THE TRANSFORMATIONAL BENEFITS OF INVESTING IN REGIONAL RAIL

FOUR CASE STUDIES

October 2017

URBAN TRANSPORT GROUP

SYSTRA

The Urban Transport Group represents the seven strategic transport bodies which between them serve more than twenty million people in Greater Manchester (Transport for Greater Manchester), Liverpool City Region (Merseytravel), London (Transport for London), Sheffield City Region (South Yorkshire Passenger Transport Executive), the North East (North East Combined Authority), West Midlands (Transport for West Midlands) and West Yorkshire (West Yorkshire Combined Authority).

The Urban Transport Group is also a wider professional network with associate members in Strathclyde, Bristol and the West of England, Tees Valley and Nottingham.

www.urbantransportgroup.org

URBAN TRANSPORT GROUP

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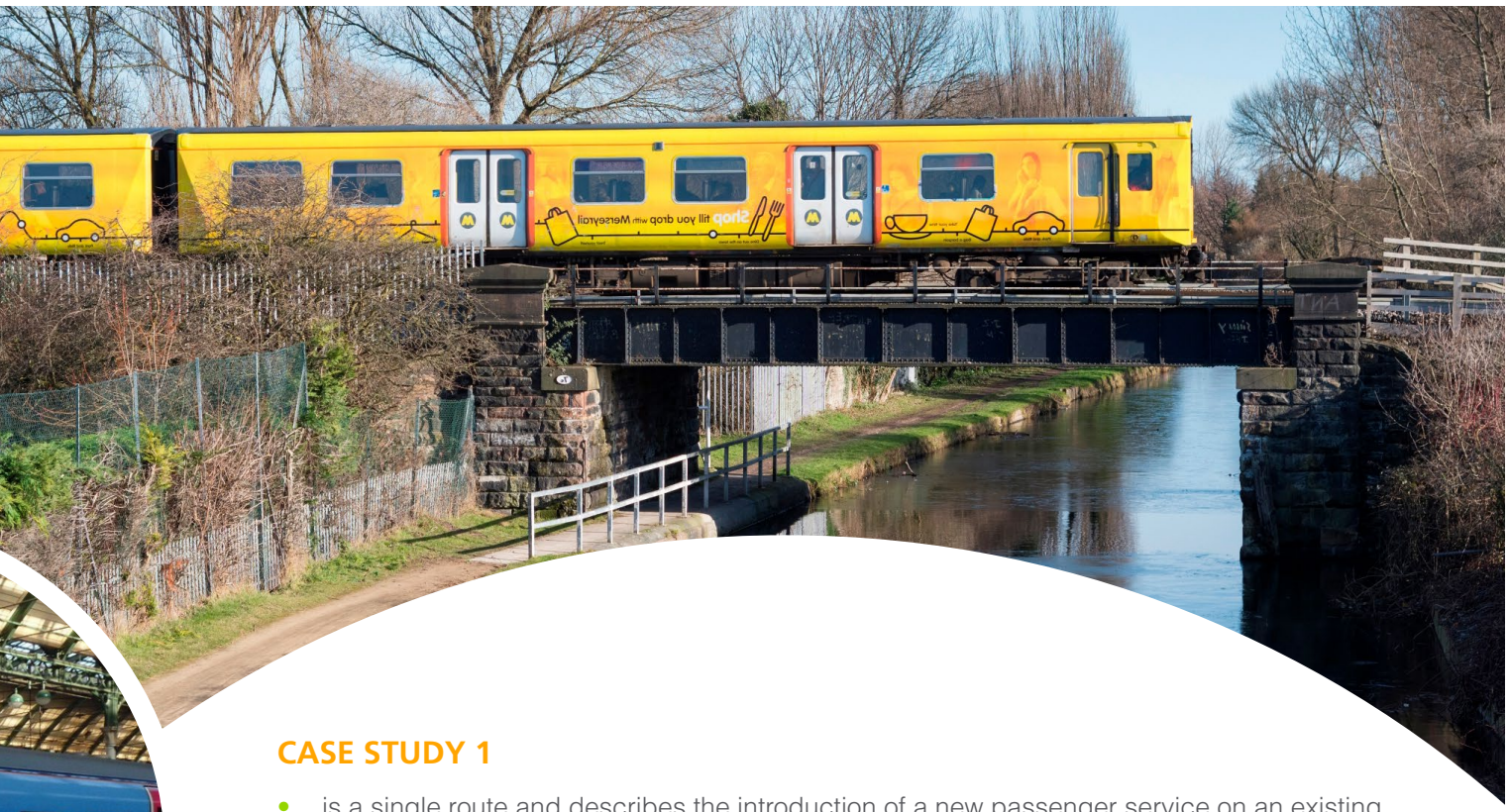
EXECUTIVE SUMMARY

In Destination Growth we showed how regional rail services carry more than three times the numbers of passengers than the much higher profile long distance (Inter-City) services and play an important role in their local and regional economies and by extension, the national economy. As the UK's city regions develop their service sector economies and concentrate employment in city centres, rail enables large numbers of people to be moved efficiently and effectively into and out of these ever more congested places. In rural localities they provide important links for residents to reach services and facilities in neighbouring town and cities, addressing issues of economic and social exclusion and bringing vital tourism spending into their local economies.

Regional services are already playing a vital role in our local and regional economies, but could be playing an even bigger role with the right sort of investment. This report builds on the strong generic case established in Destination Growth for investing in regional rail by showing how such investment could translate into benefits for different types of services. Inevitably there isn't a 'one size fits all' formula for their development so with this in mind we have developed four different case studies of investment in the regional rail network to show how each can support the development of their economies. While they are based on real examples [1] they were selected as typical city region rail corridors or networks to represent what transformational improvement would look like, how it could be achieved, and the level of social and economic benefits that would be expected to be generated.

1 We have based the case study examples on actual projects but have subsequently taken and developed certain elements of them to show what could be achieved on this type of corridor. The case studies are therefore neither directly comparable to, nor worked up to the level of detail as the real projects, and should not be taken as being endorsed locally.



CASE STUDY 1

- is a single route and describes the introduction of a new passenger service on an existing freight line. The aim of the service would be to promote regeneration of surrounding settlements by increasing the opportunities to find work and releasing development land to promote housing growth along the corridor. The scheme is estimated to generate economic benefits worth £233 million in present value (pv) terms and have a benefit cost ratio of 2.35:1.

CASE STUDY 2

- describes a 'whole route' upgrade approach which is designed to transform an existing passenger service. The investment package would help to provide capacity that would support the delivery of housing growth and promote mode shift from the car to rail, in turn improving road congestion across the area. The benefits are calculated at £812 million (pv) and the scheme shows a benefit cost ratio of 4.0:1.

