Leek – Stoke Strategic Outline Business Case

Restoring Your Railway Fund

November 2022

Final

Contents

Title page photographs:

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Version Control

Version No.	Date	Created/Modified by	Notes
V.01	30.09.2022	Mark Beckett James Jackson John Donaghy	Working draft for comments by client group
V1.0	24.10.2022	Mark Beckett James Jackson John Donaghy	Incorporating comments made by Client Group, MPs, Network Rail, Northern Railway and Aggregate Industries
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Final	24.11.2022	Mark Beckett	Incorporating minor amendments for final issue

Executive Summary

This Strategic Outline Business Case (SOBC) was commissioned by Staffordshire Moorlands District Council and Stoke-on-Trent City Council with the support of the Department for Transport as a part of the latter's Restoring Your Railways initiative.

It seeks to address economic and social challenges in Stoke-on-Trent and the area to the east and north through a transport scheme to improve connectivity. The challenges it is seeking to address are:

- Poor transport connectivity in the Leek area
- Poor transport connectivity internal to the six Potteries towns, including access to the national rail network
- High car dependency in the target area despite c.30% of households having no car
- Deprivation in large areas of eastern and northern Stoke-on-Trent
- Widespread road congestion in the target area, which increases pollution and limits journey speeds
- Large lorries from Cauldon quarry on the local road network causing pollution, congestion and noise
- Poor access to tourist attractions in the Leek area
- Poor public transport access from north east Stoke-on-Trent to the education, skills and training hubs in the University Quarter adjacent to Stoke railway station

Poor transport connectivity, of course, limits access to jobs, education opportunities and heath care, as well as opportunities for active lifestyle and wellbeing. The scheme is focussed on delivering economic growth through addressing the challenges above. There are 73,155 people who would directly benefit (<0.5 miles) from a new public transport corridor (approximately 35,116 of whom are people living in Leek and the immediate rural Moorlands local to Stoke-Leek services). Approaching 100,000 people within Stoke-on-Trent city live within 1 mile of the corridor.

A number of options were assessed against how they would perform in addressing these challenges, including better bus services on existing networks and major infrastructure interventions such as guided busway, light rail and heavy rail solutions.

The solutions with the greatest potential to "make a big difference" were the heavy rail and light rail options. This is because they have the biggest impact on improving mobility through reducing travel times, allowing onward connections regionally and nationally, and because of the way a linear fixed network can encourage and support regeneration.

Because of the high expense of the infrastructure required, a particular focus has been placed on finding the "Minimum Viable Product" or MVP. This is the level of service that can achieve the objectives at lowest cost in a reliable and efficient way. The MVP should also be capable of being scalable over time to meet growing demand in order to achieve greater outcomes.

Through train service modelling we have identified a heavy rail MVP that would provide an hourly service between Leek and Stoke requiring one train and the minimum viable infrastructure to operate. The journey time has been assessed as c.23-25 minutes depending on the rolling stock used and the number of intermediate stations. At Stoke an additional platform is essential as the new service could not be accommodated in the existing platforms alongside other services.

The economic analysis, however, shows that better value for money is secured through the reinstatement of a rail freight service between Cauldon Quarry and the rest of the UK, in addition to the passenger service. The market for aggregates is growing, and some quarries closer to the sources of demand are closing or running down. Cauldon

is well placed to serve these markets via rail in a way that would either not be possible otherwise, or would cause environmental, air pollution and congestion problems if attempted by road.

The infrastructure cost of securing these benefits has been assessed at between £275m and £383m for the passenger railway with an incremental £47m for freight. A complete re-build of the railway is needed given the current state of the assets. The wide range of costs results from uncertainty around their state, and engineering judgements have needed to be made in advance of detailed surveys undertaken during further development.

The economic appraisal, based on mid-range costs, has the passenger service with a Benefit-Cost Ratio of 0.78 and a combined passenger and freight service of 1.02. Other, more expansive options, or light rail options (that would preclude freight services operating) have BCRs lower or ones similar to the heavy rail passenger option.

Although the upfront investment in infrastructure required to reinstate the railway is substantial, the fact that it can, on this initial appraisal, achieve a BCR of around 1, indicates that the operating position is healthy (ie is able to cover some of the capital costs). Our forecasts indicate passenger revenue of £5.2m pa by 2030 (in 2019 prices) compared to operating costs of £1.6m pa. This is passenger revenue for the UK as a whole, and illustrates how "contributory revenue" from people making longer distance journeys from the proposed route that would not otherwise have been made can help make the case (including onto HS2). Other options, including light rail, also show a positive net operating position.

Stoke-on-Trent City Council has announced concept plans for a metro network through the Potteries, including linking Hanley to Stoke railway station. The economic cases for a wider light rail network and for a very light rail option have not been assessed within the parameters of this work. However, should heavy rail solutions for the Leek route be considered undeliverable in the medium term, this SOBC supports the potential for the Leek route to be part of that metro network, but at the expense of the rail freight opportunity.

The conclusion from this SOBC, therefore, is that there are a number of potential options that would merit further development, subject to affordability. Further work would particularly focus on understanding the state of the current assets on the line, and the extent of intervention needed to bring them back into use. The close involvement of Network Rail as owner of the route will be particularly important, building on the excellent collaboration from them and the Train Operators delivered to date.

In summary, a re-opened public transport corridor would:

- Deliver against national and local strategic objectives to reduce road congestion; improve air quality and journey times; level up communities deprived on multiple measures; support productivity and business growth; and spur and unlock housing development, directly linking Local Plan-allocated housing sites to the rail network and onward access to centres of employment.
- Create a rail ink for one of the UK's largest cement quarries, removing potentially up to 80% of quarry freight from road journeys through Staffordshire Moorlands and Stoke-on-Trent conurbation and enabling higher levels of extraction to meet the supply needs of national infrastructure projects and UK house building.
- Provide direct public transport access from Stoke-on-Trent communities to recreational opportunities in the Peak District National Park, delivering a sustainable transport solution for the North Staffordshire visitor economy.
- Provide direct public transport from Leek and deprived communities within Stoke-on-Trent to further and higher education establishments.

Letters of support can be found at Appendix E.

November 2022

1. Introduction

This Strategic Outline Business Case is seeking to improve economic and social outcomes in the Stoke-on-Trent area through improving transport links between Leek and Stoke.

It was the subject of a successful bid under the Restoring Your Railways Fund submitted to Government in March 2021. This focused on re-opening the railway line between Leek and Stoke, which was closed to passenger traffic in 1956. Freight services to the Quarry at Cauldon using the line ceased in 1988. Since then much of the line has been left to decay. Sections between Endon, Leekbrook and Ipstones have been leased from Network Rail by the Churnet Valley Railway, and they operate heritage services along some of it. They have also secured planning consent for reinstatement of the line for heritage purposes to the outskirts of Leek.

The map below shows the line in question.

Key: Yellow = mothballed, Green = leased to Churnet Valley, and brown = the mothballed links to Cauldon Quarry and Leek. The red circles are potential locations for new stations under this scheme.

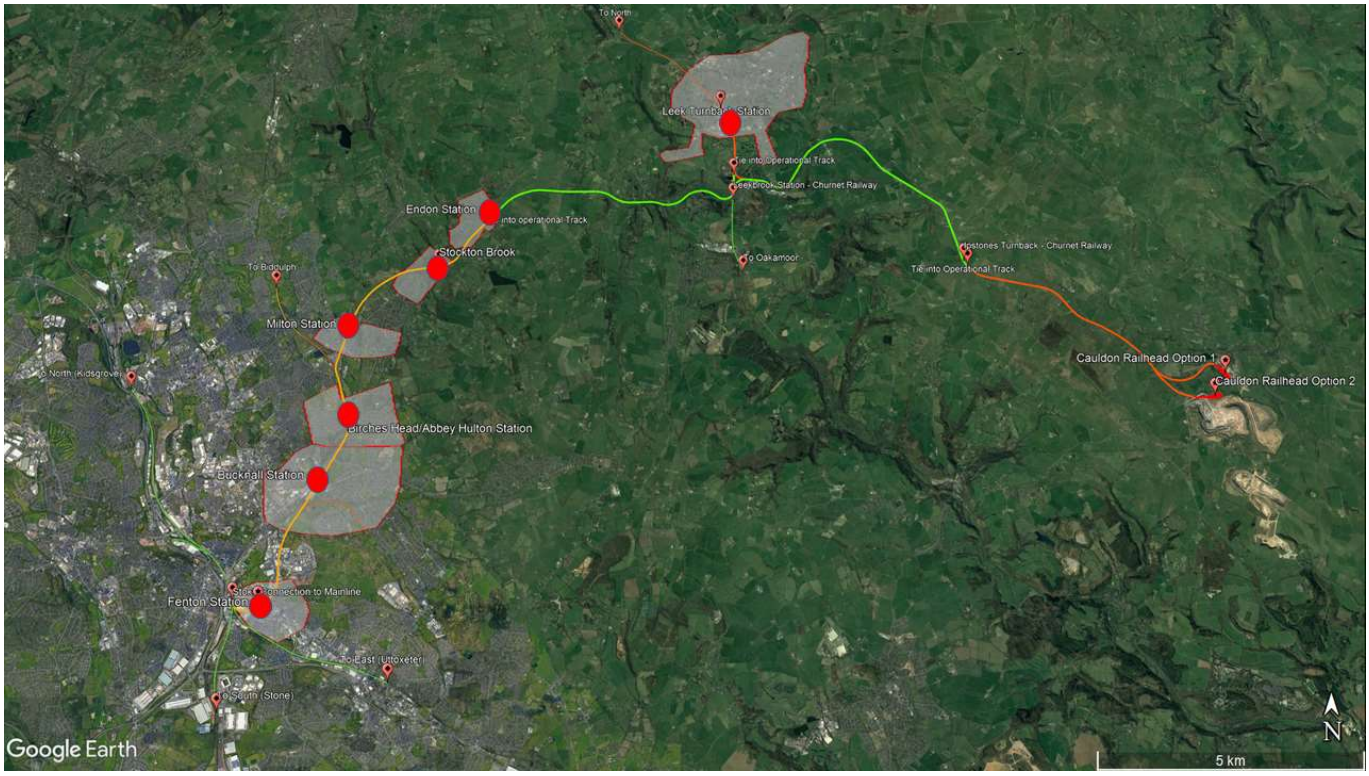


Figure 1 - Map of rail route. Google 2022 ©

In June 2022 Staffordshire Moorlands District Council, with the support of the DfT, commissioned a Strategic Outline Business Case (SOBC) to develop the case further, building on the comprehensive strategic narrative included within the Restoring Your Railways application. The SOBC was commissioned from SLC Rail and Systra. This work has particularly focused on three aspects:

- The operability of a new service between Leek and Stoke (this is dealt with in summary in section 2.9 of this report).
- The demand and economic appraisal (in chapter 3)
- The engineering and cost estimates for reinstatement (in chapter 4)

Otherwise, this report follows the prescribed format for SOBCs, based on the five case model, as adapted by the Restoring Your Railways guidance on production of an "SOBC-lite". Of necessity, given the stage of development of the project, the Commercial and Management cases are less well developed than the others, with key decisions still to be made about how the project will be managed and procured should it proceed to further development.

Whilst duplication with the Restoring Your Railways bid has been avoided as much as possible, this SOBC should be read in the context of that document, which is included at appendix D.

2. Strategic Case

2.1. Strategic Context

Whilst North Staffordshire is well connected to national infrastructure (the M6, A50, A500 and West Coast Mainline serve the city, and HS2 is set to enhance this national connectivity), the local connectivity within Stoke-on-Trent and North Staffordshire is very poor and there is no direct public transport from Leek, the largest town in the Staffordshire Moorlands, nor indeed from many of the communities on the proposed route, to Stoke-on-Trent railway station and the Civic Centre of Stoke-on-Trent. (N.B. Stoke-on-Trent is one modern city of six historic market towns. The Victorian railway station, Town Hall, Civic Centre, the main Sixth Form College and University Quarter are in Stoke Town, 1.3 miles from the modern-day City Centre –Hanley – home to the main retail centre, Cultural Quarter, main bus and coach station, and major development sites such as Smithfield and Etruscan Square.)

Both Stoke-on-Trent and Staffordshire Moorlands are Priority 1 authorities for the Government's Levelling Up Fund.

The transport challenges arising from the development of Stoke-on-Trent as a linear, polycentric, city are significant, which the DfT has recognised in awarding £29 million of TCF funding to Stoke-on-Trent to significantly improve inter-modal connectivity at the railway station and to deliver a fast public transport corridor, with bus priority, between the rail station at Stoke and the City Centre.

2.2. Problem Statements and Objectives

The following graphic identifies the key problems we are looking to address through this scheme, translated into a number of objectives for the funding from the RYR scheme.

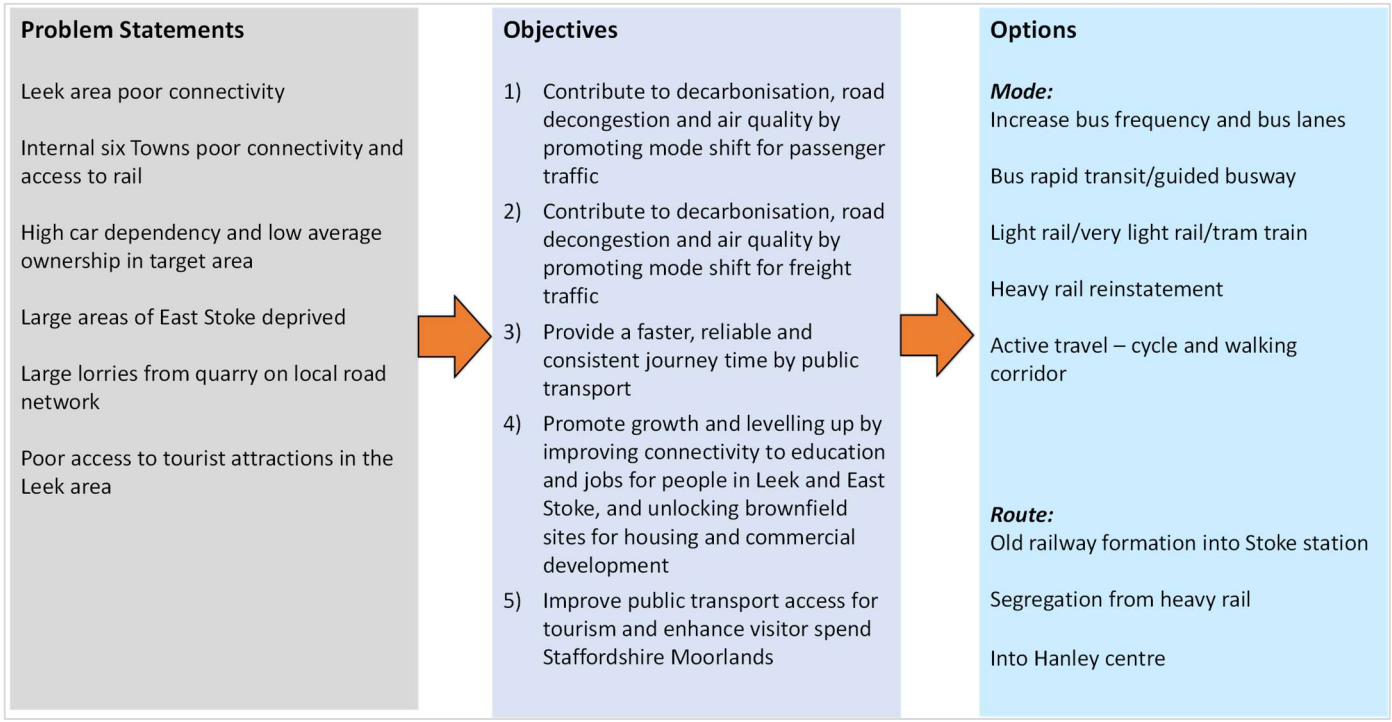


Figure 2 - High level analysis of problems, objectives and options

The problem statements are explained in more detail in the following section.

2.3. The Case for Change

Poor Connectivity within the Six Towns and Access to Rail

The strategic road network is particularly congested where it runs through the urban conurbation. The A500/A50 currently operates at around 110% capacity, resulting in significant tailbacks and poor reliability at peak times. Parts of the local network in Stoke-on-Trent are even worse, with parts of the network operating far above designed capacity. Over the next decade this challenge is expected to get worse as shown on the map.

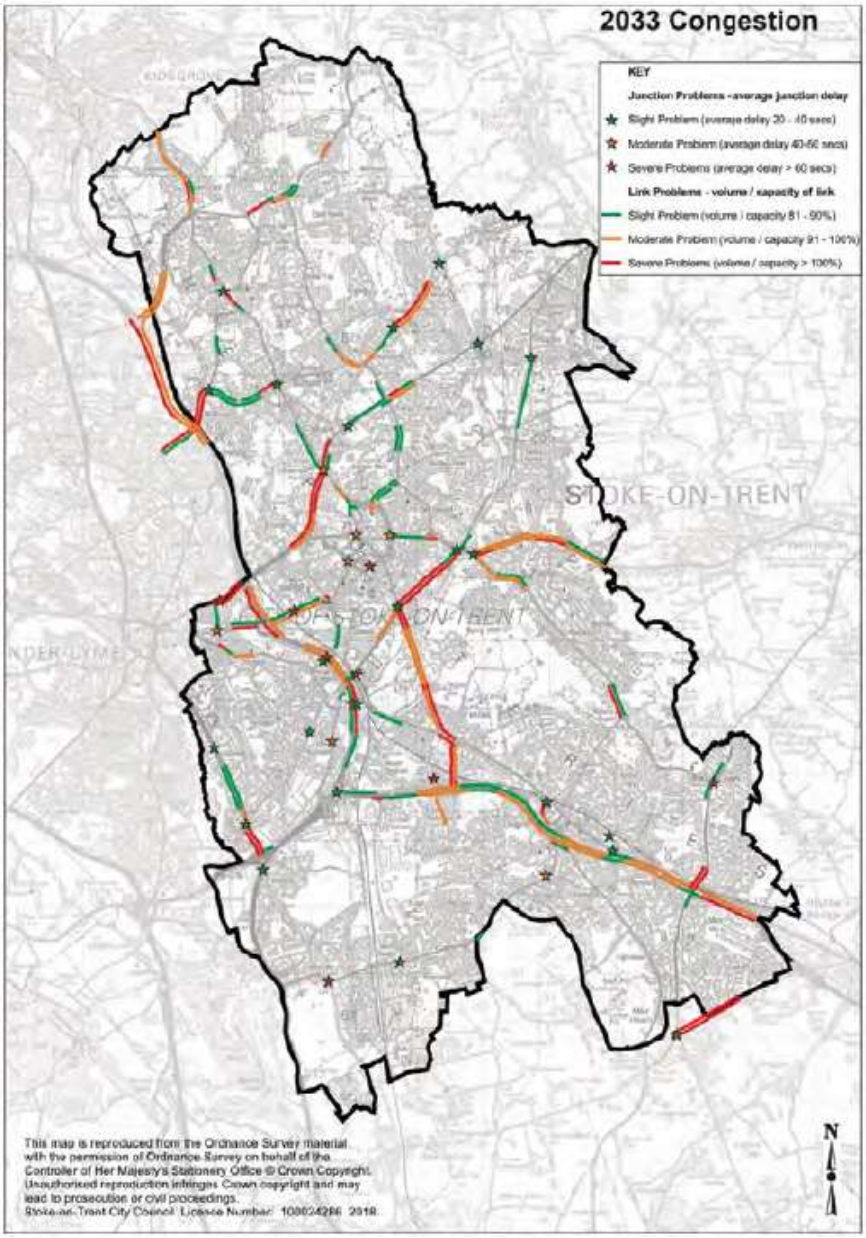


Figure 3 - Forecast average road network junction delay by 2033 (Source: Stoke-on-Trent TCF Tranche 2 SOBC)

The combination of road congestion with lack of connectivity and poor reliability of local buses, due to that congestion, is currently inhibiting both business and housing investment – a compounded barrier to employment for people who already struggle to access employment opportunities and affordable housing. Improved local public transport would support wider development in the area, unlocking currently unviable sites with outline planning permission for housing and economic regeneration.

