge Road. This will allow the diversion to be delivered within the initial 12-month timescale as determined in the removal notices, Austhorpe Lane will be completed in the subsequent 12 months dependent on the electrification project phasing. The scope of works can be finalised for the Dewsbury – Huddersfield works pending the out of Network Rails application to the Secretary of State for Transport. Once

The projects will be progressed as far as possible within RIIO-1 until confirmation is received that the electrification project is certain to go ahead and the diversions necessary, however no additional funding is being requested in RIIO-2 for the investment incurred during RIIO-1.