CASE STUDY 3

- describes an approach to linking two radial passenger routes into a city to create new cross-city and longer distance journey opportunities. The investment would improve inter-urban connectivity and reduce journey times to achieve a modal shift from car coupled to an improved network of local services that would support higher density development around new stations. Economic benefits are valued at £933 million pv and the benefit cost ratio is 3.58:1

CASE STUDY 4

- describes an approach to transforming an entire local rail network. The outcome of the project would be a substantially enhanced city region functional labour market helping support regeneration, economic and housing growth whilst also in turn reducing congestion and improving the environment. The project could generate £3,608 million pv of benefit and have a benefit cost ratio of 3.0:1.

1 INTRODUCTION

1.1 CONTEXT

Regional rail services carry more than three times the numbers of passengers than the much higher profile long distance (Inter-City) services. As the UK's city regions increasingly develop their service sector economies and concentrate employment in city centres, rail enables large numbers of people to be moved efficiently and effectively into these ever more congested places. In rural localities they provide important links for residents to access services and facilities in neighbouring town and cities, addressing issues of economic and social exclusion, while bringing vital tourism spending into their local economies.

And they have been a major success story. Far from being the Cinderella of UK rail, the regional network has enjoyed massive growth in recent years. Between 2002/3 and 2014/15, demand for regional services grew by 66%. Until 2012/13 the regional sector was the fastest growing part of the UK rail network, and indeed remains so when measured against passenger kilometres (+74%) or passenger revenue growth (+151%). One of the regional train operators (TransPennine Express) carries the second highest number of passengers per available seat across the rail industry, second only to London Overground.

But they are becoming a victim of their own success. This high level of growth has not been matched by an equivalent level of investment in infrastructure and rolling stock. Over the last ten years the average age of rolling stock has increased by 30% whilst in many places signalling infrastructure and operating procedures dating back to the Victorian era are compounded by the effects of track rationalisation in the second half of the last century. Lack of investment is already beginning to limit growth, and this will only get worse in the future.

It doesn't have to be this way. In the Destination Growth report the Urban Transport Group set out the evidence to support the proposition that with investment in infrastructure and vehicles, regional rail has the potential to perform even better, delivering more benefits, more cost effectively.

By preparing a set of scenarios for the future featuring a rolling programme of investment to revolutionise regional railways and deliver exciting and transformational change, the report showed that the regional rail network could deliver benefits to the economy worth as much as £10.5bn per annum at current prices. The cost benefit analysis prepared as part of this report showed that the investment represents very high value for money with every £1 of investment delivering £4.36 of benefits, relative to a 'business as usual' approach to investment in regional railways.

Just as importantly, with a concerted long term commitment to investment over 30 years it was found that it is possible to both reduce operating costs and raise demand significantly. This would help move the regional rail network from its present position, where it requires a substantial level of subsidy, to one which operates close to break-even.

As the Urban Transport Group report Rail Devolution Works shows, rail devolution has a big role to play in supporting this positive development trajectory. The last decade and a half has seen responsibility for the Merseyrail service being devolved to Merseyside in 2003, the Scottish Government gaining control of Network Rail's Scottish budget and the ScotRail franchise in 2006, and the devolution of London Overground routes in 2007. In 2016 Rail North (which brings together local authorities in the North with the DfT) took over the Northern and Trans-Pennine franchises. And in 2017 West Midlands Rail (bringing together local authorities in the West Midlands) will play a key role in a new West Midlands franchise.

By being closer to their local rail operator and passengers than Whitehall ever could, they have raised the bar on performance and been held to account for any shortcomings. Development plans for rail networks are now fully embedded in wider transport and spatial plans. It's why, the report argues, more local rail lines have opened in Scotland over the past fifteen years than in the rest of the UK put together. It's why devolved urban networks tend to have higher frequencies and much better off-peak services than those networks which aren't devolved. It's why rail networks that were consistently hovering near the bottom of league tables for performance and customer satisfaction are now consistently at, or near the top of, those same league tables.

1.2 AIMS OF THIS REPORT

With signs that central government is beginning to recognise the strength of these arguments, there is a need to translate them into something more tangible and practical by using evidence taken from case studies from around the UK rail network.

The regional rail network is not a single homogenous group of services, there are many different types of service all serving specific regional and local needs and the aim of this report is to illustrate for a selection of these different types of routes and services what transformational improvement could look like, how it could be achieved, and the range of social and economic benefits that might be expected to generate.

As a consequence, this report is less about the high level arguments – although history nevertheless suggests that these do need to be continuously repeated and reinforced – rather it is about illustrating the building blocks that UTG members, local authorities and other local stakeholders can put in place to help move things forward. The idea is that by providing case studies that potentially have a resonance with other locations the report can help these locations demonstrate the potential economic, social and environmental benefits of developing their own projects to stakeholders and funding and delivery partners.

In the next four chapters we therefore describe and subsequently quantify four 'typical' approaches to the development of regional rail services;

CASE STUDY 1

- describes the development of a **new passenger service on an existing freight route**. The route would link a number of relatively isolated and deprived settlements with their nearest regional centre. The development of such a service would promote regeneration of these settlements by increasing the opportunities to find work and releasing development land to promote housing growth across the area. This case study is based on the Ashington Blyth and Tyne project in South East Northumberland. Other projects with similar features have included the reopened Ebbw Vale line in South Wales, or the Portishead branch in Somerset.

CASE STUDY 2

- describes a **'whole route' upgrade approach** which is designed to transform an existing passenger service. This upgrade would build on a very successful but under resourced service. The upgrade would take the opportunity to re-signal and electrify the route increasing capacity, providing an uplift in service frequencies and reducing journey times. This, along with additional stations on the route, will further increase rail use and reduce levels of road congestion. This case study is based on the Harrogate Line in the Leeds City Region, although other similar examples might include the Calder Valley line in West Yorkshire or routes in Greater Manchester to Marple and New Mills.

CASE STUDY 3

- describes the approach to **linking two radial passenger routes into a city to create new longer distance and cross-city journey opportunities.** This would be achieved through a city centre infrastructure intervention that will remove a number of bottlenecks and allow service patterns to be re-planned and expanded. Inter-urban services will be speeded up whilst new local services will be developed serving new stations across the network. This case study is based on simplified version of the proposed Midlands Hub scheme in Birmingham. A similar scheme already being delivered is the Northern Hub in

Manchester and in particular the Ordsall Chord which lies at the centre of that scheme, linking Manchester Victoria and Piccadilly stations.

CASE STUDY 4

- describes an approach to transforming an entire local rail network. This involves the **introduction of tram-train technologies and on-street running in city centres**. Such an approach is justified by the high density of stations across the network with an opportunity to reduce journey times and increase frequencies over the network. The network-based approach will address a range of themes such as connectivity, congestion, regeneration and access to gateways. This case study is loosely based on the Valley Lines network in South Wales.