Poor Connectivity in the Leek Area

Whilst roads in Stoke-on-Trent suffer most from congestion, the issues of connectivity are most pronounced in Staffordshire Moorlands. Staffordshire Moorlands and the main town of Leek are recognised as having the worst transport connectivity of any district in Staffordshire. There are no railway stations or dual carriageway roads in the Staffordshire Moorlands constituency and this lack of connectivity has deterred business investment, held back growth and results in out-migration of skilled workers and high growth firms. The rural road network is compounded by having key aggregates logistic traffic and high levels of car journeys from visitors.

This is illustrated by the bus provision. There are two routes between Leek and Stoke-on-Trent. Route 18 is operated by First Bus and roughly follows the proposed rail route. Route 16 is operated by D&G and runs between Leek and Hanley but not on a route similar to the rail line, instead running via Cheddleton and Wetley Rocks. Both operate half-hourly. The graphs below illustrate both the long journey time and the very wide variation in journey times. Whilst in some instances the services run faster than their advertised journey times, in the majority of cases they fail to achieve them, leading to a real and perceived service unreliability.

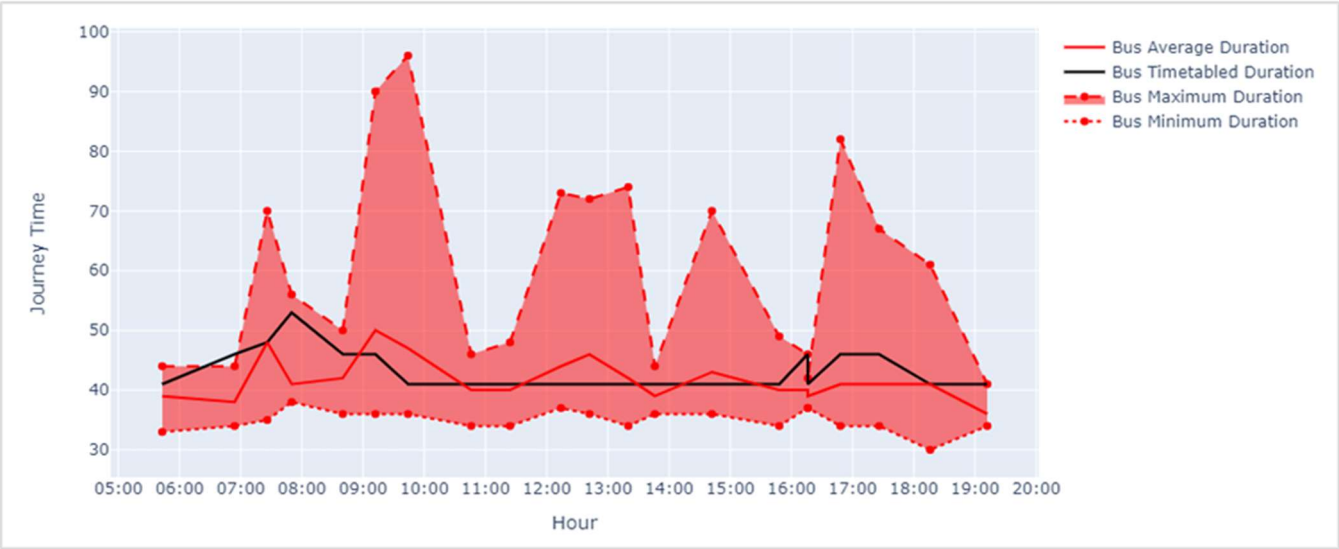


Figure 4 - Bus reliability and journey times for route 16 Leek – Hanley (Source: Systra analysis)

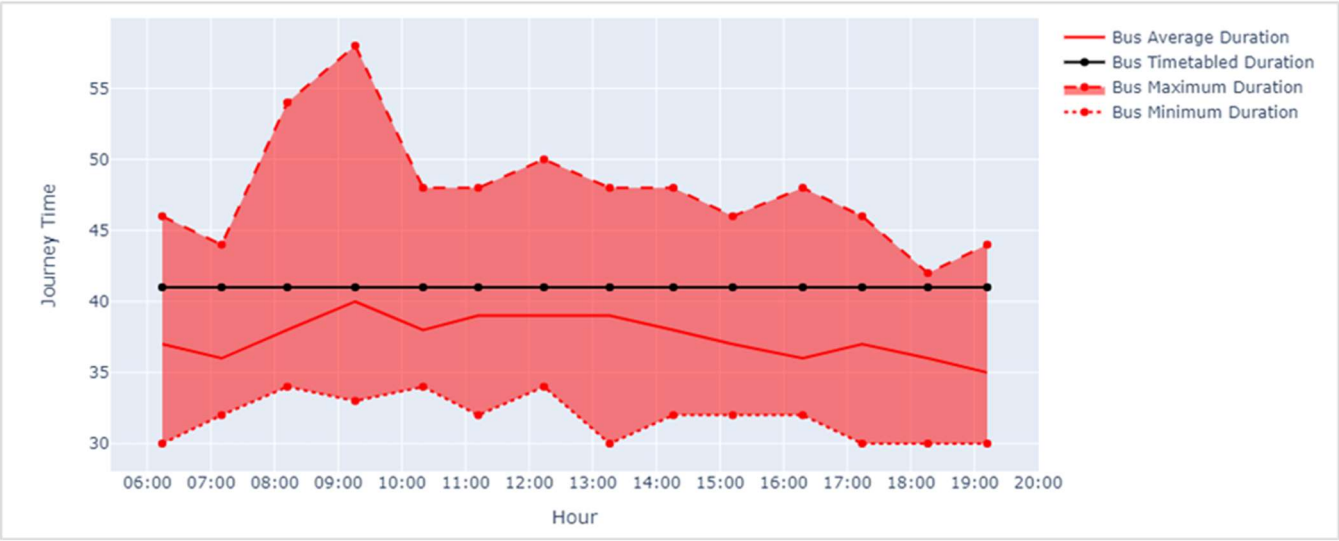


Figure 5 - Bus reliability and journey times for route 18 Leek – Hanley (Source: Systra analysis)

In addition, it is important to note that neither of these bus routes serve Stoke railway station. They run from Leek to Hanley for the City Centre, and the railway station is in Stoke Town, 1.3 miles from it.

High Car Dependency (and Low Average Ownership)

There is heavy local dependency on the car to access work, skills and leisure opportunities, and this car dependency comes despite 30% of the city's population having no access to a (private) vehicle.

Bus use across the Potteries is in decline (it reduced by 10% in the year before the pandemic, with over one million fewer bus passenger journeys in 2018-19 than there had been in 2017-18). There has been a 38% reduction in bus use over the last 10 years. The main reason, according to operators, is a lack of reliability and delays caused by road congestion (see graphs above) as well as length of journey time and lack of interconnectivity between bus and rail. The continuing fall in fare-income and inability to deliver a guaranteed journey timetable, has rather perversely led to bus operators running fewer services at peak times, as they struggle to deliver a service that the community can rely upon.

In addition, many of the centres for employment within North Staffordshire are not based in the City Centre but are within established industrial estates or linked to incubation and growth corridors close to Keele and Staffordshire University. So even where there are bus routes, potential passengers are required to use multiple services, with unreliable journey times, no guarantee of connection and with no-through ticketing options. Furthermore, buses after 5.30pm in North Staffordshire are a rarity. This is despite the North Staffordshire area's largest sector of employment being manufacturing which primarily employs people on varied shifts, and Stoke-on-Trent providing the majority of evening leisure opportunities for the area.

As more people have had to turn to cars, congestion has inevitably worsened. The local road network is not capable of meeting future economic demands, much of it is single carriageway. The lack of direct public transport is especially problematic for people living in Staffordshire Moorlands – as the majority of its 97,000 population do not have access to a local rail or bus network.

Historically, rail played a prominent role in North Staffordshire's connectivity, but over the last century, lines and stations have gradually been closed. North Staffordshire has not seen a single station reopening since the Beeching axe. Whilst large cities and conurbations have seen stations reopen since Beeching, in Stoke-on-Trent local services have worsened. Etruria station was closed in 2005 and services at Wedgwood and Barlaston were suspended in 2004. This was the legacy of a city in decline.

Improvements to the West Coast Main Line now mean that the fast-train journey time from Stoke-on-Trent to London Euston is currently 1 hour 24 minutes, 11 minutes quicker than travelling by public transport the 12 miles from Leek to Stoke station at peak time.

And Stoke-on-Trent is now growing, with significant new housing proposed, and there is insufficient public transport capacity to serve the current economic expansion, particularly so that it benefits communities of higher levels of deprivation with low car ownership. It is vital to ensure that all communities are connected to new economic opportunities.

Deprivation in Communities in the North-East of Stoke-on-Trent

Stoke-on-Trent now has the 12th highest proportion of deprived neighbourhoods, on multiple measures, out of 317 council districts in England, up one place since 2015. The map below illustrates the extent of the challenge, much of it along the corridor under consideration here.

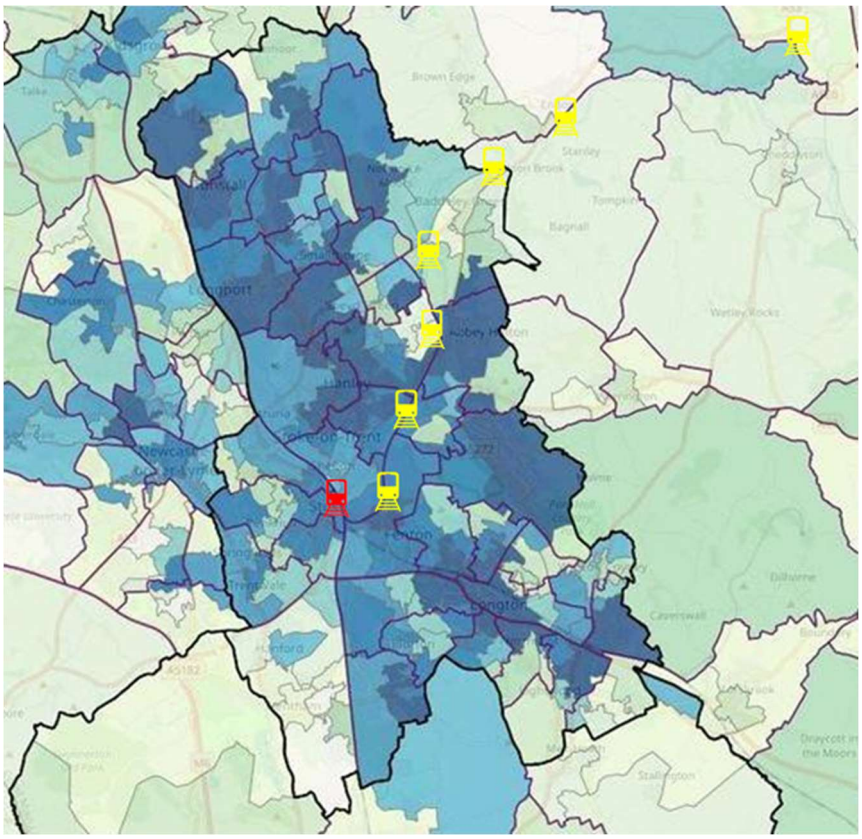


Figure 6 – Deprivation map of Stoke-on-Trent area (Source: Office of National Statistics)

GVA per head in Stoke-on-Trent (£20,763) trails regional (£22,144) and national averages (£27,060), (2016). Using productivity measures that identify relative performance of the economy in an area by comparing gross value added (GVA) to a job (rather than per head which includes retired residents) it is clear that the whole area is lagging behind its potential. Stoke-on-Trent has a GVA per job of £42,584 and Staffordshire Moorlands is just £39,996 – compared to averages of £46,419 for Staffordshire as a whole and £55,658 nationally. The lack of connectivity and reliance on congested roads impacts on business productivity. It also inhibits inward investment, and discourages businesses from investing in innovation and workforce skills at higher/further education institutions due to the difficulties in traveling between locations.

Earnings in Stoke-on-Trent are lower than regional and national averages by some margin as shown in the table below.

	Stoke-on-Trent	West Midlands	Great Britain
Full-Time Workers	501.2	550.8	587
Male Full-Time Workers	539.8	588.6	632
Female Full-Time Workers	417.6	495.3	528.9

Figure 7 - Weekly pay by place of residence (2019) - source ONS

Stoke-on-Trent workplace earnings average £26,596 per annum – well below the UK average of £30,707 – and while Staffordshire Moorlands has a rate closer to the national at £29,211 – it needs to be recognised that rural

disadvantage is often masked by a small number of more affluent residents. If one looks at IMD ratios of workplace earnings, Staffordshire Moorlands – with a score of 77.4 – is actually in the bottom 20% of districts nationally[1].

Furthermore, levels of academic qualification in Stoke-on-Trent and Staffordshire Moorlands are significantly worse than other parts of the country and it is vital more is done to improve access and promote realisable ambition. Only 22.5% of people in Stoke-on-Trent have a qualification of NVQ4 or above, and while this is higher in the Moorlands at 33%, this still represents a considerable gap below the national average, 40.3%.

From Staffordshire Moorlands it is difficult to get by public transport to Stoke-on-Trent 6th Form College, Stoke (FE) College and Staffordshire University, all of which are within walking distance of Stoke railway station.

The current poor state of public transport and lack of local rail connectivity forces people towards the car, which is impossible for the 30% of households in Stoke-on-Trent that do not own one. Obesity is especially prevalent in the north of the city and surrounding areas where active transport has given way to the car (or no travel at all). Indeed, Norton (20.9%) has the third highest prevalence of obesity in the whole of England; Milton Station would be located nearby. Endon and Brown Edge (20.7%) have the highest levels of obesity in Staffordshire Moorlands, and would be served by a station at Endon.

The covid crisis has reinforced the need for people to have access to green space to support not just their physical health, but also their mental wellbeing. Many urban dwellers within Stoke-on-Trent live without gardens and if they do not have a car, their route to access the Moorlands countryside can be a long and awkward multiple-bus journey which can be especially taxing with children. Access to the countryside has significant equality aspects as well; as providing clear and easy access for BAME urban communities, who may not have access to the countryside.

Large Aggregates Lorries on Local Road Network

Cauldon Quarry, operated by Aggregates Industries Limited, relies entirely on the North Staffordshire road network for the delivery of its aggregate and cement products. The quarry has one of the largest cement works in the UK, producing c.10% of the cement used in the country. It is currently the only major cement quarry in the country without a link to the rail network.

Aggregate production is set to increase from c.800,000 tons of aggregate pa to up to 1,750,000 tons pa with a life of 40 years, but only if new more effective distribution methods can be achieved. Rail is ideally suited to this quantity and weight of product, distributing it to where it is needed more widely than is currently possible. Currently the quarry inevitably makes a significant contribution to road congestion and poorer air quality through its road logistics operation. Despite major road-to-rail transfer of aggregates on a national level, the potential for modal shift has been held back locally by lack of infrastructure, not least because of the closure of the Stoke-Leek line to freight in 1988. Road-dependency has significantly added to congestion and air pollution in the city, including three locations under ministerial direction for air quality breaches, two of which would be in close proximity to proposed stations (Fenton Manor/Bucknall Park). The high level of congestion means that motorists and the carless alike struggle to get around the conurbation of Stoke-on-Trent, limiting access to employment, skills and leisure, and reducing business productivity.

[1] Source: earnings by workplace ONS 2020/ IMD comparative ranking Grant Thornton

There is an environmental imperative in the need to move freight onto rail. In Derbyshire, for example, upwards of 80% of Tarmac and Cemex aggregates have been relocated off the highway and this has resulted in significant reductions in congestion as well as carbon savings. In addition, the removal of heavy goods traffic from communities has enabled them to be rejuvenated as attractive and desirable locations, attracting private sector housebuilders and business investment. The opportunity to reconnect Leek for its residents is a vital one, but the cost and environmental benefits primarily come from the opportunity to significantly reduce HGV traffic from the road network.

Poor Access to Tourist Attractions

Staffordshire Moorlands is home to approximately 50% of all tourism travel and spend in the Stoke and Staffordshire Local Enterprise area. Over 6.5 million visitors come to the district per annum, and the area has seen an increase in tourism numbers & tourism expenditure - some 7% increase per annum (2014-2016 STEAM data). This growth is linked to the recent expansion of accommodation at Alton Towers Resort (592 new bedrooms with average 2.97 visitors per room) on top of their annual 2.1m annual visitors and 1400 employees. A new flagship Premier Inn in Leek has recently opened and there has been an increase in independent accommodation development linked to new tourism trends (glamping, eco-pods, farm diversification, Air B&B accommodation and conversion of rural pubs into accommodation).

2018 STEAM data covering the wider Peak District has identified the value of tourism at £2.3bn to the economy, attracting 42 million people to the area and supporting over 30,000 jobs.

Leek itself is a popular day visitor and weekend tourism location, with a very strong independent retail hub (94% retail occupancy even despite covid oct 2020) and speciality markets which attract many day and staying visitors. The town also acts as the principle southwestern gateway to the Peak District National Park.

However, the number of visitor days in the Moorlands, and spend in the local economy, are currently limited by the fact that there is currently no easy public transport access from Stoke and the wider region. Additionally, the Churnet Valley Railway starts and finishes in small hamlets with few amenities, necessitating car travel for the majority of visitors to this popular heritage railway.

The Alton Towers Resort is 3 miles from the end of the Churnet Valley Railway's current operation. The new station at Leek is proposed to work as a co-terminus with the heritage railway – meaning that tourist passengers could then transfer onto/off heritage rail services which already exist to the wider countryside and Peak Wildlife Park, and are proposed to be further extended to a new holiday complex at Oakamoor and close to Alton Towers and Peak Zoo. Alton Towers supports this bid, and the Churnet Valley Railway is developing plans for the ultimate extension of their operation to the closed station at Alton Towers.

The potential demand for the travel extends beyond the resident population; visitors from Stafford, Wolverhampton and Birmingham do not currently have quick and easy access by public transport into the Staffordshire Peak for exercise, well-being and leisure.

2.4. Meeting Local , Regional and National Priorities

The project supports key national priorities, including:

- Economic growth through supporting and facilitating business and housing growth in local economies
- Levelling up poorer areas of the country in the Midlands and the North
- Decarbonisation of the economy
- Maximising the benefit from public investment, in particular HS2 which will serve Stoke-on-Trent from 2028-2030.

The project is also supported by a range of regional strategies, delivering local, regional and national priorities, including:

The City of Stoke-on-Trent Transport Strategy and Delivery Plan 2022 – 2031. This draft document, recently published and seeking adoption in early 2023, contains a comprehensive analysis of the transport challenges facing the city, and identifies a need for investment in all transport modes to secure the city's prosperity and sustainability. Specifically, it proposes the reopening of the Stoke – Leek line by 2029, and a very light rail network of three routes for the city (see section 2.7 below).

Stoke & Staffordshire LEP emerging Local Industrial Strategy (LIS) Specifically identifies need for new rail stations, to address congestion on A500/A50, invest in local transport schemes, and deliver high quality sustainable housing close to suitable infrastructure. Furthermore, the LIS specifically addresses the need to support "flourishing town and city centres and successful rural areas – with a revitalised / repurposed commercial offer, high quality housing, a growing visitor economy, and excellent quality of life." This will be achieved through "Improved public transport and accessibility within our town and city centres" and "Tackling persistent deprivation and joblessness, through better linking up skills provision."