1.3 RELATIONSHIP BETWEEN THE CASE STUDIES AND THEIR SOURCE PROJECTS

A note of caution. The four case studies are based around real examples, but in every case we have developed them to demonstrate what can potentially be achieved, elaborating on certain aspects of the projects and discarding other elements that don't add anything new to the narrative. As well as being different in scope it is also important to note that they have not been worked up to anything like the level of detail that the source projects will have been, several of which have been in development for many years. Consequently the results of the case studies cannot be compared back to their source schemes, nor should it be assumed that these case studies are endorsed by the sponsors of the real projects.

2 CASE STUDY 1: A NEW PASSENGER ROUTE

2.1 CONTEXT

Case Study 1 is based on the proposed reintroduction of passenger traffic to the Ashington Blyth and Tyne line in South East Northumberland. The route is situated in a former mining area which suffered economically with the closure of its coal mining industry during the 1980s and has never fully recovered. Unemployment rates are significantly above the national average and the area is economically depressed with many of the jobs that do exist being part-time and / or at minimum wage levels. Nevertheless, the line is well located in proximity to its potential catchment area and it passes through an area which has significant tracts of development land adjacent to it.

An operational railway currently exists in the form of a lightly used, slow-speed, freight only route. Passenger services were withdrawn in the 1960s. Up and down running lines are provided at the end of the line and for a short distance where it joins the local rail network, but for approximately 11 miles only a single running line is provided.

The line is signalled, for the most part, by means of traditional, manually controlled mechanical signalling. The route has a large number of pedestrian and vehicular crossings of various types which, combined with the historical lack of investment in the track, signalling and structures, impacts upon the current operational speeds, with very restrictive speed restrictions in place on structures in poorer condition.

2.2 PROBLEMS AND OPPORTUNITIES

The area surrounding the 20 mile long route experiences a high level of social and economic exclusion amongst its 150,000 residents. It exhibits all of the characteristics of an area in need of a regeneration stimulus, as some of the key indicators on population, employment, educational attainment and levels of deprivation illustrate:

- Population growth between 2001-2011 was less than half the English average, pointing towards a pattern of outward migration and a lack of inward migration and reflecting, in part, a lack of employment opportunities accessible to local people;
- The majority of the region's most deprived Lower Super Output Areas (LSOAs) in the Income, Employment, Health and Disability, Education Skills and Training, and Crime deprivation domains are concentrated in the Case Study area where no fewer than 16 LSOAs are amongst the 10% most deprived nationally. The most deprived LSOA served by the line ranks 400th in the UK, just outside the 1% of most deprived areas in the country;
- Unemployment remains a challenge. Whilst the female unemployment rate is only just above the national average, the male unemployment rate (measured as Job Seeker Allowance claims) stands at 4.5%, nearly double the national average of 2.6%;
- Where people are in work within the study area their employment is concentrated in more traditional and/or lower value sectors, with the local employment opportunities continuing to be over-reliant on manufacturing and public sector jobs and suffering from low weekly and hourly wages.

CASE STUDY 1:

Key Features

- Provides access to employment and other opportunities from an economically deprived area to a major regional economic centre.
- Supports local regeneration aims.
- Features the introduction of a new passenger service to an existing freight railway.
- Provision of new passenger stations.
- Substantial signalling, track and structures infrastructure renewal, plus upgrades for new passenger service.
- Costs: a little over £140m (including programmed spend irrespective of the scheme)
- Benefits: quantified transport benefits of around £230m with up to a further £70m of GVA impacts.

Nevertheless, the line could help connect these areas of need with areas of opportunity and there are potentially significant social and economic benefits that a re-opened passenger rail service could help realise, by providing better links to employment, educations and skills training, as well as making the local area a more attractive place to live and work.

The Local Plan for the area emphasises the strategic importance of the land adjacent to the route. A third of all new employment land within the plan is being allocated in the vicinity of the line, including an area designated as a Strategic Employment Zone.

Similarly, a third of the dwellings required in the Local Plan are located in the settlements along the route. With many of the allocations within walking distance of potential new stations, a re-opened line could potentially greatly enhance the attractiveness of the allocated land to investors and increase the likelihood of development.

The route would also deliver direct rail access to the centre of the neighbouring city region with the whole of the route being within a 40 minute journey time of the central area station and with an urban light railway network providing the opportunity to gain further access to employment and other opportunities across the conurbation. This journey time would compare favourably to the existing bus journey times of over an hour. The scope of demand for the service may well be significant with the nearest existing station to the area having seen passenger numbers double over the last 10 years.

Re-opening the route for passenger services would therefore help in the regeneration of the local area by providing access to employment in the neighbouring city region and beyond. Good transport connections, including links to London and key regional cities in the North and Midlands through connecting services at the city region mainline station, would make the area more attractive to a wide range of industries with a regional or national footprint. People who already have jobs would find that the communities the line serves become more attractive places to live due to the improved commuting offered and in so doing would bring new money into the local economies, whilst there would be an opportunity to broaden the horizons of residents in terms of the range of jobs available to them. There would also be the opportunity to open up large areas of housing land, helping the region to address its growing population whilst providing the opportunity for sustainable transit based development. There may also be the opportunity to redefine other public transport networks in the area with the opening of the railway allowing bus networks to be coordinated with rail services and hubs or interchanges developed.

2.3 THE PROJECT

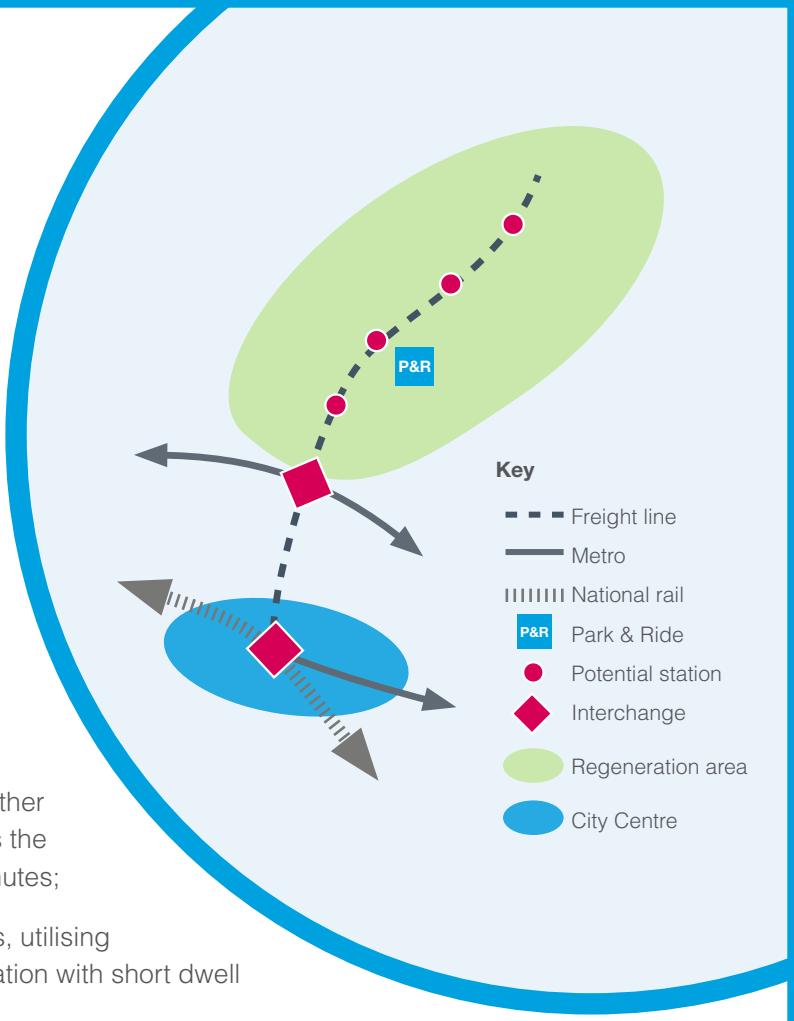
The railway line was originally built with double track throughout and whilst focussed on coal traffic, a passenger service was operated along it until 1964.

The route is now single track for a distance of just over 11 miles. The track throughout is maintained for heavy axle-load slow moving freight traffic. With the maximum speed of the line limited to 40 mph, this single line section has the effect of limiting line capacity to two trains per hour in each direction. There are two major river crossing viaducts and a large number of level crossings along the route. Most of the level crossings are automatic with half-barriers, although some are manually operated, and two are crossings with very heavy road user levels. All this adds up to a low capacity, low speed railway with high operating costs.

As a lightly used, slow-speed route used solely for the movement of coal and suffering from decades of underinvestment and rationalisation, the introduction of a passenger service

requires a significant upgrade of the existing infrastructure, in addition to the opening of new stations to service passenger services.

The scheme that has been developed includes:



- The provision of an hourly passenger rail service to the city region central station, with the service being increased to half-hourly during peak times and freight services operated during the off-peak period;
- Raising the line speed to facilitate 60 mph running to provide an end to end journey time of 35 minutes, although with a commitment to further line speed improvements, this has the potential to be improved to 30 minutes;
- Operation by three diesel trainsets, utilising vehicles designed for urban operation with short dwell times and good acceleration;
- Four intermediate station stops to cater for the local communities along the route with a further stop to provide the opportunity for interchange and onward travel via the city region light rail network;
- A park and ride station to cater for the longer distance market and to support traffic decongestion aims in the city centre located adjacent to the main trunk road into the city region;
- One or two platform stations (depending on whether they are on the single or double track section) with waiting facilities, CCTV and ramps where required, designed to lie predominantly within railway-owned land. Small scale car parking and drop off facilities are provided at stations where space is available;
- The provision of a 2.45km 'dynamic' passing loop and a further 1 km extension of the two track portion of the railway to facilitate the reliable delivery of the timetable;
- Either the complete re-signalling of the route or major modifications to the existing signal arrangements in order to support passenger services alongside provision for an hourly freight service.

Once completed the scope exists to develop the service further, with the capability to operate a half hourly service all day, with provision made for train lengthening at a later date. As the geography of the longer term benefits become apparent in terms of housing and employment growth it will be possible to identify locations for further stations to serve the route.

At a network level the opening of the route may add critical mass to the rest of the local rail network, potentially helping build a case for electrification to improve services further.

2.4 IMPACTS

The scheme outlined above represents a potentially transformational scheme at a local level. The operation of a direct and frequent rail service providing access to the rail network for a substantial population has the potential to bring positive social and economic change to the area it serves, with the change in use of the railway from freight to passenger traffic reflecting the changing shape of the local economy.

IMPACT ON JOURNEY TIMES

At present journey times from one end of the route to the regional centre are around 55 minutes by bus or 30 minutes by car. However in peak periods the car journey may take over an hour. A rail journey would take only 35 minutes even in the peak period and, whilst the fare may be higher than a bus fare, it would be lower than the cost of travelling by car, especially when city centre parking charges are considered.

2.4.1 Scheme Costs

The existing condition of the route, having been maintained as a low speed, low maintenance freight route for over 50 years means that the costs of upgrading the line to passenger status are considerable. In many respects this represents the worst case scenario for an intervention of this type as all aspects of signalling, permanent way and structures have converged to require upgrading as part of the same scheme. However, this very thorough approach of upgrading all aspects of the route would mean that ongoing expenditure would be limited to day-to-day maintenance for many years after opening.

The total scheme costs have been estimated as being around £144m. This includes a complete re-signalling of the route, replacement of all of the existing trackwork, allowing an increase in line speeds and capacity, and the construction and opening of seven stations.

The Present Value of Costs including both capital expenditure and operating costs over 60 years is estimated at £183m, based on an hourly service being provided supported by additional services at peak periods.

CALCULATING SCHEME COSTS

The costs of reopening schemes can vary significantly depending on the existing condition of the route and the service specification proposed for the route. In this case, typical costs have been estimated from Network Rail GRIP2 level costs for other similar schemes.

2.4.2 Transport Benefits

Once opened the route is forecast to generate around 320,000 trips per year, rising to 400,000 trips as the service develops. Planned development in the area could add up to a further 40,000 trips to this figure, with even more in the long term. In practice these forecasts may prove to be underestimates as locally transformational infrastructure such as this will have a longer term impact on people's decisions about the locations they wish to work or live in, driven by reduced levels of road congestion, an improved environment and a reduced reliance on car use. Other routes which have seen wholesale transformation, such as the Airedale and Wharfedale lines in West Yorkshire, have seen a shift in lifestyles meaning growth as a result of investment has continued for over 20 years. All of these impacts derive from a better use of existing of current infrastructure – developing what is there rather than starting from scratch.

As proposed the service would represent high value for money based on transport benefits alone, with a Benefit Cost Ratio of 2.35, suggesting that for every £1 spent the scheme would deliver £2.35 of benefits. The table below summarises the source of these benefits.

Table 2.1 Case Study 1 Scheme Benefits Summary

BENEFIT TYPE	DISCOUNTED VALUE £M
Value of Time Savings	£220.40
Decongestion & Environment	£13.10
Total	£233.50

It can be seen that the vast majority of the benefits from the scheme are related to journey time reductions, demonstrating the impact that rail links can have on connectivity to city centres in particular from their hinterland. The table below shows an appraisal of the scheme based purely on transport benefits.