Stoke & Staffordshire Strategic Economic Plan (April 2018) Specifically Objective 2 (Connected County) "- Develop the infrastructure needed so that the growth planned for Stoke-on-Trent and Staffordshire can be accommodated"; "Support and deliver improvements / upgrades to the local transport network" which is acting as a constraint on movement due to congestion; and a constraint on development due to poor connectivity. The project will also deliver against Competitive Urban Centres, which identifies as a key priority the need for "Enhanced transport links, including sustainable transport investments linking strategic transport routes and residents to key centres".

Constellation Partnership HS2 Growth Strategy (Oct 2018) Specifically identifies re-instatement of Stoke-Leek line as a project linked to both 'good-growth principles' as infrastructure will support "skills development"; "connect both urban and rural growth with the natural environment so that all communities benefit from the Constellation's exceptional parks, moors, and landscapes, natural features that provide the area with its unique identity." And "High quality sustainable development will attract new communities to the Constellation and offer amenities and uses that appeal to people who already live here, driving footfall to support existing town centres."

HS2 2a Consultation (Staffordshire) (Feb 2021) According to Midlands Connect "The DfT's commitment to run HS2 classic-compatible services through regenerated stations in Stoke-on-Trent and Stafford means more people and businesses will be able to access prospects offered by fast and frequent journeys to the North West and London, as well as Birmingham and Manchester airports. We will work with the West Coast Partnership franchise to ensure new services recognise these needs."

Staffordshire Moorlands District Council's Corporate Plan 2019-23 Aim 3 (To help create a strong economy by supporting further regeneration of towns and villages) projects to "Support the development of [Leek] Cornhill and improved rail links" is identified as a key priority which this project will deliver against. Leek Cornhill is the proposed location of a station in the town of Leek.

Staffordshire Moorlands Local Plan (adopted 2020) The overall Leek strategic policy SS5 Part (5) states that proposals should have "regard to the Churnet Valley Masterplan" which specifically identifies actions "Re-opening of rail line to Leek". In addition, the former rail network routes are protected under policy T2 (Pol T2 seeks to reuse disused or mothballed railway lines).

Stoke-on-Trent emerging Local Plan Congestion in Stoke-on-Trent is well recognised as a barrier to new development and the redevelopment of brownfield sites. The re-introduction of a rail service to Leek is identified as a key part of a future sustainable development programme.

Staffordshire Moorlands Growth Strategy (SCC & SMDC joint strategy) 2018-2031 The project is linked specifically to connectivity, improving access to skills to support employment and as well as supporting visitor and town centres through the extension of the Churnet Valley Railway; attract more staying visitors, improve sustainable travel and "Working with SCC, Stoke and Newcastle to link housing development to countryside as quality of life offer for urban areas."

Stoke-on-Trent Transforming Cities Fund Budget 2020 confirmed TCF funding for Stoke-on-Trent – the investment focuses on the transformation of Stoke station into a multi-modal hub. The TCF funding will improve the passenger experience at Stoke station as a place to embark, disembark or change trains, as well as interconnectivity of bus and rail, improving bus journey times and restoring cross-conurbation routes. TCF is the beginning of the step-change we need to address the city's relationship with public transport, fuelling demand for feeder services into Stoke – including from Leek – for fast links to the City Centre, national rail services, HS2, and, indeed, for enjoying the renaissance of Stoke Town and its High Streets Heritage Action Zone (DCMS). Confirmation that award-winning developer Capital & Centric will draw up an exciting £75 million redevelopment of the old Goods Yard at Stoke station, unlocked by TCF, was announced in early 2021. It includes 180 new homes, a 150-bed hotel, 25,000 sq ft of workspaces and 10,000 sq ft of retail and leisure space.

Clean air delivery objectives: Ministerial Directions on air quality have been imposed on the city due to breaches to World Health Organisation limits. Two of the key hotspots for poor air quality where improvements to air quality are required are on the route of the line in Fenton A50 and Bucknall A52.

West Midlands Rail Investment Strategy. This document, launched for public consultation in October 2022, sets out ambitions to increase service frequencies on the Crewe – Stoke-on-Trent – Birmingham route and HS2 connectivity between Stoke-on-Trent and the HS2 Interchange in Solihull, thus enhancing the value of interchange with local services at Stoke station.

Midlands Engine Rail Strategy. This strategy, developed by Midlands Connect, sets out objectives to reduce journey times between Stoke-on-Trent and Derby and to double the frequency on that route. Again, this would enhance the value of interchange with the route to Leek.

2.5. Objectives and Outcomes

The graphic below illustrates how the objectives set out for the scheme above link to outcomes and impacts that address the problem statements.

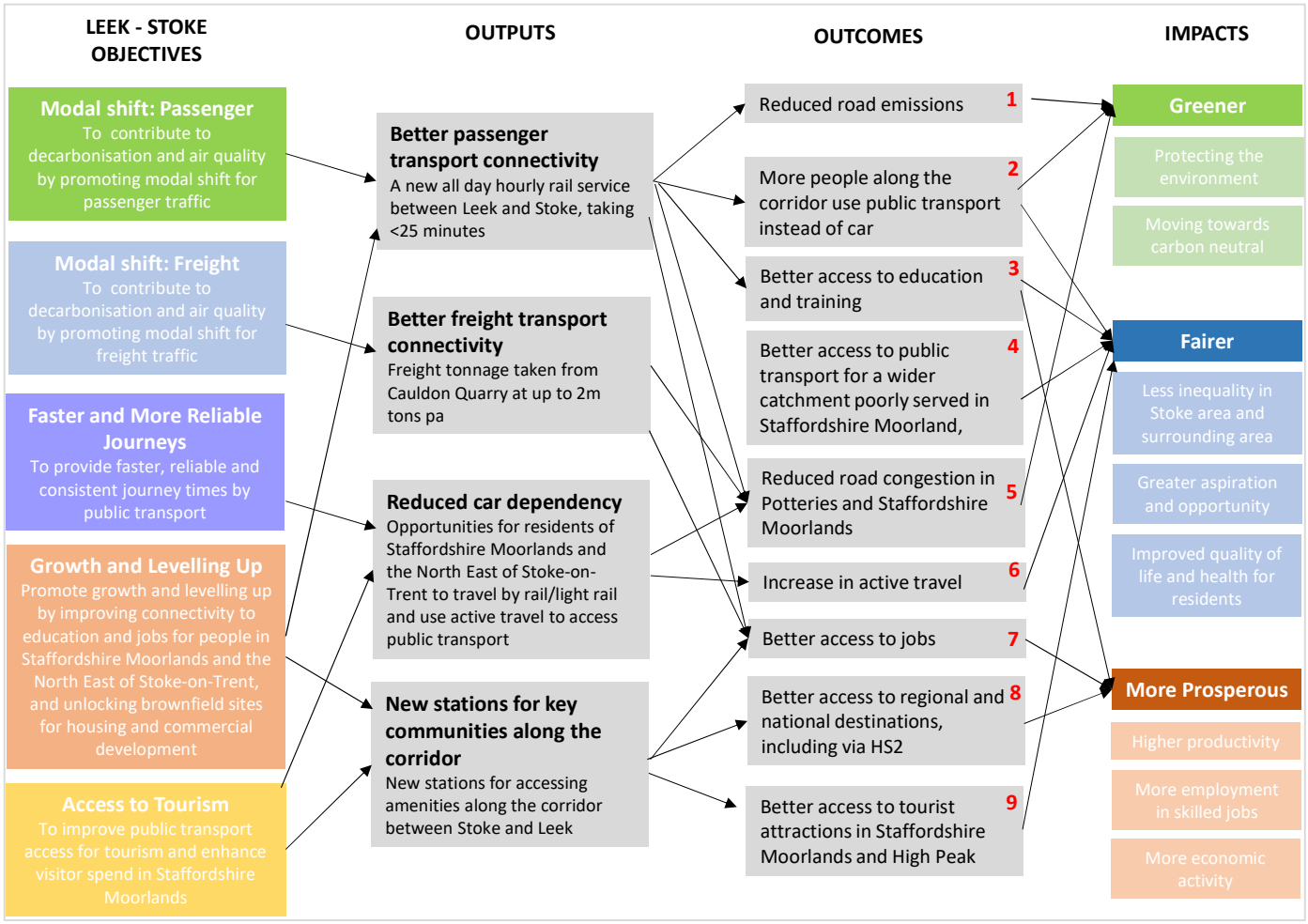


Figure 8 - Logic map

Key to any transport investment scheme is being able to measure achievement of the objectives and outcomes over time. The table below indicates our current thinking about what measures would be used to do this, referencing the numbers on the above graphic.

No	Outcome	Measure
1	Reduced road emissions	Air quality measures on key roads affected by the scheme
2	More people along the corridor use public transport instead of car	Railway LENNON data showing passenger usage from new stations on route
3	Better access to education and training	Difficult to measure impact, but could include data collected from educational establishments
4	Better access to public transport for a wider catchment poorly served in Staffordshire Moorland	Railway LENNON data showing passenger usage from new stations on route
5	Reduced road congestion in Potteries and Staffordshire Moorlands	Automatically collected data – focused on specific roads likely to be impacted. Quarry data on number of lorries used by day for transport of aggregates

6	Increase in active travel	Difficult to measure impact, but could involve surveys of passengers using the railway
7	Better access to jobs	Difficult to measure impact, but could involve surveys of passengers using the railway
8	Better access to regional and national destinations, including via HS2	Railway LENNON data showing passenger usage from new stations on route to regional and national destinations
9	Better access to tourist attractions in Staffordshire Moorlands and High Peak	Tourist numbers and surveys collected by STEAM

Figure 9 - Potential measurement for outcome achievement

Further development of the logic map and SMART objectives should form part of the next stage of development, especially as a single preferred option is chosen and developed.

2.6. Why Now?

None of the improvements to social, economic/productivity and environmental outcomes discussed above would be delivered without better local transport connectivity. There is no obvious alternative to reopening this corridor for transport use; the urban roads along its length are already approaching capacity or are operating above capacity and cannot be widened. The result of no action will be ever-worsening road congestion and slower journey times, impacting on productivity. Without improved connectivity the area will continue to struggle to address challenges of underperformance relative to other parts of the country (GVA is 20-40% lower than national averages).

Communities without cars – including 30 per cent of households in Stoke-on-Trent – would remain solely reliant on slow bus services, but these would continue to be withdrawn because congestion makes bus services unreliable and therefore unpopular and unviable. The carless would increasingly be at risk of having no transport options at all. This inevitably leads to a compounding of deprived communities in Stoke-on-Trent being "left behind". Levelling up will be much harder to deliver and social mobility/life chances for younger residents restricted by lack of access to higher skills and apprenticeships.

Furthermore, it will be difficult to continue to deliver housing sites identified to meet Government targets without improved connectivity. Brownfield sites will deteriorate and there is potential for business out-migration to sites with better transport links, which could then compound unemployment for those without private transport.

One of the Government's primary transport objectives is to secure maximum economic benefit from the investment in HS2. HS2 services through Stoke-on-Trent are due to start towards the end of the decade, at around the same time or shortly after the transport corridor subject to this SOBC would be fully open. Feeding into HS2 at Stoke from the Leek area and the north and east Potteries, therefore, would support the HS2 investment from its outset.

2.7. Option Assessment

In the table below we assess the ability of various options to achieve the objectives (and hence outcomes) for the project.

Option	To contribute to decarbonisation and air quality by promoting modal shift for passenger traffic	To contribute to decarbonisation and air quality by promoting modal shift for freight traffic	To provide faster, reliable and consistent journey times by public transport	To promote levelling up by improving connectivity to education and jobs for people in Leek and Eastern Stoke-on-Trent	To improve public transport access for tourism and enhance visitor spend in Staffordshire Moorlands
Do minimum	No improvement	Further constraints on longer distance freight	No improvement. Journey times may get worse as road congestion increases	No improvement. Road congestion becomes an increasing problem	No improvement. Reducing visitor numbers over time
Active travel and cycleway	Some improvement	No impact	No impact	Some improvement	Some improvement
Bus frequency and bus lanes	Held back by road congestion and narrow roads making this difficult	No impact	Some improvement, but constrained by road congestion and narrow roads	Some improvement	Some improvement
Bus rapid transit/guided bus way	Improvement	No impact	Improvement	Improvement	Improvement
Light rail	Significant improvement	No impact	Significant improvement	Significant improvement	Significant improvement
Heavy rail	Significant improvement	Significant improvement	Significant improvement	Significant improvement	Significant improvement

Figure 10 - How options perform against objectives

Reviewing these options in more detail:

Do minimum. As already noted above, the single carriageway road network in Staffordshire Moorlands is congested and increasingly unfit for purpose. Journey times for travel between Leek and Stoke-on-Trent would remain slow and likely to get worse, both for travel by the private car and by bus. Lorry traffic from the quarry would continue to use the local road network with associated noise and pollution impacts, and the quarry could not realistically expand to support economic development wider afield. The transport network would not be able to support a significant increase in economic activity.

Active travel and cycling. Conceptually, it would be possible to convert the mothballed railway corridor into an active travel corridor for walking, jogging and cycle use. Whilst this would be a welcome facility for residents it

would not address the key transport objectives being considered here: in particular improved journey times for residents accessing education and job opportunities as an alternative to the congested road network. Clearly this option would offer no improvement for freight traffic.

It would not be possible to combine an active travel/cycling route and a reinstated railway on the same formation between Leek and Stoke. This is because of the space required for the railway to meet modern standards and risks to safety.

Bus frequency and bus lanes. We have already seen in section 2.3 how the reliability and journey time of bus services between Leek and Stoke-on-Trent is poor because of the congested road network. An increase in bus frequency would not address these fundamental issues. The opportunity to create bus lanes on the key road arteries into Stoke-on-Trent is limited. Because of the journey time issue an increase in bus services is likely to result in increasing need for subsidies. The number of bus passengers continues to fall. This option would also offer no improvement for freight traffic.

Bus rapid transit/guided busway. It would potentially be possible for the mothballed railway corridor to be converted into a bus rapid transit/guided busway between Leek and Stoke station. There are a number of technical challenges associated with this, including width of road over rail bridges and width of formation. Examples of previous deployment are not encouraging (eg St Ives to Cambridge). This option would offer no improvement for freight traffic, and create problems in relation to the corridor used by the Churnet Valley Railway heritage line.

Light rail. Stoke-on-Trent City Council has recently announced a consultation on a proposed very light rail/tram network: https://www.stoke.gov.uk/news/article/1153/stoke-on-trent_residents_invited_to_have_their_say_on_new_transport_strategy

This proposed network would have three lines as shown below.

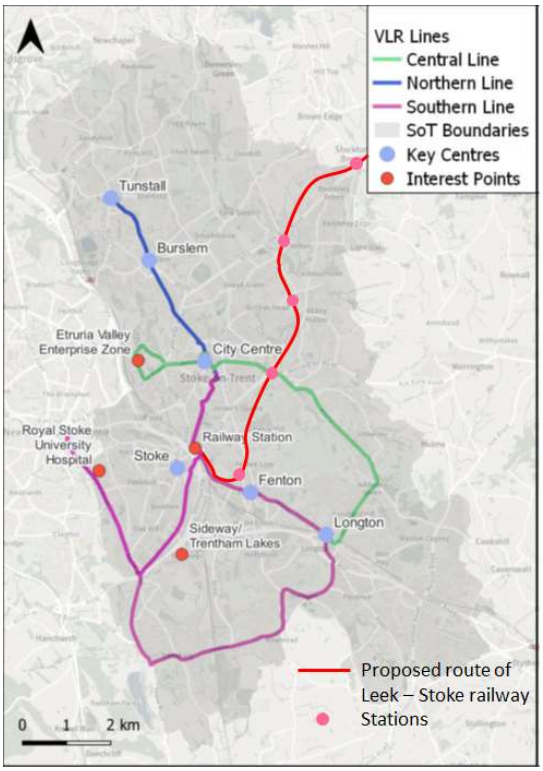


Figure 11 - Proposed Very Light Rail network for Stoke-on-Trent

Whilst this indicative network would not use the mothballed railway corridor, there would be the opportunity to integrate the Leek corridor into the network, either at Stoke railway station or via the City Centre (by deviating off the railway route in the vicinity of Milton). The existence of these proposals suggests that the option of using the Leek – Stoke corridor for light rail should be considered further in this SOBC. As shown in the table above it would be capable of meeting many of the objectives identified to address the known transport problems. A higher frequency would likely be possible than could realistically be achieved by a heavy rail option. However, it would preclude the use of the corridor for freight and the interface with the Churnet Valley Railway would need to be considered. The plans for a light rail network in Stoke-on-Trent are at an early stage, and if approved delivery would likely be in the 2030s.

Heavy rail. The final option is the reinstatement of the corridor as a railway, linked into the main line network at Stoke. This option would provides a strong fit with the objectives, and is capable of being scalable to provide a large range of future scenarios, including incremental increases in frequency, extension of services through Stoke to other locations (such as Crewe or Manchester) and the ability to accommodate freight from Cauldon Quarry.

From this high-level analysis, the best options for achieving the objectives set for the scheme appear to be the light rail and heavy rail options, and the rest of this report focuses on these.

2.8. Stakeholder Engagement

This application is strongly supported by the MPs for Staffordshire Moorlands, Stoke-on-Trent North, Stoke-on-Trent Central, and Stoke-on-Trent South and has a very significant number of sponsors and supporters. There is close liaison between sponsoring MPs and local authority leaders. Stoke-Leek is a current cost to Network Rail and meetings between Network Rail and MPs have been held to discuss the project.

Network Rail has instituted a Stoke Roundtable for the future of rail in the city, which includes Network Rail, MPs, the City Council, TOCs, and Chambers; invitations have been issued to HS2 and National Highways to join this group.

There is close liaison between all local authorities and a wide range of interests:

- Staffordshire Moorlands District Council
- High Peak Borough Council
- Stoke-on-Trent City Council
- Staffordshire County Council: transport authority for Staffordshire (outside of Stoke-on-Trent UA).
- Stoke-on-Trent and Staffordshire Local Enterprise Partnership
- Aggregates Industries Ltd
- Staffordshire Chambers of Commerce and Industry
- Staffordshire Moorlands Chamber of Commerce
- City Centre Business Improvement District
- Trent House Business Centre, Fenton Manor
- Alton Towers
- Peak District National Park
- Churnet Valley Railway PLC
- Train Operating Companies: Avanti/West Coast Partnership, East Midlands Railway, Northern Railway, West Midlands Trains
- Staffordshire University, Stoke Sixth Form College, Goodwin Training School, St Peter's Academy
- Leek Town Council, Cheddleton Parish Council, Brown Edge Parish Council, Ipstones Parish Council, Bagnall Parish Council, Endon & Stanley Parish Council, Waterhouses Parish Council, Horton Parish Council

There were 5,750+ signatories to a change.org petition to restore the line: https://www.change.org/p/reopen-the-railway-line-from-stoke-on-trent-to-alton-towers-and-leek. In addition, Jonathan Gullis MP presented a petition to Parliament for the reopening of the Stoke-Leek line in December 2020 (P002639).

MPs have engaged with constituents along the line and many letters of support have been received from private individuals. MPs have a strong online presence to continue engagement and will keep communities fully informed with mailings and media activity.

2.9. Option Development and Operating Models

Minimum Viable Product: Option A

In response to the opportunities outlined above, it was important to identify what heavy rail and light rail solutions might be achievable. As this is the restoration of a closed railway it will inevitably be an expensive scheme in which the benefits may struggle to outweigh the initial cost of investment. For this reason it was important to identify the minimum scope to deliver a credible train service efficiently and reliably. In this document we term this the "Minimum Viable Product" or MVP.