Table 2.2 Case Study 1 Appraisal Summary

BENEFIT TYPE	DISCOUNTED VALUE £M & BCR
Present Value of Costs (after passenger revenue deducted from costs)	£99.1
Present Value of Benefits	£233.49
Net Present Value	£134.39
Benefit Cost Ratio	2.35

2.4.3 Wider Outcomes

However the table above presents only a partial story, looking only at the pure transport impacts of the scheme. The real impact of the scheme comes from its ability to regenerate and support the economy of an area which has historically seen high levels of unemployment. The opening of the railway would have the potential to trigger a wealth of secondary impacts. Most obviously there would be an improvement in the level of access to employment in other areas. In addition, the railway would stimulate development and release employment land, helping to strengthen the economy within the communities served, and release land for housing, helping to reverse population decline in the area whilst helping the region as a whole to cope with its forecast population growth. When the route is compared to other similar comparators it was found that there might be the potential to generate over 2,000 jobs and up to £70m of additional GVA per annum. To deliver such change would require initiatives going beyond the railway itself, but the railway can act as a catalyst for change. If only half of this impact were attributed to the railway and included in the appraisal this would be enough to move the case from **high** to **very high** value for money.

Beyond direct monetary impacts the scheme will also impact on environmental and social issues. Stimulating the economy in a sustainable way will help reduce levels of deprivation across the area served as access to opportunities improve. Individuals levels of health may also improve as mode shift from car to rail will be likely to involve greater levels of walking or cycling to access stations. In turn this will also help to improve the quality of the environment, not just locally within the vicinity of stations, but reduced car use will help to improve air quality on key parts of the road network. This could be supported further through integration of bus and rail facilities helping to extend the catchment area of rail services and promote the use of non-car modes.

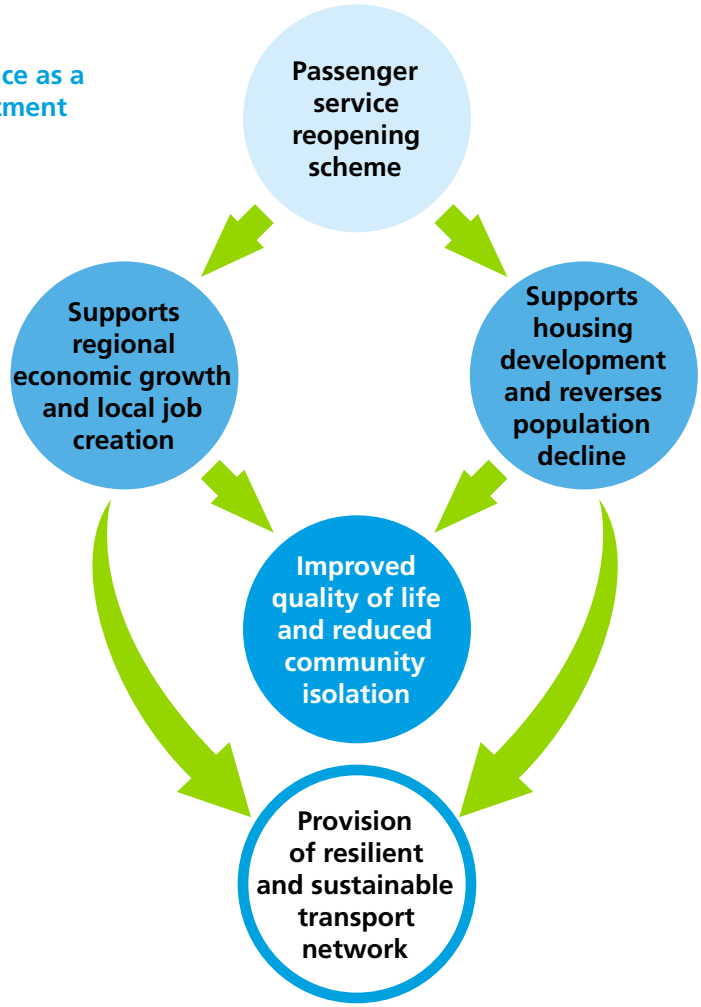
2.5 CONCLUSIONS

Case Study 1 will deliver a new passenger rail service which will represent a transformational change in connectivity at a local level. This would be delivered to an area which has historically been relatively isolated, and which has suffered from negative structural changes to the economy over a long period of time.

The costs of delivery of the scheme in some way reflect the economic history of the area, with what is now a lightly used freight railway, which has seen little investment requiring substantial works to upgrade it for use by passenger traffic. These costs do impact on the economic appraisal of the transport impacts of the scheme but, as has been discussed, there is scope in the future for the service to be developed further, and previous experience suggests that the full benefits of the scheme will come over the long term, with other routes showing strong growth for many years after the initial investment.

The real impact of the scheme, however, comes from the impact it would have on regeneration and the economy in the area. The rail service will significantly improve access to jobs from the communities served to other parts of the region, helping to rebalance the economy. It will also act as a catalyst for regeneration within the area helping to deliver additional jobs and housing by making the area more attractive place to invest. These benefits go beyond the direct transport impacts of the scheme and demonstrate wider importance of rail investment even at a local level.

Reopening of passenger rail service as a catalyst for transformative investment

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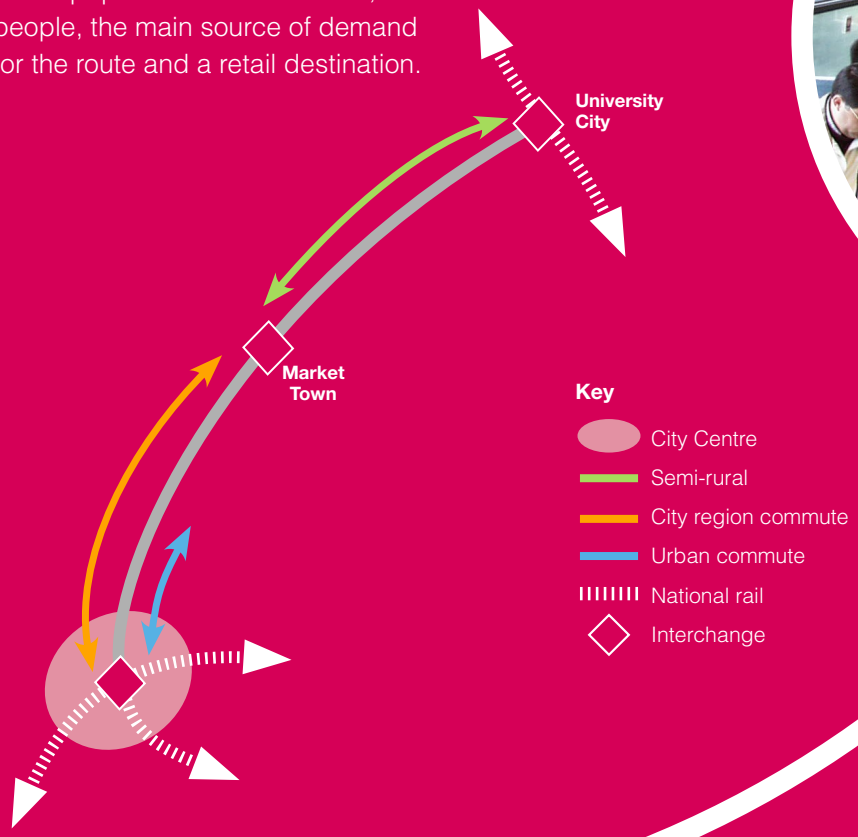
3 CASE STUDY 2: TOTAL ROUTE MODERNISATION

3.1 CONTEXT

Case Study 2 is based around the Leeds – Harrogate – York line and looks at the total modernisation of an entire route linking a major city to several neighbouring towns and suburban areas. The route in question has, like many regional routes in recent times, seen a substantial increase in ridership with demand increasing at some stations on the route by around 40% over the last 10 years.