Delivery of the MVP could allow an initial service to be introduced, but one that is scalable over time in response to growing demand and new traffic opportunities. The concept is illustrated on the graphic below.

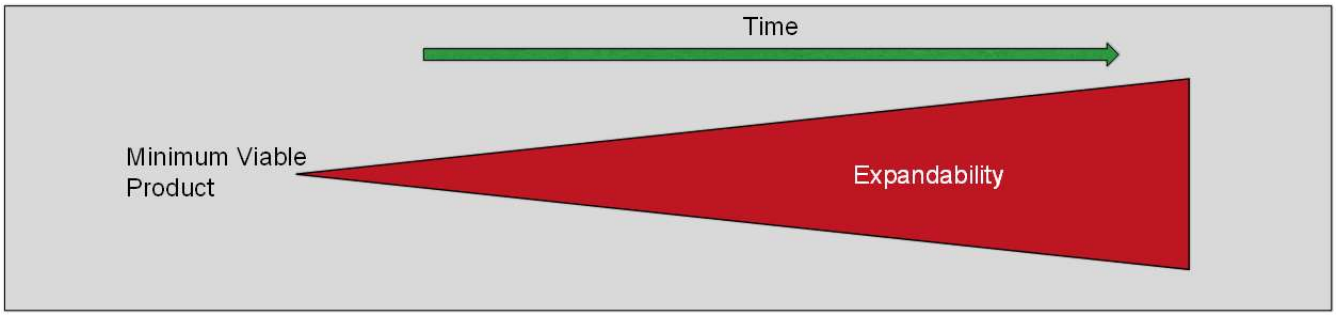


Figure 12 - Scalability of heavy rail options

The first exercise was to calculate potential journey times on the branch using Network Rail's standard Railsys modelling tool for various types of rolling stock. The modelling results are shown below.

Rolling stock type	156	170	319	323	331
Six intermediate stations	00:57:35	00:56:44	00:52:47	00:50:51	00:50:37
Five intermediate stations	00:54:46	00:53:24	00:50:07	00:48:24	00:48:41

Figure 13 - Heavy rail journey times (figures in hh:mm:ss)

The times shown are for an "out and back" run (Stoke – Leek – Stoke). This analysis assumes:

- a 60 mph railway
- a 6 minute dwell at Stoke (the minimum set out in the Timetable Planning Rules for Stoke)
- a 4 minute dwell at Leek (the Timetable Planning Rules generic minimum)
- ½ minute dwell at intermediate stations

These are the technical running times, so there would be some rounding up to the timings to create "official" Sectional Running Times, which would add a couple of minutes each way.

We can conclude that it would be possible to run an hourly service with a journey time between Stoke and Leek of c.23-24 minutes using only one train. The other importance of this conclusion is that if only this service were operated, it could be done on a single line with no pointwork or signals (other than at Stoke). This represents the minimum infrastructure required, and is akin to that now existing on a number of branch lines following rationalisation in the 1960s and 1970s, such as the Matlock branch and the Windermere branch.

The next question, therefore, was whether it would be possible to terminate the train in the existing Stoke station. This has three platforms: platform 1 and 2 are the through platforms and platform 3 is a bay platform facing north, and therefore irrelevant for our purposes. We undertook a timetable analysis against both the current timetable (May 2022) and the proposed December 2022 timetable. We found that whilst it was just theoretically possible to terminate a train from Leek in platform 2 and leave six minutes later with some adjustment to existing services, there was no leeway at all to cater for late running. Conflicts with existing services would exist as the Leek train crossed the junction onto the main lines. Our judgement, with which Network Rail concur, is that this is not a robust solution.

We also looked at moving the train into one of the sets of sidings north of Stoke station to wait for a space to move back into the station to depart. This would prevent a solution where only one train was used and would create a need for a passing loop on the branch for the trains in either direction to cross.

We therefore considered whether it might be possible to terminate the Leek train at Stoke clear of all other traffic. Options were considered to create new bay platforms either next to platform 1 or platform 2, but each option came with heavy constraints. The site of Stoke station is constrained by a bridge over Glebe Street immediately to the south and by converging trackwork to the north.

We concluded that the solution meriting further work was to create a new platform on the east side of the formation immediately south of Glebe Street bridge, as shown on the annotated photograph below.

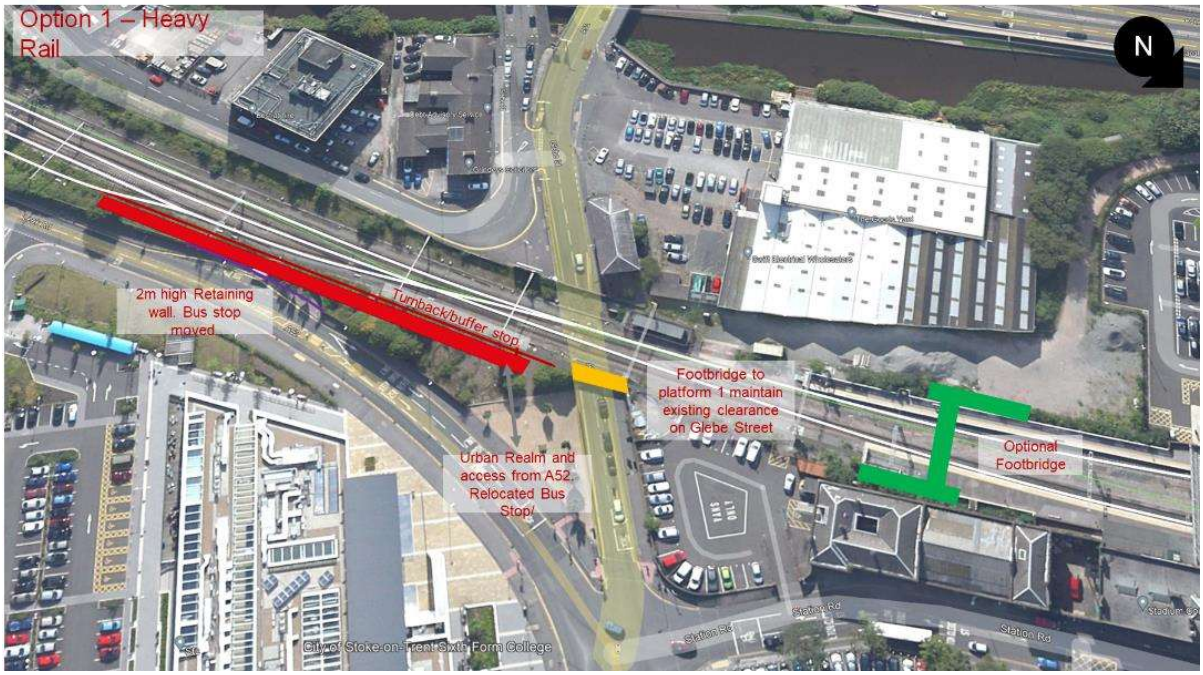


Figure 14 - Proposed platform at Stoke station. Background image Google 2022 ©

This has several important advantages:

- It means that in operation there is no interaction between Leek trains and services using the main line
- Trains from and to Leek can be moved around the clockface so that they make the best connections with other services, including with HS2 when timings are known.
- The concept is adaptable to cater for a light rail solution that is extended on road into the City Centre, as shown on the annotated photograph below with the dotted lines showing possible extension.

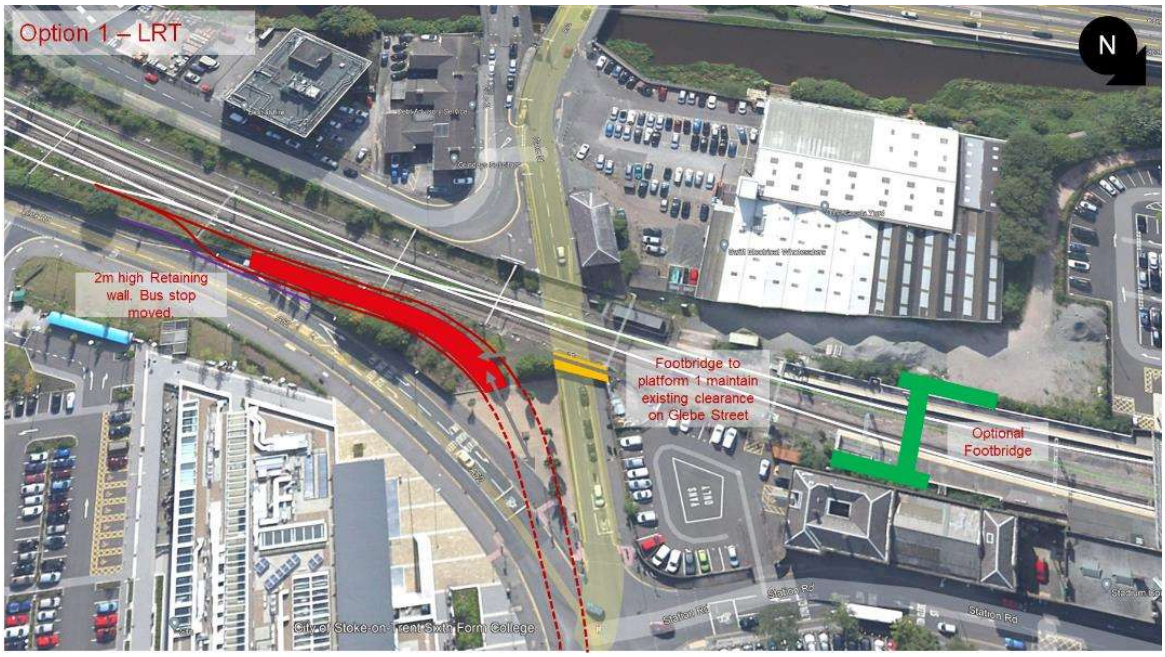


Figure 15 - Potential light rail adaptation to allow street running. Background image Google 2022 ©

The MVP, therefore, is a one train per hour service between Stoke and Leek using a single line terminating in a new bay platform at Stoke. This is termed Option A. The concept track layout could be as shown below.

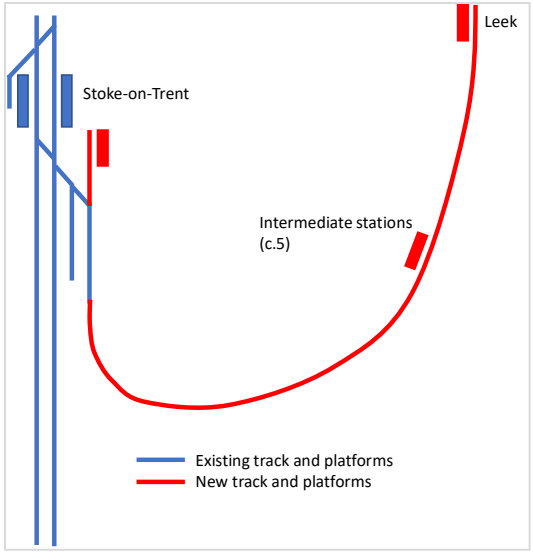


Figure 16 - Concept track layout for option A

The figure above shows only the minimum requirements for a passenger service between Stoke and Leek. It does not show the Churnet Valley Railway's requirements. The proposal is likely to include a shared operation between

Leekbrook Junction and Leek (c.1.5 miles). This could be either by sharing the track including associated signalling and safety regime or by two parallel tracks. This detail will need to be worked up at the next stage of development in conjunction with the Churnet Valley Railway.

MVP and Freight: Option B

The simplest solution for accommodating freight trains is time separation: ie to run them at night. However, this has a number of problems, including:

- Noise nuisance for residents
- Limits on the amount of traffic that could be accommodated at night

Emerging results from the economic analysis suggested that freight could contribute net benefits to the value for money assessment, but that this required more flexibility in the departure times of trains from the quarry and more traffic than could be accommodated at night..

We assessed the freight running time between Leekbrook (where the line to Cauldon Quarry would join the passenger line) and Stoke as 17-19 minutes for a 2,000 ton train. This is approximately the same journey time as a passenger train calling at intermediate stations. Therefore, it was possible to derive a concept solution with a passing loop in the Milton area to allow a freight train to pass a passenger train travelling in the opposite direction. This is shown diagrammatically on the indicative time/distance train graph below. The hourly passenger service is shown in blue and notional freight trains shown in red.

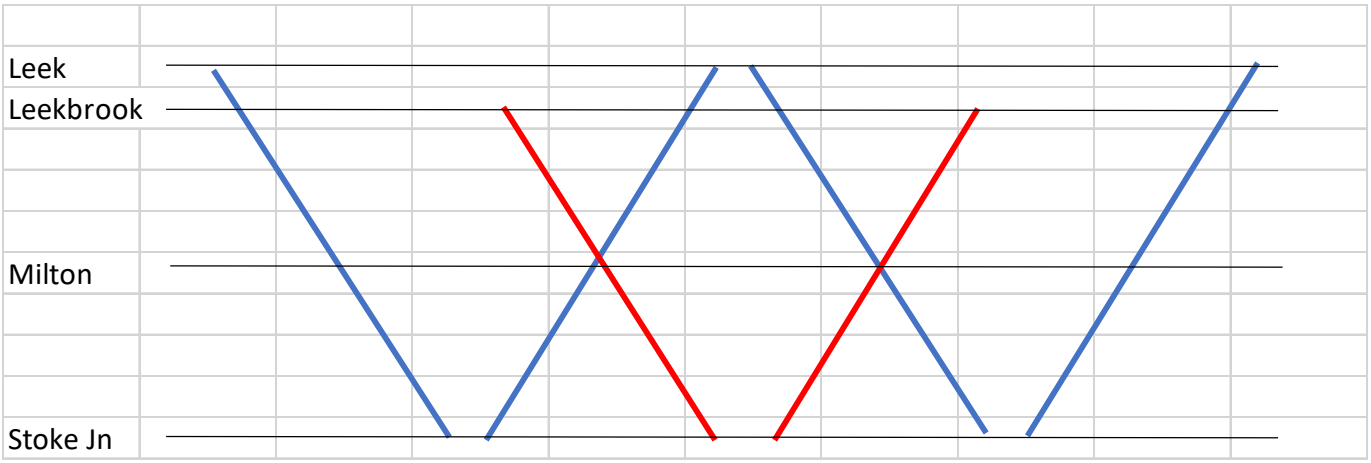


Figure 17 - Notional train graph for freight trains

A freight train could be held in the loop until there was a path across Stoke Junction onto the main line and beyond. This development of Option A is called Option B. Additional infrastructure, including signalling, would be required for the loop in the Milton area, and also to allow access to the freight spur to Cauldon Quarry. This is shown on the concept track layout below.

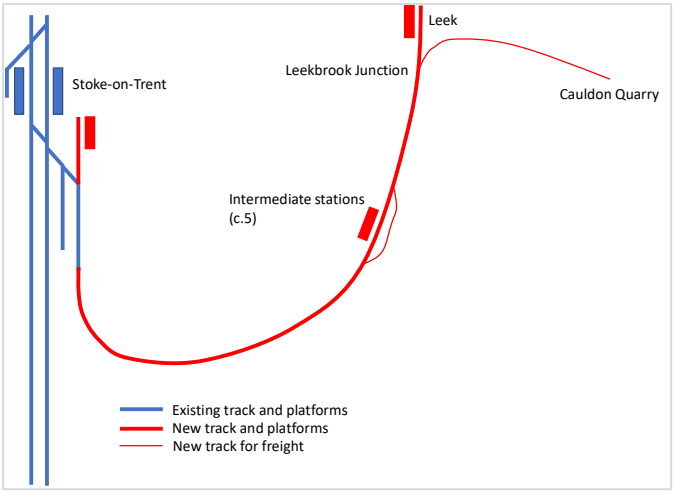


Figure 18 - Concept track layout for Option B (freight)

It is important to note that the deliverability of freight benefits depends also on the availability of capacity (and access rights) to run freight service from Cauldon Quarry on the main line network. Establishing this availability would be a item of work during the next stage of development.

Leek – Crewe: Option C

We tested the operability of extending the Leek – Stoke service to Crewe as Option C. We assumed the same service structure as for Options A and B and sought to identify whether there was a path between Stoke and Crewe that could allow the Leek service to be extended. We were able to make this work in current timetable. However, in the December 2022 timetable services through Stoke have been replanned, and this removes the gaps to make the extension of Leek services to Crewe work. However, it is likely that services through Stoke will be replanned again at some point, especially when HS2 starts operating, and for this reason we retained this option for appraisal.

Leek – Manchester: Option D

We also tested linking the Leek – Stoke train to the existing hourly Stoke – Manchester local service operated by Northern Railway. This currently terminates in the North end bay platform 3 at Stoke, and we assumed it would stay in its current path north of Stoke, but use platforms 1 and 2 to run through towards Leek. Because of the timing of the Manchester services arriving and departing at Stoke, the extended trains would pass each other on the Leek branch in the vicinity of Bucknall, requiring a passing loop.

The rolling stock required would need to be bi-mode instead of the current electric trains, as it is not envisaged that the Leek branch would be electrified. Train lengths would be longer than in other options, as they would be governed by capacity requirements into and out of Manchester, with consequential knock-on effects for the length of platforms on the Leek branch. However, it is also worth noting that train lengths on the Manchester service are currently limited to 3 cars – less than is sometimes needed – because of the length of the bay platform at Stoke. Extension to Leek could allow longer trains to run, as there is no easy solution to lengthening the bay platform.

Leek – Stoke 2 tph: Option E

It is important to consider how, in the future, the service on the branch could be scalable to operate every half hour instead of hourly. If these services were spaced 30 minutes apart they would pass in the vicinity of Milton – the same location as the passing loop required for freight in option B. If freight were not operating, it would be possible to operate this enhanced service on the concept track layout shown in Figure 18. Both trains could use the proposed bay platform at Stoke station, as they would be there at different times.

Adding freight services on top of a 2 tph passenger service has not been specifically considered in this SOBC. However, it is likely that a second passing loop would be required.

Other Heavy Rail Options: Options F and G

For the purposes of testing other service increments in the economic appraisal we also identified two further options with two trains per hour between Leek and Stoke. These are:

- Option F: one train per hour between Leek and Stoke and one between Leek and Crewe
- Option G: one train per hour between Leek and Stoke and one between Leek and Manchester

Light Rail Options

Light rail has different characteristics from heavy rail, including:

- Infrastructure standards which are different (for example, the signalling system is much simpler and train weights are lower resulting in different track standards)
- Higher frequencies can be operated because of the different signalling standards applied

We assumed that the platform solution for Stoke at Figure 15 would be applied. The implications of this are that:

- The line would have to be physically separate from Network Rail infrastructure
- No freight could operate on the line

The options we have tested are:

- Option H: four trams per hour
- Option I: six trams per hour

Summary

The following table summarises the options taken forward into the economic appraisal.

Option	Passenger	Freight
Option A	1 tph Leek – Stoke	NO
Option B	1 tph Leek – Stoke	YES
Option C	1 tph Leek – Crewe	NO
Option D	1 tph Leek – Manchester	NO
Option E	2 tph Leek – Stoke	NO
Option F	1 tph Leek – Stoke and 1 tph Leek – Crewe	NO
Option G	1 tph Leek – Stoke and 1 tph Leek – Manchester	NO
Option H	4 tph Leek - Stoke trams	NO
Option I	6 tph Leek – Stoke trams	NO

Figure 19 - Summary of options taken forward into economic appraisal

2.10. Rolling Stock and De-carbonisation Implications

The railway makes a contribution to de-carbonisation and net zero in two ways. The more significant way is through modal shift, taking polluting cars and lorries off roads and carrying passengers and freight by a more

carbon-efficient means, even if the railway vehicles are powered by diesel. This is because the carbon used per passenger or freight ton is much lower than for road transport.

The second way is through de-carbonising the traction used on the railways, through replacing diesel trains with ones powered by electricity through overhead wire contact, batteries or through the conversion of hydrogen stored on the train to electricity to power the traction motors.

Electrification through overhead wires for a heavy rail service is highly unlikely to have a business case on the Leek branch. To make a business case for electrification the level of traffic has to be high (more frequent and higher tonnage).

Hydrogen power requires extensive facilities for storage and fuelling which do not exist at most places in the UK, although some are being developed (eg in Teeside). In order to make this work, a higher concentration of services using hydrogen would be required than that available from the Leek branch (bearing in mind that the main line through Stoke is already electrified).

The other option is battery power. This technically is increasingly proven, with several manufacturers and operators in the testing phase of trains operating in this mode (either as the sole source of power or as a hybrid alongside diesel engines or overhead line electrification – the latter allowing operation beyond the limits of the overhead line, as well as charging the batteries from it). Examples include Merseyrail and the Greenford Branch on GWR.

In the case of the Leek branch we have based the business case and economic appraisal on a conservative case of using diesel trains that already exist, can be deployed from other routes as they in turn are electrified, and which still have asset life available. Our costing assumptions are based on ex-British Rail Class 158s.

However, if the project moves to the next stage of development, it will be important to consider the options in more detail, along with an assessment of the whole-life carbon impact of the scheme. Options to be considered would include:

- Use of more modern generation diesel trains, such as the Class 195s introduced by Northern Railway between 2017 and 2020. These comply with the latest diesel engine emissions standards.
- Use of battery trains (for Option A, B or E), charged in the platforms at Stoke and Leek.
- Use of electric/battery hybrid trains (for options that combine the service with the Northern Railways service between Manchester and Stoke)

The rolling stock strategy for the local services in this area has not yet been fully determined, and use of battery or hybrid trains on the Leek route would need to be part of a wider fleet strategy, as it is not realistic to have a "isolated" single train to operate the branch – a wider fleet of the same type would be required, operating other adjacent routes at the same time.

Light rail options would require either electrification, battery operation or a hybrid involving both. In this case, given the frequency required to make a tram network viable, a larger fleet would be required for the Leek branch. This would make the possibility of a bespoke, "isolated" fleet more plausible, but would more likely be deployed as a part of a wider Stoke-on-Trent Metro.

There is no immediate prospect of freight services on the Leek branch being operated by anything other than diesel locomotives.

Resourcing

How a heavy rail train service is resourced (and which Train Operator operates it) will depend on such factors as:

- Whether the service is Stoke – Leek only or whether it extends beyond that
- Location of Train Operator's traincrew
- Location of train servicing depot

A decision on this will need to be taken during the Develop Stage so that a single Train Operator is able to fully engage on the practical and commercial considerations of the project as it may affect them.

3. Economic Case

3.1. Approach

This chapter explores the economic case for the reopening of the Stoke to Leek railway to passenger services and the line from Leekbrook Junction to Cauldon to freight traffic. We explore the costs and benefits of different options, culminating in an assessment of the value for money of the scheme.

As outlined elsewhere in the report the Stoke – Leek scheme is unusual in that there are a wide range of use cases for the route covering heavy rail passenger services, light rail and freight traffic. These differing use cases generate a variety of interactions and dependencies some of which are complementary and have the ability to strengthen the business case. To support the short listing process we have appraised a wide variety of options to better understand their strengths and weaknesses, and identify which option has the strongest case.

The options that we have appraised are listed below and are described in more detail in the Strategic Case.

- Option A = Operating a 1tph (train per hour) passenger service between Leek and Stoke, with no freight services included
- Option B = As option A but with freight services included
- Option C = Operation of a 1tph Leek to Crewe passenger service
- Option D = Operation of a 1tph Leek to Manchester passenger service
- Option E = Operation of a 2tph Leek to Stoke passenger service
- Option F = Operation of 1tph Leek to Stoke & 1tph Leek to Crewe passenger services
- Option G = Operation of 1tph Leek to Stoke & 1tph Leek to Manchester passenger services
- Option H = Operation of a light rail system calling at all proposed intermediate stops on a 4 trains per hour frequency (no freight services operated)
- Option I = As Option H but with a 6tph frequency

The remainder of this chapter presents a summary of the approach taken to demand forecasting and appraisal but primarily focuses on reporting the finding of the demand forecasting and appraisal work undertaken. A more detailed demand forecasting, and economic appraisal technical note can be found at Appendix A.

3.2. Passenger Demand Forecasting and Appraisal Summary

The demand forecasting for the scheme was focussed on seven new station sites at:

- Fenton Manor
- Bucknall
- Birches Head / Abbey Hulton
- Milton
- Stockton Brook
- Endon
- Leek

The figure below presents the locations and modelled catchment areas of these stations.

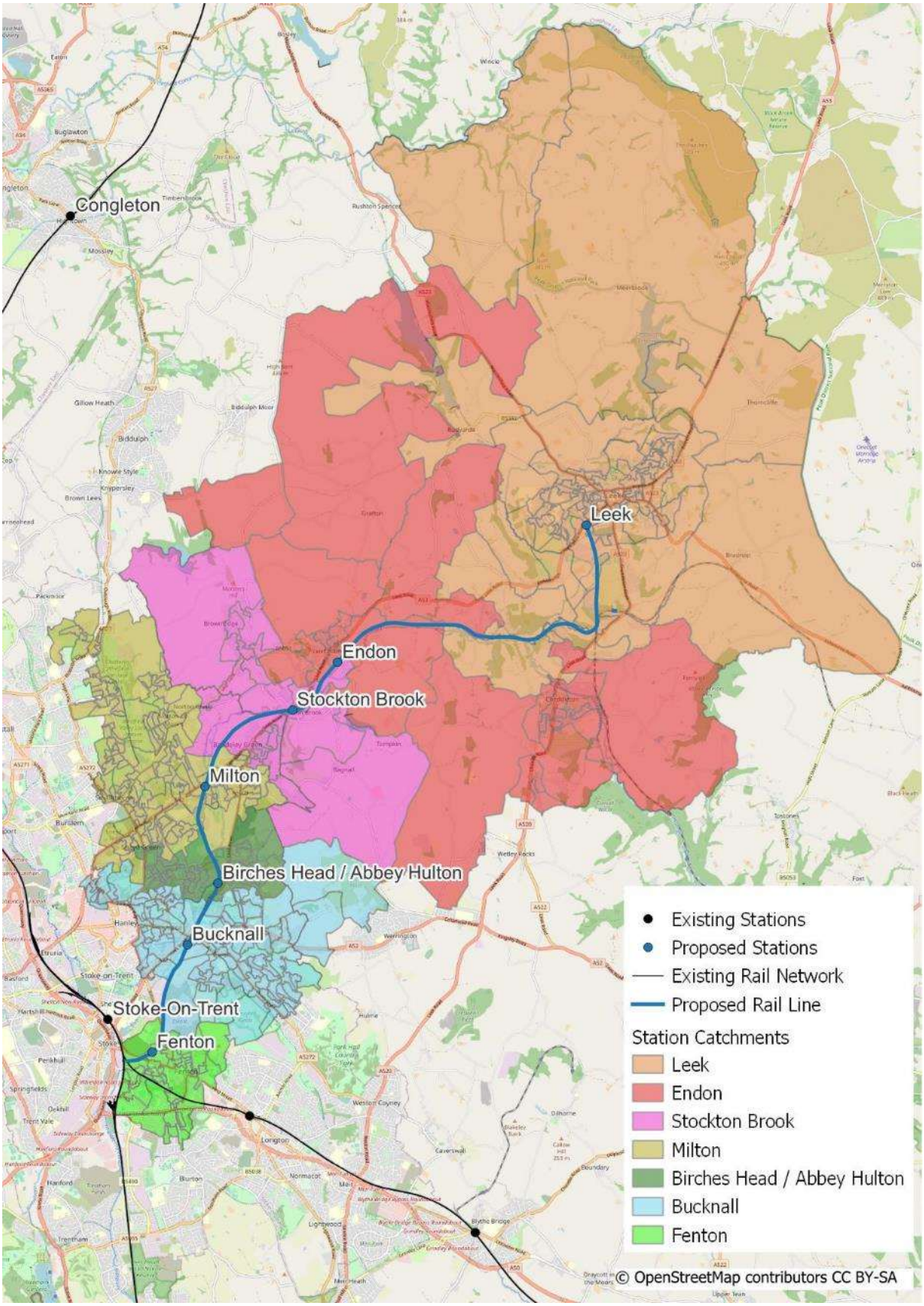


Figure 20 - Station catchment areas (source: Systra analysis)

The station sites mainly reflect the historic locations of stations on the route. Whilst these generally still align with the location of population and employment there have been changes to patterns of development since the route was closed to passenger traffic. A station at Birches Head/Abbey Hulton would be entirely new and would serve large housing estates that have never previously been served by rail.

The station sites should therefore be seen as indicative locations to provide an understanding of the order of magnitude of demand that might be achievable rather than definitive station locations. If the scheme is to be progressed further an early action would be to undertake more detailed analysis of locations both from a demand and engineering perspective to optimise the station sites. This might result in either a rationalisation of sites or especially in high frequency service options an increase in the number of sites.

Within the timetabling work associated with this study it was identified that were a service based around the concept of a *minimum viable product* to be developed one of the intermediate stations would have to be removed. This was necessary to ensure that a one train per hour service could be operated with a single train, whilst also providing a sufficiently robust timetable. Following an initial demand forecasting exercise (discussed in the following sections) Stockton Brook was removed. This was based on a review of both demand forecasts and catchment areas. Whilst Stockton Brook did not have the lowest level of demand, the location of housing and development in relation to possible station locations led to the conclusion that there was a greater risk that the station would not deliver the projected level of demand in practice. In addition the former station building is in private hands and this raises issues of land ownership and purchase that do not apply to any of the other potential station locations (which are in Network Rail or local authority ownership with the exception of Endon, where the station building is owned by Endon and Stanley Parish Council and currently operated as a tearoom).

For rail options we have developed a trip rate model capable of incorporating the impact of differing service levels including frequency and interchange. Trip rates were derived for a broad cross section of stations covering Derbyshire, Staffordshire, Cheshire, Shropshire and parts of Greater Manchester. Trip rates from the contributor stations with services and demographics comparable to the Stoke – Leek route were than amalgamated and applied to the population and employment information of the catchment areas of each station on the Stoke - Leek route.

The trip rates were initially estimated for a one train per hour service between Stoke and Leek. Forecasts for other service options were pivoted from this initial forecast using the Generalised Journey Time elasticities contained in the Rail Delivery Group Passenger Demand Forecasting Handbook (PDFH).

Key features of the rail demand modelling work included:

- Estimation of newly generated rail trips from each station
- Estimation of revenue impacts
- Estimated abstraction from bus service
- Future year forecasting and incorporation of demand lags after opening

The way in which our demand model is constructed includes longer distance trips beyond Stoke-on-Trent. This is important to this scheme, as whilst the majority of trips are likely to be to Stoke station, Stoke-on-Trent is also well connected to Manchester, Birmingham and London. In addition, the size of the market to Stoke-on-Trent itself is hampered by the polycentric nature of the city and the poor location of the existing station in Stoke Town, one mile from the modern-day city centre in Hanley.

Light rail options have been appraised using the same demand forecasting method. A limitation in our approach to light rail is uncertainty over the development of any wider Stoke-on-Trent light rail system. Such a system would generate considerable local demand in Stoke which would be additional to demand generated on the Leek line.

Similarly, our approach does not forecast the impact of any increase in demand between Stoke and Crewe as a result of increased service frequency on this route were Leek – Crewe services operated.

Our economic appraisal of the scheme has followed DfT TAG guidance. More detail on the approach can be found in Appendix A.

The main sources of benefit from the scheme are transport provider, user and non-user benefits. These include revenue from passengers, decongestion impacts, decarbonisation and air quality. The focus of decongestion impacts is on Stoke -on-Trent rather than the Leek area, though these benefits will also apply to longer distance flows.

3.3. Freight Demand and Appraisal

Aggregates transport by rail is on a gradually upward trend, as can be seen from the graph below.

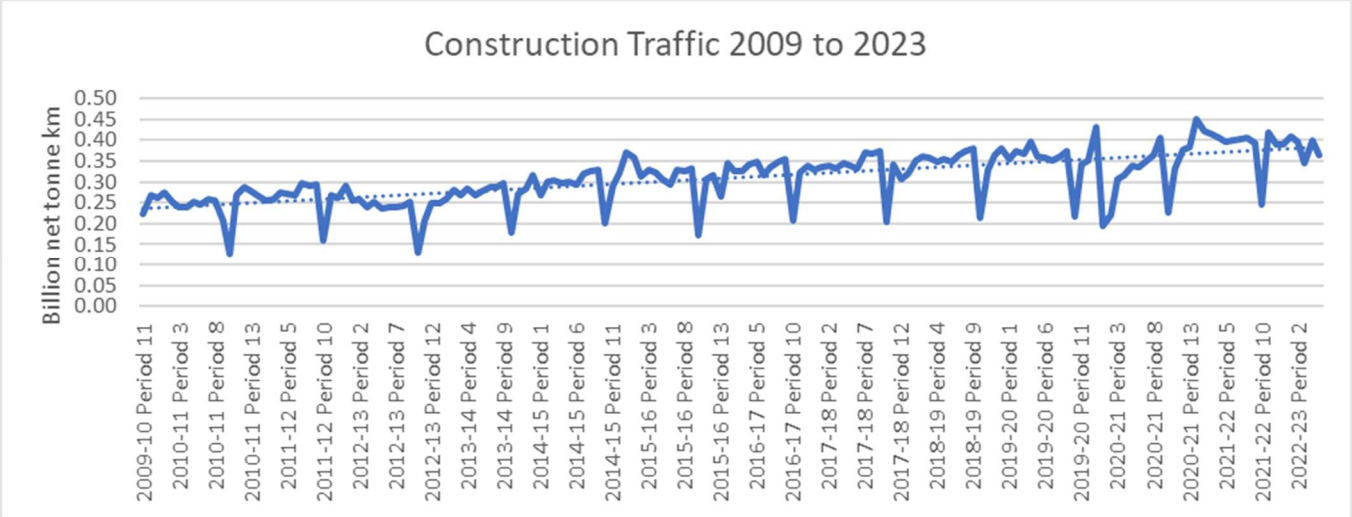


Figure 21 - Long term trend on freight aggregates traffic (source: ORR)

A deeper understanding of the market for freight and its impacts was estimated based on a series of assumptions following discussion with Aggregate Industries, the operator of Cauldon Quarry. Aggregate Industries identified that outbound flows from Cauldon would be both cement and unprocessed aggregates and that typical payloads would be in the order of 1,500 tons per train, which typically would form a train of 22 wagons. There is also scope for inbound movements of bulk fuel associated with cement production. In the longer term the outputs of carbon capture could also be moved by rail. This latter process involved capturing the carbon associated with cement production and moving it away from the site.

Aggregate Industries identified a number of medium and long distance destinations for freight movements. From this we have assumed that typically four trains per day could be operated from the quarry. This level of service is not untypical for larger rail served quarries such as Hindlow and Tunstead in the Peak District or Swinden Quarry in the Yorkshire Dales.

Based on the range of destinations provided by Aggregate Industries we have assumed that with four trains per day in operation, services would operate to the following locations:

- Pendleton (Manchester)
- Small Heath (Birmingham)
- Banbury

- Acton (London)

The ability to move material by rail would have two effects on Cauldon Quarry. For medium distance flows (Birmingham and Manchester) services would be replacing road haulage which brings a reduction in costs for Aggregate Industries and a reduction in the impacts of carbon emissions, other air pollutants and congestion to wider society. For longer distance movements the benefit to the quarry operator would be access to a larger market. The cost of transport is a significant factor in the overall costs of cement and stone and thus the catchment area and output from each quarry is determined by the cost of transport. Rail freight provides an efficient way of moving stone and cement in bulk and therefore provides the basis for expanding the catchment of the quarry, thus allowing an increase in output from the quarry and an increase in income to Aggregate Industries.

As demonstrated in the figure above the number of net tonne km for construction traffic has increased over the last 10 years, at a time when overall production has crushed rock, sand and gravel has been broadly stable. This indicates that the length of haul has been increasing over time. Based on engagement with Aggregate Industries it is understood that this increase in length of haul has been driven by consolidation in the aggregate sector with a focus on fewer larger quarries. In addition there has been a notable reduction (through exhaustion of sites) in the number of quarries in the South East and East of England meaning that quarries elsewhere (in the north of England and south west) are increasingly supplying the market in the south of England, especially London. These longer distance flows from larger quarries are more suitable for rail haulage than road haulage.

To address this in the economic appraisal we have undertaken two tests:

- In the core scenario we have assumed that the two long distance trains would result in the loss of two existing rail movements to these destinations from competing quarries that incur higher costs, typically by being a longer distance movement. For example, a Cauldon – London flow would replace a Tunstead – London flow which has a greater distance and thus a higher cost. The benefits that can be derived from this are therefore a change in operating costs and a change in carbon emissions. This is a very robust approach that accommodates any future scenario where the scope for transfer from quarries in the south of England is limited.
- We have also produced a sensitivity test where it is assumed that the two long distance flows replace shorter distance routes operated by road vehicles from sites closer to the final destinations in the South East. This will provide a more positive result than that described above.

Whilst in practice it is possible that overall demand for aggregates may rise (independent of this scheme), we believe that the approach above provides a robust way of estimating the overall societal impact of the freight component of this scheme.

3.4. Demand Forecasting Results

The tables below present the volume of trips generated for each heavy rail scenario. The demand is broken down into three elements in three forecast years. The figures are presented for the first year of full operation (2027), 2030, and 2040. There is a build-up of demand over the first four years from opening, so data for 2030 is presented as a year after the completion of the demand lags.

Option	2027	2030	2040
Option A = 1tph Leek – Stoke	371,950	757,830	821,187
Option B = 1tph Leek - Stoke + Freight	371,950	757,830	821,187
Option C = 1tph Leek – Crewe	373,522	760,981	824,516
Option D = 1tph Leek – Manchester	385,237	785,187	851,757
Option E = 2tph Leek – Stoke	446,907	909,885	984,421
Option F = 1tph Leek - Stoke/1tph Leek – Crewe	447,685	911,446	986,070
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	455,086	926,725	1,003,235
Option H = 4tph Leek - Stoke Light Rail	588,098	1,193,137	1,280,468
Option I = 6tph Leek - Stoke Light Rail	683,876	1,385,843	1,483,033

Figure 22 - Demand forecast by option (Annual Demand)

The figures above suggests that by 2030 demand would vary between 757k and 1.38m trips per annum dependent on the service option, rising to totals of between 821k and 1.48m by 2040. Key points that emerge from the forecast are as follows:

- The 1tph Leek – Stoke option (Options A and B) delivers the lowest total demand but this figure is still in excess of 80% of the total demand of the highest heavy rail demand option (Option G)
- Increasing frequency to 2tph between Leek and Stoke (Option E) increases demand by 20%
- Extending services towards Crewe or Manchester does not significantly increase demand. In part this is because there are multiple locations beyond Stoke and extending to only one destination cannot serve all markets well. Further to this whilst Manchester is a major regional centre a direct service from Leek would be an all stations stopping service with a journey time from Stoke to Manchester of 53 minutes compared to around 35 minutes for fast services which could be connected into at Stoke from Leek.
- The light rail options with a much higher frequency generate markedly higher levels of demand, up to twice the demand in Option A.

The finding that the service extensions beyond Stoke do not add significantly to the demand figures is important in understanding the case for these service extensions both of which incur operational complications as set out in the strategic case.