The route serves a diverse range of markets. It begins in a major regional city and has a number of inner suburban stops as the line makes its way to the edge of the city. The line goes on to serve a number of smaller settlements before reaching a large town with a population of around 100,000 people, the main source of demand for the route and a retail destination.



CASE STUDY 2:

Key Features

- Supporting city region access, economic growth and congestion relief. Also providing longer distance connectivity.
- Mixed, urban, suburban and semi-rural operation.
- Comprehensive route modernisation.
- Service frequency and journey time enhancements.
- New stations including parkways.
- Signalling and possible electrification interventions.
- New rolling stock.
- Phased development.
- Costs of circa £150m rising to circa £210m with subsequent investment in stations over ten year period.
- Quantified benefits of £0.8bn.

Moving north, the lines goes on to serve a smaller town of around 15,000 people before passing through a more rural area with a number of small stations all of which are within the commuting catchment of the cities at either end of the line. The service terminates at a historic university city and tourist destination which also offers an extensive range of long distance rail links.

The existing service has been in place for many years, with train lengthening being the only intervention bringing any relief to growing capacity challenges with extremely high levels of overcrowding in existence and evidence developing that demand is being suppressed as a result.

The service level operated is typical of many regional services with a half hourly service for the southern part of the route focused on serving the regional city centre, reducing to an hourly service for the more rural section in the north.

Stakeholders in the area have a number of aspirations to improve the service with a view to addressing shortcomings in the existing service, delivering new access to the rail network to reduce congestion, and also to facilitate housing and economic growth. Local communities in the surrounding area have a strong interest in developing the stations to improve facilities and make the route more attractive.

3.2 PROBLEMS AND OPPORTUNITIES

The route has a range of issues that contribute to limiting the potential of the line. The route has seen only incremental investment over a long period of time. For example, it is still largely signalled using nineteenth century mechanical signalling. A few sections have seen investment in new signalling, but only on a piecemeal basis.

The route has also seen rationalisation with the rural end of the line having been reduced to single track in the 1970s, a move at the time designed to reduce operating costs but with the long term consequence that it is difficult to increase the capacity of this section of the route, despite demand for travel to the cathedral city increasing substantially. There are also substantial opportunities for housing development in this area which would increase demand for services further.

At the urban end of the route many services are at capacity as they approach the urban centre, limiting the ability of the route to help serve the dense urban area where road congestion is at its worst.

The line has also struggled with rolling stock issues. Old, poor quality trains have dominated for many years, being relieved only by slightly newer trains which are designed for inter-urban operation and unsuited to high density urban operations, making the service slow and creating delay at busy periods.

In contrast to the range of problems identified above there are a huge range of opportunities going forward which the route could take advantage of.

At the urban end of the line the route has the potential to reduce traffic on some of the most congested routes into city centres, where it has over a long period been difficult to improve the road network. A large parkway station is proposed that would provide access from a broad catchment to the city centre. Employment surrounding the parkway station would make the new station both a producer and attractor of trips. Supporting this there are proposals for the development of a number of further stations on the approach to the city centre which will help improve rail mode share, reduce congestion and improve access to labour markets. Additionally there will be the opportunity through service improvements to coordinate bus networks with rail services via the new stations, improve accessibility from rural settlements and help reduce dependency on car use.

The need to replace the existing signalling system presents the opportunity to address capacity and line speeds issues at the same time, whilst simultaneously reducing operating costs. Similarly a need to replace existing rolling stock presents the opportunity to provide trains that are better tailored to the service being provided.

At the rural end of the route there is the opportunity to develop rail markets through sustainable development. There are proposals for substantial developments in the area that would justify the development of new stations and the improvement of services on this more rural section. Additionally, the route could have a role to play in improving access to the cathedral city where the road network is heavily congested.

Together there are a diverse range of ongoing opportunities that could be brought together into a single modernisation programme for the route that would provide a comprehensive upgrade to the quality of services and the relevance of the service provided to the communities and economies it serves. This would help to better utilise existing infrastructure rather than having to develop wholly new routes whilst allowing communities to develop in a more sustainable way and improving access to jobs.

3.3 THE PROJECT

The project proposed for Case Study 2 is a far reaching total route modernisation that would seek to address all of the issues impacting the development of the line. The modernisation would involve significant infrastructure improvements including electrification of the route. Trains would be introduced on the line that would be capable of providing a high density stopping service through a combination of short dwell times and high acceleration.

Phase 1 Re-signalling: The first stage of the modernisation would involve the re-signalling of the route to provide greater flexibility in operation at lower ongoing cost. This would allow services to operate later into the evening and start earlier in the morning as the timetable would not be determined by signal box opening hours. The re-signalling work would also provide the opportunity to improve track layouts and address capacity constraints, such as the sections of single line. At the same time platforms would be lengthened to provide provision for longer trains in the future, potentially moving from existing four coach operation to six coach operation.

Phase 2 Electrification and Service Enhancement: After these measures were completed the next stage would be to electrify the route. This would provide an ongoing saving in operating costs as electric trains cost less to operate than diesel trains, but would also provide the basis for operating a faster service with better acceleration between stations, a key feature of an effective urban network.

The delivery of the infrastructure investment would in turn allow an overhaul of the service provided. The service would increase from two slow to four fast trains an hour with the rural section increasing from one to two trains per hour. On the approaches to the city centre, provision would exist for up to six trains per hour in the peaks, whilst in the off peak two trains per hour would stop at all stations and two would operate fast to provide a balance between the dense urban journeys and outer suburban journeys.

The scheme achieves savings in journey time to the two cities at either ends of the line, creating a rapid, high density service that better serves the commuter flow using the corridor to access the urban centres. The improvements in service levels and journey times as a result of the investment in the corridor are summarised in the table below.

Table 3.1 Case Study 2 service improvements

ORIGIN STATION	FREQUENCY TO CITY CENTRE		JOURNEY TIME SAVING TO CITY CENTRE
	EXISTING	FUTURE	
Rural station	1tph	2tph	9 minutes
Suburban station	2tph	4tph	3 minutes
Inner urban district station	2tph	4tph	1 minute

Phase 3 New Stations: With longer electric trains in place there would be the capacity available to open more stations without negatively impacting on existing users. The new Parkway station could be supported by smaller urban stations and one new station in the rural area to support housing development.