The table below summarises demand at each station in Option A.

Option A	2027	2030	2040
Leek	89,157	181,671	194,627
Endon	19,256	38,944	41,557
Milton	93,919	191,272	207,993
Birches Head / Abbey Hulton	34,173	69,625	75,789
Bucknall	88,446	180,324	196,352
Fenton Manor	46,998	95,995	104,868
Sum	371,950	757,830	821,187

Figure 23 - Option A station demand

It can be seen that Leek, Milton and Bucknall stations drive the demand for the service with around 200k passenger per annum by 2040, and Fenton Manor and Birches Head have demand of around half of this value. Endon has a lower level of demand however more detailed work may be required to understand the catchment areas for stations as it is possible that Endon may absorb more of Stockton Brook's catchment area then Milton does.

The following table is a forecast of where people from the Leek branch will be travelling to, and vice versa.

Destination	Trips (2030)	%
Stoke-on-Trent	344,097	45%
Manchester	92,345	12%
Birmingham	47,520	6%
London	41,148	5%
Crewe	9,463	1%
All Other Destinations	223,257	29%
TOTAL	757,830	100%

Figure 24 – Destination/origin points of passengers on the Leek branch

3.5. Revenue

The table below presents the revenues associated with each option. These are for 2030 demand but are presented at 2022 prices. The revenue is presented as three columns, Stoke-Leek revenue, wider industry revenue, and total revenue. The revenue has been split in this way to demonstrate the scale of the contribution that the route makes to the wider rail network. The contributory revenue going beyond Stoke represents high proportion of total revenue as the distance form Stoke to Leek is comparatively low compared to the distance associated with these longer distance flows. It should be noted that it has been assumed that in any light rail option through ticketing to the National Rail network would be available.

Option	Stoke-Leek Revenue	Wider Industry Revenue	Total Revenue
Option A = 1tph Leek – Stoke	£1.03m	£4.17m	£5.20m
Option B = 1tph Leek - Stoke + Freight	£1.03m	£4.17m	£5.20m
Option C = 1tph Leek – Crewe	£1.04m	£4.18m	£5.22m
Option D = 1tph Leek – Manchester	£1.07m	£4.43m	£5.50m
Option E = 2tph Leek – Stoke	£1.22m	£4.33m	£5.54m
Option F = 1tph Leek - Stoke/1tph Leek – Crewe	£1.22m	£4.33m	£5.55m
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	£1.24m	£4.49m	£5.72m
Option H = 4tph Leek - Stoke Light Rail	£1.54m	£4.48m	£6.01m
Option I = 6tph Leek - Stoke Light Rail	£1.73m	£4.48m	£6.20m

Figure 25 - Revenue at 2030

The **total** revenue generated would be sufficient to cover the operating costs of all services, however as the wider industry revenue would be absorbed by other operators, revenue support would be required to fund the service to Leek. In Options A and B (1tph Leek – Stoke) the level of revenue support required would around £0.6m per annum.

3.6. Scheme Costs

Estimates for both capital and operating costs have been produced. Low, medium and high estimates have been produced for the capital costs. We have used medium values in this appraisal. For capital costs we have applied TAG guidance to apply Optimism Bias to point estimates to derive a figure to be included in the appraisal. Similarly, we have applied an appropriate level of Optimism Bias to the operating costs. Details relating to engineering and capital costs can be found in Appendix A.

The table below present the point estimates, Optimism Bias and discounted costs for the scheme. Optimism Bias has been applied at a rate of 56%, which is in line with TAG Unit A5-3 for new-build rail schemes at SOBC level.

Option	Point Estimate	Point Estimate + Optimism Bias	Present Value
Option A = 1tph Leek – Stoke	£200.40	£312.63	£175.51
Option B = 1tph Leek - Stoke + Freight	£299.22	£466.79	£262.06
Option C = 1tph Leek – Crewe	£200.40	£312.63	£175.51
Option D = 1tph Leek – Manchester	£200.40	£312.63	£175.51
Option E = 2tph Leek – Stoke	£206.23	£321.72	£180.62
Option F = 1tph Leek - Stoke/1tph Leek – Crewe	£206.23	£321.72	£180.62
Option G = 1tph Leek - Stoke/1tph Leek - Manchester	£206.23	£321.72	£180.62
Option H = 4tph Leek - Stoke Light Rail	£180.68	£281.86	£158.24
Option I = 6tph Leek - Stoke Light Rail	£180.68	£281.86	£158.24

Figure 26 - Capital costs (£m)

Note that the point estimates are not the same figures as shown in the Financial Case. This is because they have been discounted in accordance with TAG guidance. The base figures used for the calculation are the same.

The capital costs associated with the scheme are substantial in all options, reflecting the need to reconstruct the infrastructure of a route which has been mothballed for 30 years. The point estimates are around £200m for heavy rail passenger services, rising to £243m for light rail options, reflecting a need for more passing loops.

In Option B the additional costs of upgrading the freight only line to Cauldon Low plus the addition of a passing loop between Leek and Stoke add approaching £100m to the cost estimates associated with Option A.

The table below presents the combined capital and operating costs discounted at 2010 values to give the Present Value of Costs. More detail on the derivation of operating costs can be found in the financial case. The operating costs do however contain an allowance for ongoing track renewals as well as train movements costs.

Option	Passenger CAPEX	Freight CAPEX	OPEX	PVC
Option A = 1tph Leek – Stoke	£175.51	£0.00	£34.38	£209.89
Option B = 1tph Leek - Stoke + Freight	£175.51	£86.55	£34.38	£296.44
Option C = 1tph Leek – Crewe	£175.51	£0.00	£71.34	£246.85
Option D = 1tph Leek – Manchester	£175.51	£0.00	£45.55	£221.06
Option E = 2tph Leek – Stoke	£180.62	£0.00	£58.65	£239.27
Option F = 1tph Leek - Stoke/1tph Leek – Crewe	£180.62	£0.00	£99.26	£279.88
Option G = 1tph Leek - Stoke/1tph Leek - Manchester	£180.62	£0.00	£73.47	£254.09
Option H = 4tph Leek - Stoke Light Rail	£158.24	£0.00	£82.83	£241.07
Option I = 6tph Leek - Stoke Light Rail	£158.24	£0.00	£120.23	£278.50

Figure 27 - Scheme costs (£m 2010 prices)

It can be seen that Option A incurs the lowest costs overall with a discounted value of £210m over 60 years. With the addition of the freight capital costs in Option B this increases to £296m. The extension of services to Crewe and Manchester increases the costs further. Operating to Crewe requires a new service between Stoke and Crewe. In the case of Manchester an existing service would be extended to Leek but this would require the use of longer four coach trains compared to the two coach trains which would be used for a Stoke – Leek shuttle thus increasing costs. The total costs for Light Rail services are between 15% and 33% more expensive than the lowest cost Option A heavy rail scheme, however they deliver between four and six times as many train services, thus in terms of output and supply of services they represent better value than Option A.

It should be noted that freight operating costs are treated as a change in benefit to business users and providers rather than forming part of the Present Value of Costs.

3.7. Scheme Benefits

The tables below presents the benefits associated with each scheme option. These are presented discounted to 2010 values and together form the Present Value of Benefits. Figure 28 presents the passenger benefits and Figure 29 the freight benefits associated with Option B.

Option	Passenger Benefits			Present Value of Benefits
	Rail Revenue	MECC	Bus Operator Revenue Loss	
Option A = 1tph Leek - Stoke	£97.80	£66.23	-£1.35	£162.69
Option B = 1tph Leek - Stoke + Freight	£97.80	£66.23	-£1.35	£162.69
Option C = 1tph Leek - Crewe	£98.09	£66.43	-£1.35	£163.18
Option D = 1tph Leek - Manchester	£103.40	£70.02	-£1.35	£172.07
Option E = 2tph Leek - Stoke	£104.20	£70.62	-£1.87	£172.95
Option F = 1tph Leek - Stoke/1tph Leek – Crewe	£104.35	£70.72	-£1.87	£173.20
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	£107.65	£72.96	-£1.87	£178.74
Option H = 4tph Leek - Stoke Light Rail	£112.84	£76.56	-£5.81	£183.59
Option I = 6tph Leek - Stoke Light Rail	£116.31	£78.98	-£7.26	£188.04

Figure 28 - Present Value of Benefits (passenger Services) £m

	CO2	MECC	Operating Cost Saving	PVB
Option B = 1tph Leek - Stoke + Freight	£27.24	£35.64	£76.93	£139.81

Figure 29 - Present Value of Benefits (Freight) £m

It can be seen that the bulk of the benefits emerge from additional revenue generated by the train service, followed by Marginal External Congestion Cost (MECC) impacts. It is notable that the freight benefits totalling £139.81m from four trains per day are nearly as high as the benefits generated by the passenger service. Although the freight component of the scheme has significant capital costs the benefits associated with freight will make a useful contribution to supporting the overall business case for the Leek – Stoke section of the route.

3.8. Appraisal Results

Within the following tables we present the results of the economic appraisal of the options.

Option	PVB	PVC	NPV	BCR	VfM
Option A = 1tph Leek – Stoke	£162.69	£209.89	-£47.21	0.78	Poor
Option B = 1tph Leek - Stoke + Freight	£302.50	£296.44	£6.06	1.02	Low
Option C = 1tph Leek – Crewe	£163.18	£246.85	-£83.67	0.66	Poor
Option D = 1tph Leek – Manchester	£172.07	£221.06	-£48.99	0.78	Poor
Option E = 2tph Leek – Stoke	£172.95	£239.27	-£66.31	0.72	Poor
Option F = 1tph Leek - Stoke/1tph Leek - Crewe	£173.20	£279.88	-£106.68	0.62	Poor
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	£178.74	£254.09	-£75.35	0.70	Poor
Option H = 4tph Leek - Stoke Light Rail	£183.59	£241.07	-£57.48	0.76	Poor
Option I = 6tph Leek - Stoke Light Rail	£188.04	£278.50	-£90.46	0.68	Poor

Figure 30 - Appraisal results

It can be seen that with the exception of one option, all of the appraised options produce a Benefit Cost Ratio below 1.00 representing poor value for money. Option B which combines an hourly passenger service with freight traffic generates a Benefit Cost Ratio (BCR) of 1.02. This demonstrates the scale of benefits achieved by freight traffic from Cauldon, as the benefits associated with freight are able to support both the costs associated with upgrading the route from Leekbrook Jn to Cauldon and offset the negative Net Present Value achieved by the Option A passenger service. This demonstrates a dependency between passenger and freight options as whilst the freight option can contribute to supporting the opening of Stoke – Leek it would not be able to support both Stoke – Leek and Leekbrook – Cauldon upgrades in isolation.

The remaining options have BCRs that fluctuate between 0.62 and 0.78. Of these Option A, Option D and Option H perform best. It can be seen that extending services beyond Stoke makes little difference to the value for money of the scheme, with the additional benefits being offset by the additional operating costs.

However, in a number of areas this appraisal is being very conservative. For services towards Crewe there will be marginal gains from operating a higher frequency service between Stoke and Crewe and the Light Rail options could be integrated into a wider network.

We have undertaken a number of sensitivity tests on Option B (the best performing option). These tests cover:

- A demand sensitivity looking at the long-term impacts of COVID-19 and hybrid working on rail demand. This has applied DfT's medium COVID sensitivity.
- An increase in operating costs of 20%
- The use of the low estimate of the capital costs
- Impact of additional tourism spend in the local economy based on average spend per visitor by rail to Leek

- Test of Class 195 rather than Class 158 operating costs representing a position where more modern trains have superseded Class 158.
- Application of the more optimistic freight scenario described in Section 3.3.

	Option B	Medium COVID	20% OPEX Increase	Lower Capital Cost	Tourism Impacts	Class 195 OPEX	Freight Sensitivity
PVB	£302.50	£288.08	£302.50	£302.50	£327.82	£302.50	£362.16
PVC	£296.44	£296.44	£303.32	£207.93	£296.44	£299.92	£296.44
NPV	£6.06	-£8.36	-£0.82	£94.57	£31.38	£2.58	£65.72
BCR	**1.02**	**0.97**	**1.00**	**1.45**	**1.11**	**1.01**	**1.22**

Figure 31 - Sensitivity tests on Option B

The medium COVID, 20% operating cost increase, and the use of Class 195 rolling stock operating costs make little difference to the overall appraisal. Applying tourism benefits makes a more noticeable difference with the BCR increasing from 1.02 to 1.11. The freight sensitivity makes a larger difference with an enhanced level of mode shift from road to rail moving the BCR from 1.02 to 1.22. This underlines the importance of freight to this business case. However, it is the use of the low capital cost estimate that makes the greatest difference to the appraisal, with the BCR increasing from 1.02 to 1.45.

3.9. Commentary on Economic Case

The appraisal of the scheme options has provided clarity over the case for investment in the reopening of the Stoke – Leek route. The headline findings that emerge are as follows:

- No heavy rail passenger option is able to generate a Benefit Cost Ratio in excess of 1.00. This is due to the high capital costs associated with reopening the route
- The extension of services beyond Stoke-on-Trent makes little difference to the economic appraisal as the additional benefits are offset by increased operating costs
- With the addition of freight traffic the scheme generates a BCR in excess of 1.00 representing low value for money. The freight benefits based on four trains per day are high enough to both support the investment required between Leekbrook and Cauldon and support a proportion of the capital costs between Leek and Stoke. The sensitivity test on freight demonstrates the importance of freight to the business case
- The Light Rail options generate BCRs similar to the best heavy rail options and there would be more benefits that go beyond the scope of this study were a light rail option to be integrated into a wider Stoke mass transit system. Operation of a light rail system would preclude operation of freight traffic on the route
- The overall case is highly sensitive to capital costs assumptions an areas where significantly more work would be required if the scheme is to be progressed. Using the low rather than central cost assumptions increases the BCR from 1.02 to 1.45 moving it close to medium value for money

The findings above suggest that there is a case for more detailed work to examine a combined heavy rail passenger and freight scheme (Option B). It is necessary for both passenger and freight to be incorporated into the scheme as without both components there are likely to be insufficient benefits to cover capital costs for a heavy rail option.

If more detailed work concluded that a heavy rail scheme were not viable, there may be scope for utilising the route as part of a light rail scheme, but only if this could be integrated into a wider Stoke-on-Trent light rail scheme to help maximise benefits. It is noted that the parameters of this study have not enabled full consideration to be given to the economic case for light rail as part of a wider, linked light rail network in Stoke-on-Trent, nor of a very / ultra-light rail option.

4. Financial Case

4.1. Approach

The Financial Case addresses the affordability of the proposal and its funding arrangements. This chapter therefore summarises the work to date to develop an early estimate of the:

- Capital costs of the various options for the project
- Operating costs and revenues in order to establish whether ongoing revenue support would be required

4.2. Scheme Capital Costs

A high-level engineering assessment of the capital costs of the options has been undertaken by SLC Rail on behalf of the project. These are based on an assessment of the infrastructure requirements arising from the scope of the options set out in the Strategic Case.

A more detailed analysis of the engineering requirements can be found at Appendix B and the full cost estimates can be found at Appendix C.

Overall Considerations

Estimates were produced using the Rail Method of Measure 1 based on bills of quantities developed by the designer, but also using information from mapping data for the route. Allowances have been included to cover aspects where the level of design is insufficient to produce a price build up. Costs are built up as follows:

- Direct construction costs
- Uplifts for indirect costs, design, project management and overheads taken from benchmarked data
- A 60% risk allowance added in line with Network Rail standard guidance for a project at this early stage of development

Heavy Rail Considerations

It is important to note that, although the route carried freight traffic until 1988, the railway formation is in poor condition, and substantial works will be required to bring it to the required standard to become part of the national rail network and secure approval from the Office of Rail and Road for its reopening. For example, on the section between Endon and Leekbrook the existing track is in poor condition and not suitable for the level of service required, and the track will need to be partially renewed to the required standard.

On the section from Stoke to Endon the railway has been abandoned and hence is in very poor condition and will require significant works, including complete renewal of track, formation works, drainage and rebuilding of some bridges.

These points are evident from the example photographs shown below.

Figure 32 - Examples of route condition between Endon and Leekbrook

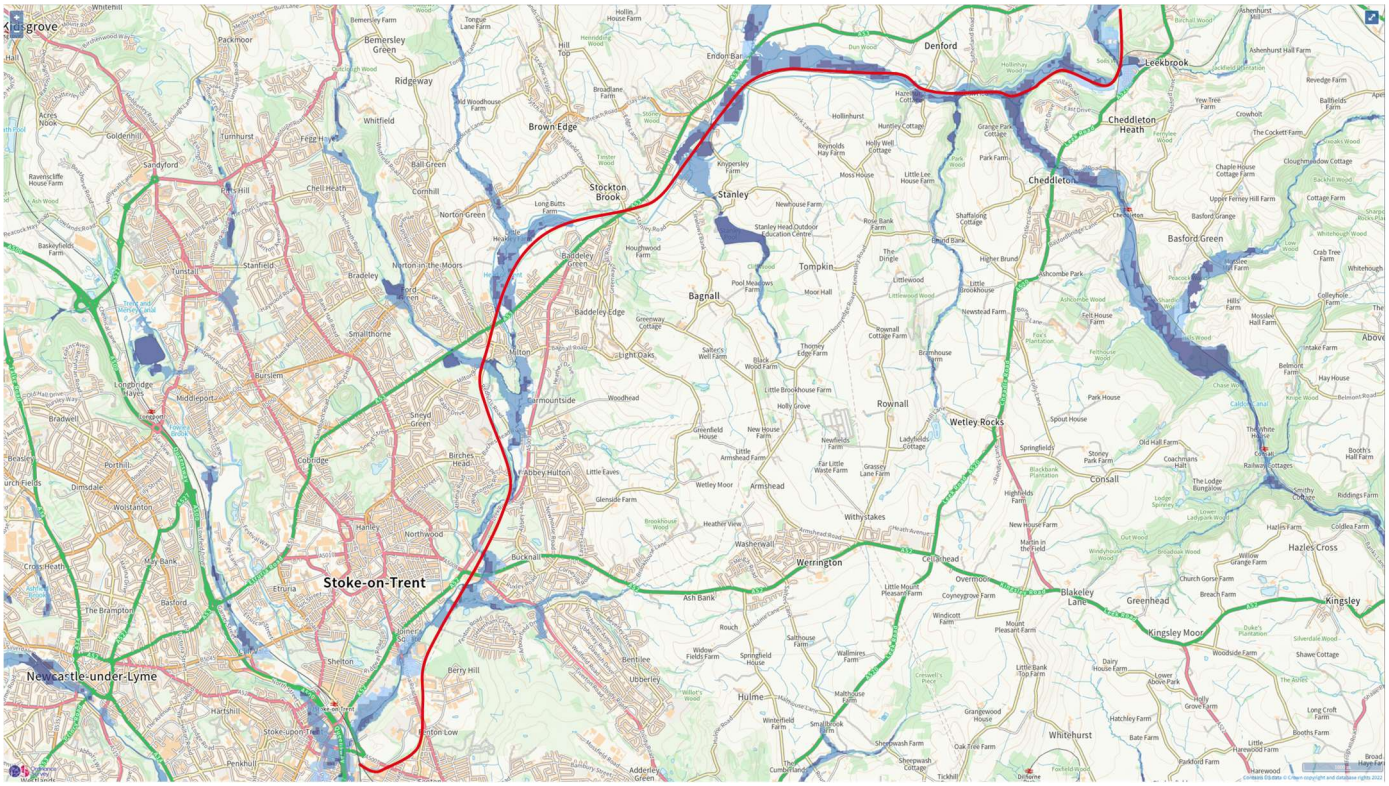
Figure 33 - Example of route condition between Stoke and Endon

The other key issues are:

- Level crossings including foot crossings, which are unlikely to be acceptable on what would effectively be a new railway
- The route has significant sections which interface with watercourses and the flood plain (see figure below)
- Until site surveys are conducted at the next stage of scheme development there will remain uncertainty about how many of the original bridges will require reconstruction and about the extent of stabilisation works required to earthworks. The route has sections in shallow cutting and on embankments which are

unlikely to meet modern standards. For example, the route at Leekbrook has a number of steep embankments that may require stabilising.

- There will be potentially significant environmental issues due to the interface with watercourses, canal and green spaces.



https://flood-map-for-planning.service.gov.uk/

Figure 34 - Map showing interface between the railway (in red) and the floodplain

Land ownership is not expected to be a major issue. The route itself is owned by Network Rail. Proposed station sites are in the ownership of Network Rail or local authorities, with the exception of Stockton Brook where it is difficult to see how access to platforms could be achieved without taking the old station building back into railway ownership. At Milton and Fenton Manor the old station buildings are now private houses/businesses, but potential alternatives are available for accessing platforms. Endon station building is owned by Endon and Stanley Parish Council and operated as a tearoom.

Heavy Rail Cost Estimate

The figure below shows the build-up of the heavy rail capital cost estimate. It can be seen that:

- Low, medium and high ranges are shown
- A breakdown of the medium range for direct construction costs is shown on the right-hand side, along with the assumptions about the level of work required. For example, 15 bridges are assumed to require reconstruction out of the 41 on the line.
- Land acquisition costs are excluded at this stage.

The costs for track, formation, sleepers, drainage and pointwork are £823.26/m. This compares with £804.91/m, recently priced by Network Rail on the Northumberland Line. The costs for replacement of existing underbridges and overbridges, at £3,750,000 each, is also comparable to recent examples elsewhere.

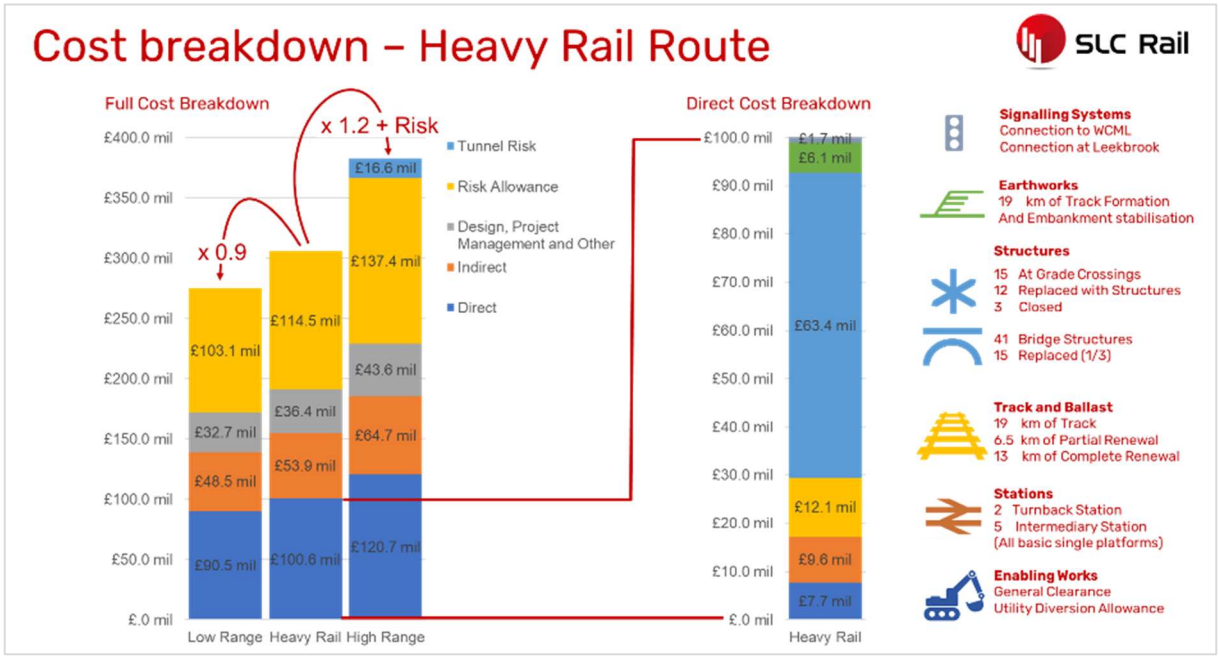


Figure 35 - Heavy rail capital cost estimate

Heavy Rail Freight

The above figures are those for a one train per hour passenger service between Stoke and Leek. The addition of freight services requires:

- Extension of the railway from Leekbrook to Cauldon Quarry
- Additional signalling
- A passing loop on the route in the vicinity of Milton

The "low range" cost estimate for the incremental cost of this is £47m.

This is based on the use of low standard track for limited low speed use by freight between Leekbrook and Cauldon. There is no allowance for a railhead at the quarry as it is assumed that this would be delivered by Aggregate Industries at or near its historic location.

Light Rail

Two options have been considered here:

- One that uses the heavy rail formation in its entirety to new light rail platforms at Stoke station (with the potential for extension into the City), as discussed in the Strategic Case.
- One that diverges off the heavy rail formation in the vicinity of Milton and then runs on street to Hanley Bus Station as part of a Stoke-on-Trent Metro system.

The other key assumptions are:

- Five intermediate stops and two turnback stations at Leek and the Bus Interchange or railway station are included in the cost, including an allowance for ancillary civils works at each site as well as minor modification to the highways. The cost of the stops has been assumed to be 50% of the cost of a heavy rail station.
- There is "new systems" cost for installing a light rail system that include the cost of a depot and procuring the light rail stock.
- Six light rail train sets are required and an allowance for procurement of light rail vehicles is included in new system cost in high rang estimate.
- The on-street track rate includes for associated and paving works.
- At grade crossings are assumed to be replaced with signalised junctions.

It is important to note that the light rail option excludes the opportunity for use by freight trains because of the different standards that apply.

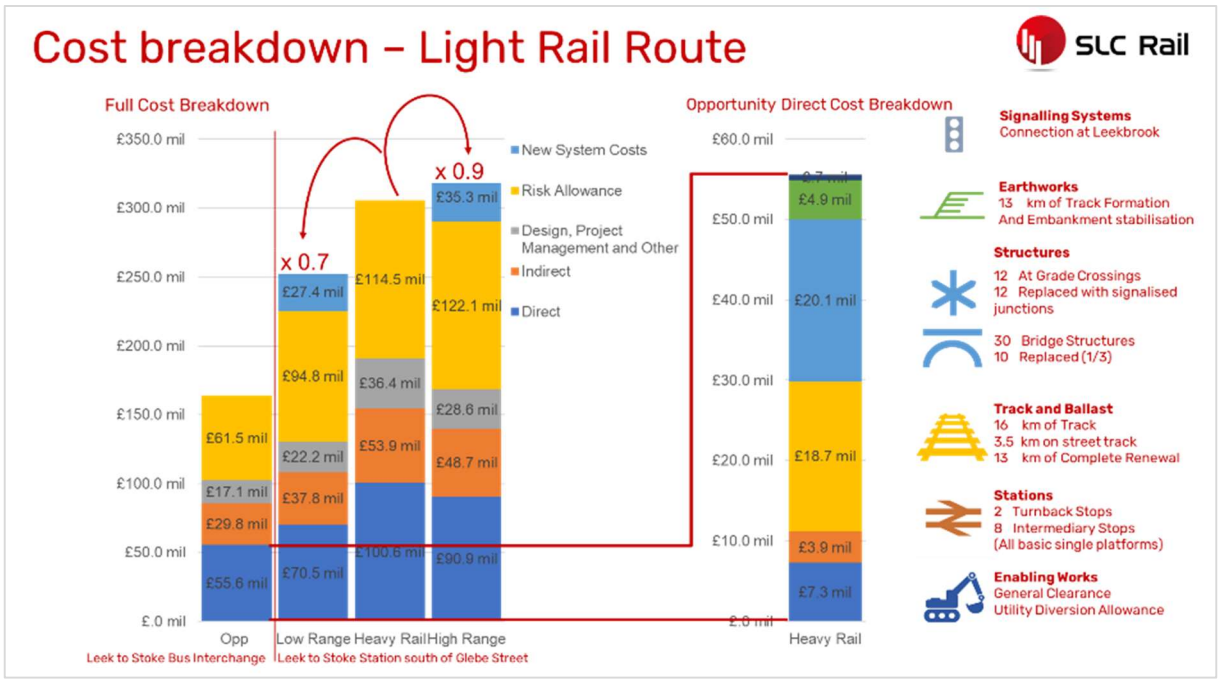


Figure 36 - Cost estimate for light rail options

4.3. Operating Costs

Notional train diagrams were prepared to enable the number of additional trains required under each option to be calculated. Standard industry unit costs were then applied to these in the following categories:

- Vehicle leasing costs
- Maintenance costs per vehicle mile
- Fuel costs per vehicle mile
- Variable track access costs per vehicle mile
- Traincrew requirements based on cost of employment and an estimate of the number of crew required based on the number of incremental weekday train diagrams
- An allowance for station operating costs

As this is new route there would by implication be a change to Network Rail's fixed track access charges. Estimating this value accurately is complex and not appropriate at this stage of development. To deal with this issue we have estimated total track maintenance charges for a route of this type using a formula contained in the ORR report "*Cost benchmarking of Network Rail's maintenance and renewals expenditure.*"

For all heavy rail service options that were self-contained between Stoke and Leek or operated to Crewe it was assumed that a two car Class 158 would be used. For the Manchester option it was assumed that a four car Class 331 would be used as a proxy for a Battery Electric Multiple Unit (and a mix of 3 and 6 car units throughout the day).

The following table shows the passenger service operating costs of each option. The freight operating costs are excluded as they assumed to be covered commercially by the revenue paid to the Freight Operating Company.

Option	**Passenger Operating Costs pa (£m) – 2019m Prices**	**Key Assumptions**
Option A = 1tph Leek – Stoke	1.6	One train required. Assumed to be class 158.
Option B = 1tph Leek - Stoke + Freight	1.6	As above
Option C = 1tph Leek – Crewe	3.3	Two trains required as there is no existing service between Stoke and Crewe that could be diverted to Leek. Assumed to be class 158.
Option D = 1tph Leek - Manchester	2.1	Extension of current Northern Stoke – Manchester. Assumed to be bi-mode rolling stock. Requires two additional trains.
Option E = 2tph Leek – Stoke	2.7	As option A but two additional trains required. Assumed to be class 158.
Option F = 1tph Leek - Stoke/1tph Leek - Crewe	4.6	Three additional trains required. Assumed to be class 158.
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	3.4	Combination of Option A and Option D.
Option H = 4tph Leek - Stoke Light Rail	3.4	Six trams required
Option I = 6tph Leek - Stoke Light Rail	5.1	Eight trams required

Figure 37 - Operating cost assumptions

4.4. Ongoing Financial Impact

The striking point is that in almost all years and in all options the whole-industry revenue generated by the new services covers the operating costs, and hence no operating subsidy would be required. The graph below shows the revenue v operating costs for the 1 tph Leek -Stoke options (A and B).

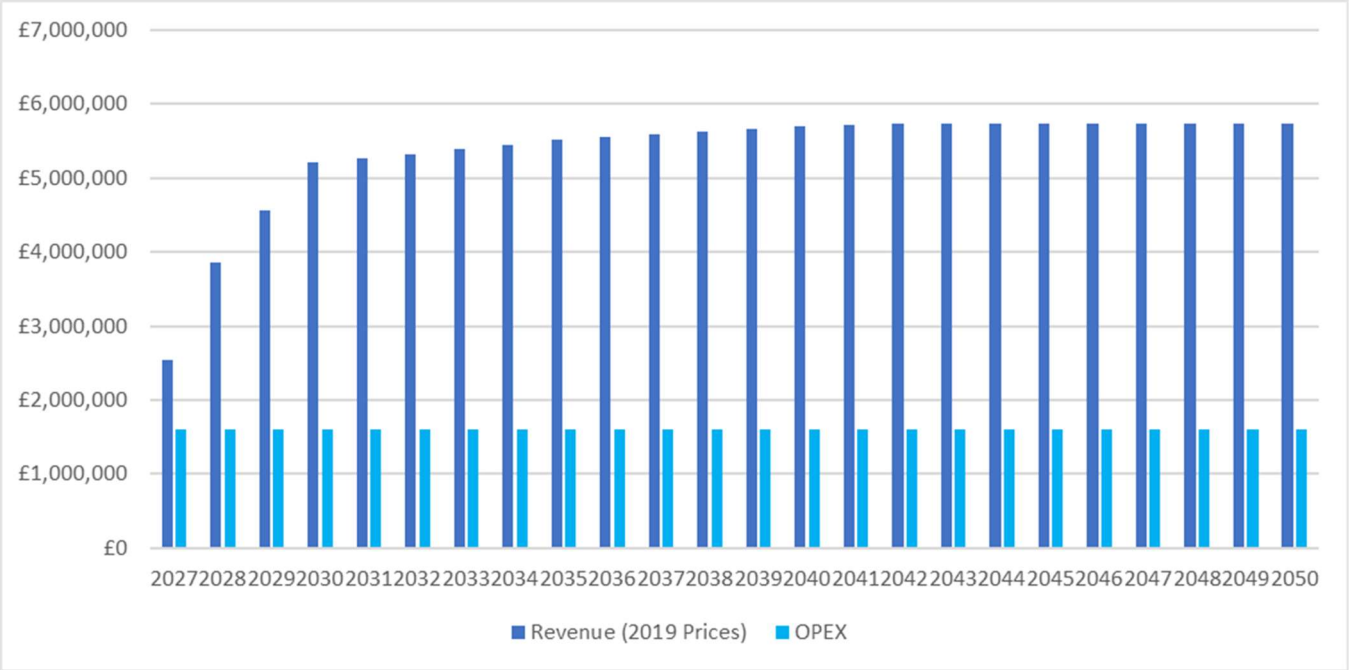


Figure 38 Option A/B passenger revenue v operating costs

The table below shows the 2030 passenger net operating surplus by option.

Option	Revenue (£m)	Operating Costs (£m)	Operating Surplus (£m)
Option A = 1tph Leek – Stoke	5.2	1.6	3.6
Option B = 1tph Leek - Stoke + Freight	5.2	1.6	3.6
Option C = 1tph Leek – Crewe	5.2	3.3	2.9
Option D = 1tph Leek - Manchester	5.5	2.1	3.4
Option E = 2tph Leek – Stoke	5.5	2.7	2.8
Option F = 1tph Leek - Stoke/1tph Leek - Crewe	5.6	4.6	1.0
Option G = 1tph Leek - Stoke/1tph Leek – Manchester	5.7	3.4	2.3
Option H = 4tph Leek - Stoke Light Rail	6.0	3.4	2.6
Option I = 6tph Leek - Stoke Light Rail	6.2	5.1	1.1

Figure 39 – Annual passenger net operating surplus by option in 2030 (2019 prices)

4.5. Funding

It is clear that, even though the service is forecast to generate a net operating surplus, this surplus is insufficient to "pay back" the capital invested on a commercial basis.

The scheme, if it is to proceed, will therefore need to rely on public sector grants for its construction. The RYR application was made under the Restoring Your Railways Fund on the basis that it will enter into RNEP as the main way in which it will be funded.

However, the client group has identified a number of other potential sources of funding that could contribute. These should be investigated at the next stage of development. They include the potential to leverage both private and

public sector funding, including funding associated with carbon reduction and the improvement of air quality, and support for the transfer of freight from road to rail, including the potential for growth of quarry extraction as a result of reconnecting Cauldon Lowe with the rail network.

As the scheme is fully aligned with the Stoke and Staffordshire LEP Local Industrial Strategy, there is the possibility that devolved funding to the LEP could be accessed, subject to the further work on the business case. In addition, the proposals could also attract Section 106 contributions from developers taking forward stalled sites adjacent to the line and benefiting from the land value uplift that improved transport infrastructure would bring.

5. Commercial Case

5.1. Approach

The Commercial Case provides evidence on the commercial viability of the proposed option and the procurement strategy that will be used.

At SOBC stage the potential commercial arrangements can only be considered at a high level. This section provides a summary of the output-based specification and the outcomes that would be supported by these requirements, the procurement objectives, outcomes and constraints and identification of potential procurement / purchasing options.

5.2. Output-Based Specification

The output-based specification defines the functional requirements for the project. At the SOBC stage this is to be developed in outline form.

Outputs - Scope of Services for Develop Stage

Once this scheme has been approved to move to the Develop stage, key services required will include:

- Consultant and project management services to progress the scheme through the stages of RNEP / PACE, including design and appraisal.
- Network Rail support covering sponsorship, operational planning and engineering assurance of designs.
- Wider Train Operating Company support for operational planning, revenue forecasting and wider regulatory considerations.

These key services will be focussed on developing the key outputs to be delivered with the aim of identifying a Preferred Single Option:

Services – which option from those identified in this SOBC (or another) has the best case in terms of strategic impact, economics, affordability and deliverability. At this stage it looks as through the "Minimum Viable Product" of one train per hour between Leek and Stoke with freight traffic from Cauldon Quarry has the best case. However, further development of the project will confirm this, or another option may emerge as better.

Rolling stock – there are a number of options for rolling stock under both the heavy and light rail options, and this may also depend on which operator is best placed to operate the service. A key consideration may be whether a non-diesel option is deliverable (and it is clearly desirable).

Infrastructure – further work will be required to optimise the infrastructure to the service specification, operating method and rolling stock. Key to this will also be to establish a much greater understanding of the state of the current assets and what will need to be done to change them to meet the service outputs.

Scalability – Future potential to enhance services should also be considered, and an understanding developed of how services could be enhanced (eg in terms of frequency, the number of stations, rolling stock type and capacity and potential service extensions).

This approach reflects the fact that the development of the output-based specification is a significant piece of work which should be focused on the preferred scheme option for market which will be refined as part of subsequent PACE / RNEP stages. This further work should include a summary of the requirements in terms of

outcomes and outputs, supplemented by a full specification, for the preferred scheme option to be taken to market. This activity will be essential to ensure the quality and performance of the procurement is not compromised.

5.3. Procurement Strategy

The initial preference of Staffordshire Moorlands District Council is for the development of the project to be procured from Network Rail. This is because:

- Of the scale and nature of the proposed works : the reconstruction of a railway, requiring a full "system approach".
- The railway is in Network Rail's ownership and will remain so (light rail options potentially excepted).

The development work to Outline Business Case could be commissioned by DfT through the RNEP processes, or by one of the Councils.

In terms of delivery of a heavy rail option, the scale of the works suggests that this would best be procured by DfT, as the major funder, from Network Rail under the RNEP process. Network Rail would use its own procurement policies to identify the best approach to completion of detailed design and delivery.

It would also be possible for these activities to be procured by one of the Councils, or by Staffordshire County Council as Transport Authority, through an Implementation Agreement with Network Rail or by a Council procuring delivery direct. These routes have typically been used for new stations. However, the scale of investment proposed in this case suggests that a Local Authority would not be best placed to manage the risks.

In the event that a light rail option is taken forward, with or without a linkage to a wider Potteries Metro network, Network Rail will not be best placed to undertake these activities. In this event, wider consideration would need to be given to governance, management and procurement arrangements which are beyond the scope of this SOBC.