- **New Station 1** – situated in a rural area to support significant levels of new housing development, with the flow of trips from its expected catchment expected to be reasonably split between the two cities at either end of the line.
- **New Station 2** – a parkway station in the outer suburbs of the major city, expected to jointly serve as a new park and ride facility for city commuters and as an interchange for users of the nearby city region airport.
- **New Station 3** – situated in the denser urban area approaching the major city, expected to serve new and existing housing developments and address the significant congestion problems on the major road corridors in the area.

New Station 1 would support proposals for significant housing development in the area, providing a new settlement with a sustainable and resilient mode for commuting into the main two employment hubs at either end of the line. It would also serve as an additional park and ride option for local labour markets, particularly for trips to the nearby university city which suffers from significant peak time congestion. The labour market access of the regional economy would be improved as a result, improving business confidence and the likelihood of future inward investment.

New Station 2 would function as a parkway station serving the major city centre and adjacent international airport. It would provide much needed park and ride capacity in the area, which would help to address the local road congestion issues and increase rail mode share. The station would be well linked into the surrounding local transport network with good cycling and walking access into the surrounding catchment as well as being served by local bus services helping funnel demand into the rail network and providing a viable alternative to car use over a larger area. In linking to areas which currently have poor accessibility it will help to broaden the travel horizons of local residents.

An enhanced park and ride option would greatly widen the catchment of the rail corridor and would be more likely to encourage a modal shift to rail and the accompanied decongestion, emissions and air quality benefits for the local communities. The alleviation of congestion would bring important benefits for commuters along the corridor, increasing access to the significant employment, training and leisure opportunities in the major city centre.

It would also provide a rail link to the region's international airport via a short shuttle bus interchange. This would help to serve the proposed employment hub and opportunities for expansion at the airport. It would also enhance the connection of the major city with international markets, stimulating investment and economic growth.

New Station 3 is in a denser urban area, with an already significant catchment in the shape of residential developments in the area. It would fill an identified 'gap' in the network where a group of communities are not currently served by a rail station, and could also serve as a park and ride option closer to the major city centre. These areas are already dependent on the major city centre for work but are served only by comparatively slow bus services at the present time and are too far out for many people to access the city by bike or on foot and are therefore heavily dependent on car access. Improving access to these areas will allow housing development to be delivered without generating an unsustainable increase in car trips.

There would also be the scope for some further new development to be located on a brownfield site around the station site. This would have the potential to be developed as a sustainable and vibrant mixed use site featuring enough facilities to be relatively self-contained, with a rapid rail service connecting its residents to major social and economic opportunities.

At existing stations efforts would be made where possible to increase car parking capacity and improve station facilities to provide an attractive product to users.

3.4 IMPACTS

The delivery of a total route modernisation to the line would in a relatively short period of time transform it from a line struggling to match capacity and demand to one that could provide sufficient capacity with scope for further growth. Higher frequencies, reduced journey times and new stations would attract significant mode shift helping address congestions issues.

3.4.1 Scheme Costs

The programme of work outlined above has been combined into an overall package consisting of signalling improvements, electrification and construction of three new stations, implemented over a three year period.

The cost of the scheme with electrification and infrastructure renewals is estimated at around £150m with costs of around a further £60m to be spent on new stations and associated upgrade work to existing stations, including car parking and access enhancements.

In present value terms the capital and operating costs are estimated at £456m over 60 years. However the scale of this investment would provide a high quality product that delivers benefits over a long period of time, whilst providing sufficient capacity to deal with background growth.

A NOTE ON APPRAISAL

The appraisal of the case studies has been conducted using a Department for Transport WebTAG-based approach, and the monetary benefits have been quantified in terms of value of time savings, decongestion and passenger revenue. Passenger demand forecasting for all elements of the scheme has been conducted using standard rail industry guidance.

Costs for this scheme have been calculated based on standard electrification, signalling and new station costs for similar schemes in the UK and Europe. Operating costs for the new service over a 60 year appraisal period have been estimated based on an expected future timetable and standard rail industry staff, fuel and rolling stock lease costs.

3.4.2 Transport Benefits

The scheme is estimated to increase passenger demand from existing stations by approximately 1.7 million trips per annum as a result of the journey time and frequency benefits, an increase of 34%, whilst the combination of the three new stations would add a further 0.8m trips per annum.

Although total operating costs would be increased as a result of the more frequent services operated, there would be a reduction in unit operating costs of 15% per vehicle as a result of more efficient electric trains replacing diesel trains.

The total monetary benefits of the scheme quantified by the appraisal process are summarised in the table below.

Table 3.2 Case Study 2 total benefits

BENEFIT TYPE	DISCOUNTED VALUE £M
Value of Time savings	£664
Decongestion & Environment	£148
Total	£812

The main focus of the scheme is on delivering transport impacts with significant savings in journey times and reductions in congestion accruing as a result of mode shift.

The table below outlines the total costs, benefits and the net present value for the whole scheme, conducted over the 60 year appraisal period in accordance with WebTAG guidance. The Benefit Cost Ratio is 4.10:1 indicating that the scheme would represent very high value for money.

Table 3.3 Case Study 2 Appraisal Summary

COST AND BENEFIT	DISCOUNTED VALUE £M AND BCR
Total Costs (after passenger revenue deducted from costs)	£198
Total Benefits	£812
Net Present Value	£614
Benefit Cost Ratio	4.10

3.4.3 Wider Outcomes

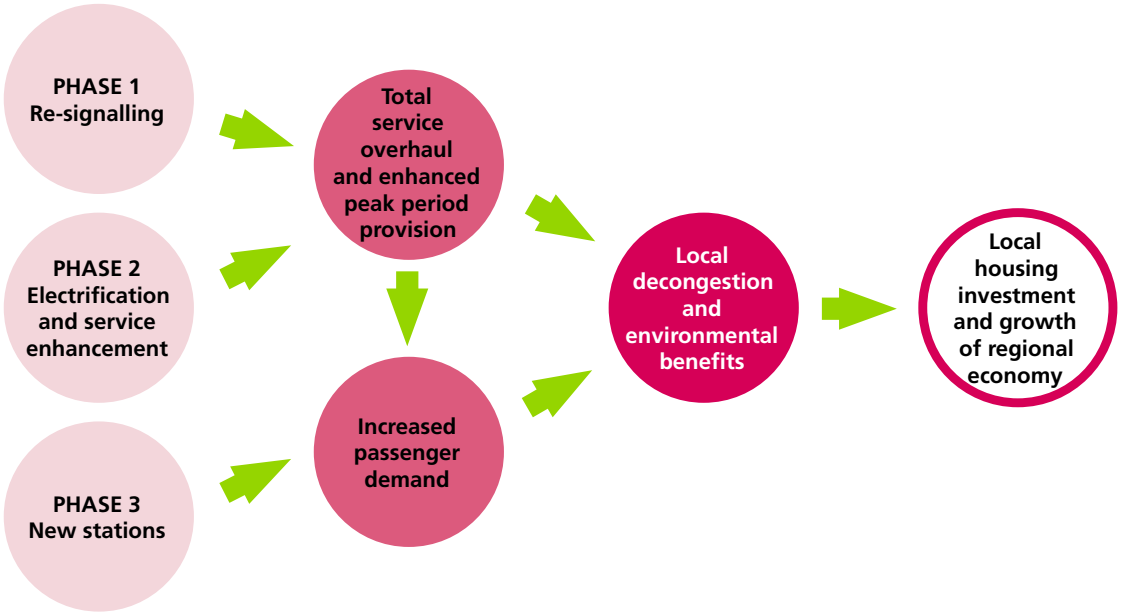
Whilst the emphasis of the scheme is on transport benefits and the total modernisation of a single route, the scheme also has the ability to support the growth agenda. The scheme will particularly be able to support the delivery of land for housing with two of the new stations each being able to support over 3,000 dwelling around them. This demonstrates the symbiotic relationship between rail and housing growth, with a new station helping to release land for development and the residents of new homes being able to support enhanced rail services.