5.4. Outcomes, Objectives and Key Success Criteria

However the Develop and Deliver stages are procured, the key to successful benefits realisation (the Outcomes in the Logic Map in the Strategic Case) will be to:

- Deliver a high quality rail service product for rail users to facilitate economic growth within the Staffordshire Moorlands and High Peak areas, as well as for wider region including connections for onward travel onto HS2 and to Greater Manchester.
- Ensure rail services contribute to delivery of an efficient and safe railway, maximising the value generated from the investment, whilst also including opportunities to expand catchment areas within the corridor.
- Ensure full commitment to the scheme by key stakeholders from the planning stage through to full scheme delivery (service introduction).
- Provide 'best value' for the public purse, pursuing improvements that promote Value for Money.

5.5. New Rail Infrastructure

There are typically three delivery and ownership models which are considered, namely:

- Option 1: DfT/Third party promoted, Network Rail delivered and owned.
- Option 2: Third party promoted and delivered, then handed over to Network Rail to own.

- Option 3: Third party promoted, delivered and owned. This option potentially relates to the new stations created along the route.

It is possible, for example, that procurement of rail systems could be separated from the new stations.

A heavy rail solution would involve the Leek branch becoming a part of the national rail network.

5.6. Parties and Potential Relationships

The following table summarises the potential roles and contractual relationships assuming a heavy rail solution.

Party	Role During Development	Role During Delivery	Role During Operation
Staffordshire Moorlands District Council and Stoke-on-Trent City Council	Joint Promoters	Members of Project Board	Stakeholders
Network Rail	Systems Operator support Potentially undertaking development role under Implementation Agreement/RNEP or Asset Protection role under BAPA/APA[2]	Managing delivery of the project under RNEP	Operator of the Network. Has a Track Access Agreement with the Train Operator to cover access to the Stoke – Leek railway.
DfT	Joint Promoter Main Funder	Promoter Main Funder	Procure train service either from GBR (legislation dependent) or from Train Operator via Passenger Services Contract
Train Operator	Operational support	Operational support	Operate train service and stations under contract to DfT or GBR as variation to existing.
Aggregate Industries Ltd	Member of Project Board	Member of Project Board Investment in quarry railhead facilities	Procure operation of freight services from Cauldon Quarry from a Freight Operating Company.
Churnet Valley Railway	Consultee	There will need to be a form of agreement between Promoter over	Operational agreement with Network Rail over the extent of joint and

[2] Standard form (Basic) Asset Protection Agreement governing the terms under which the network is protected when third parties undertake work on the railway.

		terms under which the two railways may co-exist.	segregated operation and the rules governing that
Private Sector Market	Potentially undertaking development role instead of Network Rail	Contractors to Network Rail for delivery	As normally required to support railway operations, maintenance and renewal in various roles contracted to Network Rail and Train Operator.

Figure 40 - Parties and potential relationships

Northern Railway has thus far represented the Train Operators on the Project Working Group. There is, in fact, no "stand out" candidate for which Train Operator would operate the route. East Midlands Railway, for example, also operates local services through the Stoke-on-Trent area. The decision will depend on such factors as:

- Whether the service is Stoke – Leek only or whether it extends beyond that
- Location of traincrew
- Location of train servicing depot

A decision on this will need to be taken during the Develop Stage so that a single Train Operator is able to fully engage on the practical and commercial considerations of the project as it may affect them.

5.7. Powers and Consents

It is important to recognise that significant consenting powers would be needed to construct the railway. These would include a Transport and Works Order (implying a public inquiry) and potentially planning permissions as well. A key outcome of the Develop Stage will be a planning and consenting strategy to support the Preferred Option.

6. Management Case

6.1. Approach

The Management Case assesses whether a proposal is deliverable by testing its project planning, governance structure, risk management, communications and stakeholder management, benefits realisation, and assurance arrangements.

6.2. Governance, Organisation and Roles

Good governance is critical to ensuring the effective development and delivery of any railway scheme to enable delivery of the project outcomes without exposing either the Funder, the Client Working Group, Network Rail and/or other key rail industry stakeholders to unacceptable or unforeseen risks.

Governance during SOBC Stage

During the development of this SOBC the project has been overseen by a Project Board, chaired by the Rt. Hon. Karen Bradley, MP for Staffordshire Moorlands. The Project Board has met approximately monthly and received and debated reports of progress from the project's appointed consultants for the SOBC stage.

The Project Board has been supported by a Project Working Group, chaired by Nick Lamb, the Head of Regeneration for Staffordshire Moorlands District Council. The Project Board has met every two weeks.

The Project Board has been supported by the active involvement and specialist advice of Network Rail, Northern Railway and Aggregate Industries Limited (who own the quarry at Cauldon Low).

The work on the SOBC has been undertaken by SLC Rail, a specialist multi-disciplinary rail consultancy based in the Midlands, with support from Systra who have undertaken the economic modelling.

The figure below shows the membership and attendance of these bodies.

Group	Frequency	Chair	Composition
Full Project Group	Every 6 Weeks	MP Staffordshire Moorlands	MPs Leaders of Local Authorities Receive reports from project consultants
Working Group	2 Weekly	Head of Regeneration for Staffordshire Moorlands District Council	Local Authorities MP representative Network Rail DfT Northern Railway Aggregate Industries Ltd Receive reports from project consultants
Community Engagement Group Members	Monthly	MP Staffordshire Moorlands	Local MPs and Councillors
Business Group	Ad hoc	MP Stoke-on-Trent Central	Business representatives
Education and Public Services Group	Ad hoc	MP Stoke-on-Trent North	Provider representatives

Figure 41 - Project governance structure for SOBC stage

Governance during the Develop Stage

Should the project be taken forward beyond SOBC, the approach to project governance will be dependent on the model agreed with DfT and Network Rail for procurement of the develop stage, a potential example of which is shown in Figure 40 in the Commercial Case.

If it is decided that the project will be developed as part of the RNEP process, Network Rail has its own well established governance procedures. Specifically, PACE (Project Acceleration in a Controlled Environment) which was developed in response to Project SPEED and the challenge to significantly reduce the time and cost associated with the development, design and delivery of infrastructure projects on the rail network.

It is agreed that Network Rail governance requirements (how decisions are taken and managed by Network Rail) linked to the PACE assurance process will provide the overarching framework for all engineering and operational deliverables on the project. Likewise, it is agreed governance requirements associated with RNEP will also be critical to the project specific framework set out for the scheme.

Adjustments to the Governance framework set out in Figure 41 will be considered depending on the route agreed for development of the project.

The Project Working Group will be responsible for oversight of the project team including core activities such as:

- Stakeholder engagement.
- Identifying, in conjunction with the Project Manager, any required decisions to be made and any queries raised which need to be resolved.
- PMO type activities: necessary assurance activities, risk management, reporting, finance, communications, and project management.
- Ensuring that risks identified in the Risk Register are considered and understood by the senior representatives.
- Managing the relationship with the Network Rail Designated Project Engineer who will provide management and co-ordination of technical and engineering aspects of various engineering disciplines from Network Rail perspective.

6.3. Assurance

Project assurance provides the basic framework of controls that assure the project is being well managed and controlled and that basic standards are being followed. Project assurance for rail schemes is well established, and the scheme is envisaged to follow industry best practice aligned to:

- DfT's five stage RNEP process, including progression to Outline Business Case and Full Business Case, with stagegate investment decisions made on the basis of these Cases prior to further funds being committed
- Network Rail's Project Acceleration in a Controlled Environment (PACE) process. This includes phase readiness review processes at critical control points in the project lifecycle. An engineering phase gate review is also required at specific milestones within the project phases.
- This assurance process will ensure that the project is being directed by a single named accountable Project Sponsor, compliance with critical standards and legislative requirements is being met, and that the project is performing well and within agreed tolerances.

A critical early activity during the Development Stage will be to develop a Requirements Management Plan (RMP) and a Project Initiation Plan (PIP). The purpose of the RMP is to describe all the processes, roles and responsibilities associated with the development, management, verification and validation of the project requirements. It describes the processes used to develop, monitor and control the requirements throughout the project lifecycle, and the verification and validation processes to be undertaken to ensure that the requirements have been satisfied. Requirements will be captured through workshops with all stakeholders into a requirements database.

The PIP sets out the project management arrangements for the project, including the cost plan and programme for the Develop Stage.

6.4. Risks and Risk Management

Risk Management Process

The risk management process for the project is set out below and will be overseen by the Project Director and reviewed in detail by the Project Working Group with key risks reported to the Project Board. The Risk Management Process will comply with the requirements of Network Rail's PACE process and the Common Safety Method (CSM) required under European and UK Law.

During the Develop stage a Risk Register will be established covering project risks. This will include a process of hazard identification and preliminary system definition to establish whether the project represents a 'significant' risk in respect of CSM in conjunction with Network Rail.

The Project Working Group will review the identified risks each period / month, depending on stage of the project based on updates from the functional team leaders (i.e. engineering, planning, property, finance, economic, legal) to ensure risks are being identified and mitigated and to make a qualitative assessment of the effect on the programme risk exposure.

The purpose of the regular reviews is to ensure mitigating actions are being put in place and to report the effect on the risk profile to the Project Board who will focus on the top five risks and issues and any new potential risks.

Not less than quarterly, or at Stagegate reviews there will be a review of the full risk register by the Project Working Group with support from technical and operations team, and Network Rail where applicable.

At this review, all newly identified risks that have been added to the register since the last Quarterly review will be assessed and validated by the whole team. The quantification of all risks (new and existing) will be assessed, and any changes to mitigating actions identified.

Periodically the project will be subject to a Quantified Cost Risk Assessment (QCRA) and Quantified Schedule Risk Assessment (QSRA). These will be carried out at the end of Develop stage based on the scope preferred option and again during the Design stage based on the Outline Design.

Key Risks

At this early stage of the project the top five risks are identified as shown below.

Key Risk	Mitigation
Affordability. The project is too expensive when considered for Government funding alongside other priorities. Unforeseen engineering complexities identified to allow the route to be restored.	Focus on the Minimum Viable Product in order to ensure that only what is absolutely required is included in the project scope. Also focus on the train service options (A and B) that deliver an hourly service with the lowest level of infrastructure and interface with the existing railway. The capital cost estimate is based on an assumption about the need to replace/reconstruct significant parts of the route. Surveys of the formation and structures and a more detailed assessment of flood risk during the Develop stage will enable this risk to be understood more clearly and managed.
Value for money. The project is not able to identify a value for money solution.	At this stage the option showing potential for the best value for money is Option B (1 tph Leek -Stoke with freight services), with a BCR of 1.02. A focus in the Develop stage will be on how value for money can be improved, including a greater understanding of the capital costs, calculation of wider economic impacts and identifying opportunities to maximise revenue.
Interface with the existing railway	Options C, D, F and G have passenger trains operating through Stoke station to Crewe or Manchester. This creates timetabling interface risk. This risk can be eliminated by options (such as A or B) that constrain passenger operations to the Leek-Stoke branch with a separate bay platform at Stoke station.
Planning and consents risk. The TWO inquiry results in the order not being granted, onerous conditions or significant project delay.	Good communication with stakeholders and the general public will be important throughout the project in order to minimise opposition during the TWO process. Similarly, early route surveys should identify environmental and habitat issues that can be a major cause of concern during the planning and consents process, and mitigations planned in at an early stage.
COVID recovery in passenger numbers stalls.	This is a risk that the project cannot control. However, at each stage it will be important to present appraisal sensitivities that show the impact on value for money of changes in travel behaviour as they become clearer (eg on travel to work and working from home).

Figure 42 - Top five risks

6.5. Programme

The important next step is to engage further with the DfT to obtain agreement for the project to progress from SOBC to the Develop Stage, which would include identification of a single preferred option and work on the Outline Business Case.

Engineering Methodology

Applying the principles of PACE and recognising the low value BCR the key task will be to improve understanding of the significant engineering risks.

This methodology for developing the engineering scope would need to align to standard NR/L2/P3M/201 Project Acceleration in a Controlled Environment (PACE) and NR/L2/CIV/095 Asset Protection and Optimisation

Management of Third-Party work on Network Rail Infrastructure (the latter only if the Develop stage is not undertaken by Network Rail).

The key tasks would be:

- Requirements developed

- Route wide drone survey
    - Approx 24km of drone survey to support a review of track geometry (Horizontal layout + vertical check). Track geometry is a significant issue with more detail needed, and the Horizontal and Vertical geometry are key to understanding if the legacy corridor can support the required service
    - Clearance at structures is also vitally important
    - There will be areas of high level vegetation where survey at OBC stage may not be feasible and assumptions will need to be made
    - Areas of high risk may require additional surveys

- Structural inspection
    - The structures are the main driver of cost
    - There are over 80 structures along the passenger and freight service
    - A risk-based approach can be applied to reduce the number/cost of inspections
    - Initial desk study of Network Rail reports to understand higher areas of uncertainty and cost. (For example, the interface with the canal and tunnel structure at Victoria road will likely require an inspection.)
    - Identification of structure to be demolished – these do not need inspecting for OBC

- At Grade Crossing inspection/engagement
    - Interfaces with at grade crossings are a major project risk
    - Some may need to be replaced with structures
    - There are several maintenances and field access points that may be able to be diverted, and this will need some level of engagement
    - The road points may support level crossings due to the low-level service, and this will need a Common Safety Method (CSM) risk-based approach. Early engagement with the Office of Rail and Road is recommended

- Civil Infrastructure
    - The constraints of the Stoke turnback stop needs to be further developed and assessed with survey data and a site walkover. The switches and crossing interface and signalling need to be reviewed to ensure there is suitable space for a platform
    - The location of the Leek Turnback needs engagement with the Local Authority to identify the appropriate location. Discussions with the Churnet Valley Railway will be required to establish a design and method of operation which is capable of accommodating safely both the new railway and the heritage operation
    - Intermediate stops should be further considered to understand the specific site constraints of each stop

- Environmental review
    - Flood risk review
    - Desk study to identify sensitive receptors

- Geotechnical review
    - Desk study
    - The assumption will be full formation replacement unless surveys identify otherwise
    - Areas of high risk to be supported by site walkover

- Utility searches

Programme

An indicative programme showing the main tasks to be undertaken during the Develop Stage is shown below.

Project Start			02 Jan 23
Strategic Review		02 Jan 23	20 Mar 23
Strategic Review	20	02 Jan 23	30 Jan 23
Stakeholder Engagement	15	30 Jan 23	20 Feb 23
Timetable Modelling	20	20 Feb 23	20 Mar 23
OBC Production		22 Aug 23	20 Feb 24
Strategic Case	80	22 Aug 23	12 Dec 23
Economic Case	80	22 Aug 23	12 Dec 23
Financial Case	40	17 Oct 23	12 Dec 23
Commercial Case	40	17 Oct 23	12 Dec 23
Management Case	20	14 Nov 23	12 Dec 23
Prepare and issue report	20	12 Dec 23	23 Jan 24
Final Report	20	23 Jan 24	20 Feb 24
Engineering		20 Feb 23	31 Oct 23
Requirement Gathering	25	20 Feb 23	27 Mar 23
Desk Study	20	27 Mar 23	24 Apr 23
Produce Survey Specification Stage 1	10	24 Apr 23	08 May 23
Survey Works Stage 1	30	08 May 23	19 Jun 23
Feasibility and Concept development Stage 1	30	19 Jun 23	31 Jul 23
Risk based Review	15	31 Jul 23	21 Aug 23
Produce Survey Specification Stage 1	10	21 Aug 23	04 Sep 23
Survey Works Stage 2	20	04 Sep 23	02 Oct 23
Feasibility and Concept development Stage 2	20	02 Oct 23	30 Oct 23
Concept GA	1	30 Oct 23	31 Oct 23
Cost Estimating		31 Jul 23	12 Dec 23
Stage 1 Risk Review Cost	15	31 Jul 23	21 Aug 23
Produce Cost Estimate	15	31 Oct 23	21 Nov 23
Review Risk and Opportunity	10	21 Nov 23	05 Dec 23
Cost Report	5	05 Dec 23	12 Dec 23
Planning Consents Strategy		31 Jul 23	18 Dec 23
Planning Consents Strategy	20	31 Jul 23	28 Aug 23
Pre Application and Request for Screening Option		28 Aug 23	20 Nov 23
Prepare	25	28 Aug 23	02 Oct 23
Engage	15	02 Oct 23	23 Oct 23
Agree Requirements for Planning and Consultation	20	23 Oct 23	20 Nov 23
Environmental and Capital Appraisal	100	31 Jul 23	18 Dec 23

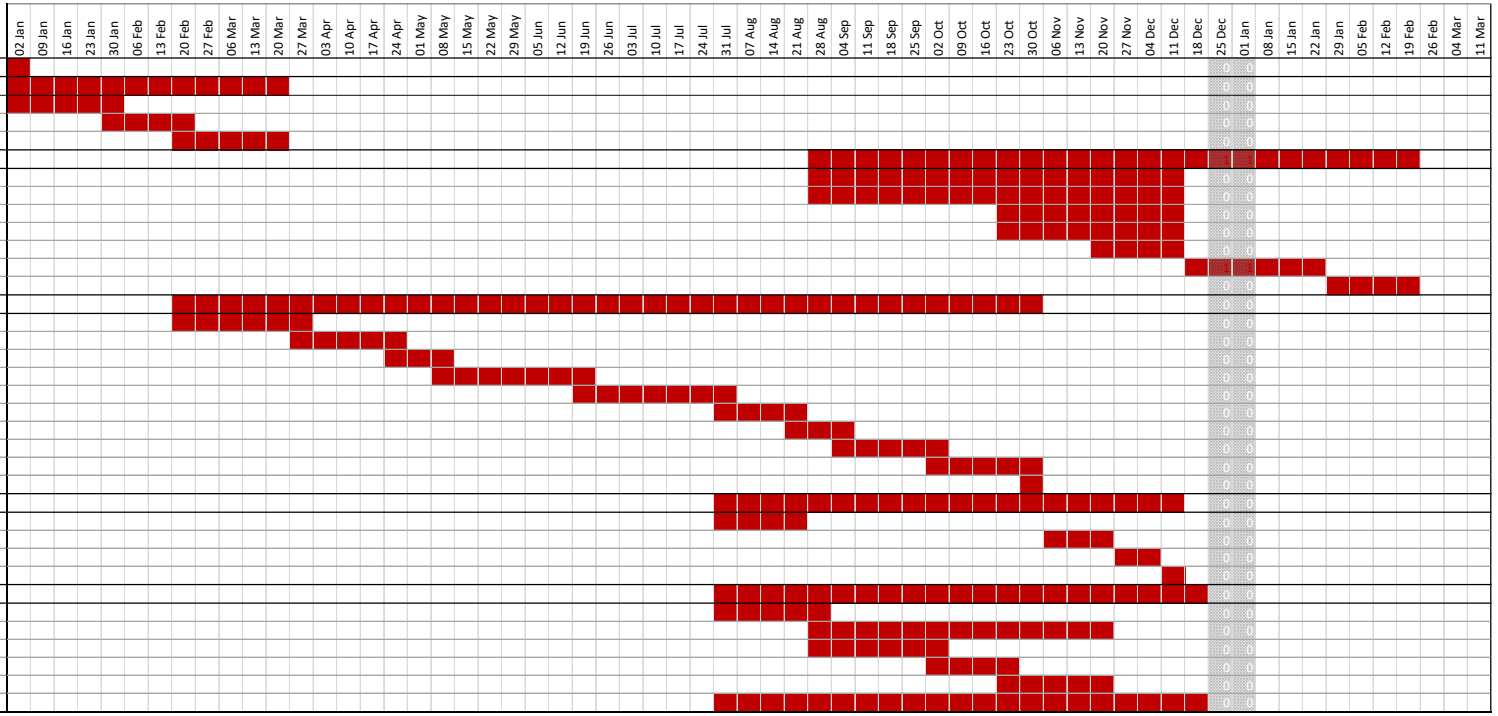


Figure 43 - Indicative programme for Develop stage