Helping to deliver more sustainable transport option is especially important on routes serving congested centres, not just the major city, but also the university city which, with a historic

road network, will find development constrained without high quality rail access. Continuing to develop a rail service that passes through a rural area will also assist with maintaining access to service and jobs for such areas and broaden travel horizons.

Encouraging mode shift by providing a high quality and frequent rail service would help to improve the quality of life for both rail users and other residents in the area as car use fell leading to improvements in air quality and reductions in congestion. By providing a reliable and comfortable service the quality of life of existing and new passengers will be improved as journeys become more hassle free, employers may see an improvement in productivity whilst workers may see an improvement in their perceptions of work life balance as daily commutes become easier.

Total route modernisation



3.5 CONCLUSIONS

Within this case study it has been shown how a Total Route Modernisation scheme has the potential to move a route that is struggling to match capacity to demand to one that provides sufficient capacity with further room for ongoing growth. Whilst there are substantial capital costs associated with the work it ultimately delivers a service that has lower unit operating costs as a result of the use of electric trains.

In delivering this investment that helps improve the operation of the railway they will also improve the attractiveness of the route to passengers, helping support much needed housing development in a sustainable way, and helping to reduce congestion on the approaches to both a major city and significant university city with a historic centre. This demonstrates how the benefits of investment would be accrued along the full length of the route.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4: Leeds only.
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2nd 08:07 Leeds
On time
07:44:58

4 CASE STUDY 3: DEVELOPING INTER URBAN LINKS

4.1 CONTEXT

Case Study 3 is based on the Midlands Hub proposals for Birmingham, situated at the heart of a dense rail network in a major city region. Usage of the rail network in the area has, like many regional networks, grown significantly in recent years. This, coupled to improvements to long distance Inter-City–type services that pass along the route, means that the existing stations that serve the city have little useful capacity left, which limits the scope for further developing inter-urban and local services.

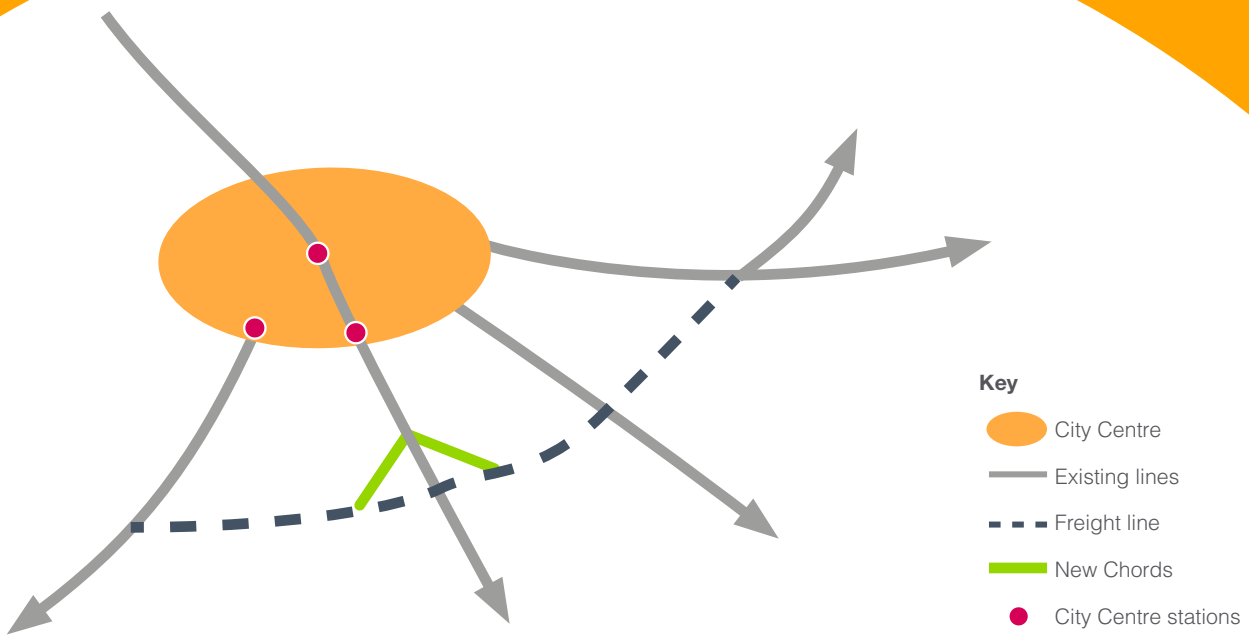
In contrast to the approaches to the main stations in the city there are sections of line which can currently only be used by freight trains which avoid the main stations, but an opportunity exists to provide a short piece of new infrastructure to better utilise these links and better serve the cities rail network.

Since 2008 demand at the main city centre stations has grown by over 50%, which has been delivered through a mixture of increases in service levels (where possible) and the lengthening of trains. Such a level of growth is not untypical across the regional network. Both local and regional stakeholders have a desire to deliver even more from their rail network to support the growth of the regional economy. The recent and future growth of the network has been largely driven by a combination of structural change to the local economy. There has been a move from manufacturing jobs at dispersed locations to consumer and producer services with many more city centre jobs, making rail an attractive mode for commute trips. High levels of road congestion have also driven demand growth.

CASE STUDY 3:

Key Features

- Structural changes to a city region economy requiring new service provision but constrained by rail infrastructure
- Small section of new infrastructure which facilitates the linking of radial routes
- Facilitates a clearer distinction between inter-urban and local stopping services
- Enables an improved service to local stations
- Provides frequency and connectivity improvements between regional cities
- Costs phased by package of improvements from £70m up to circa £300m
- Quantified Benefits: The scheme would generate around £0.9Bn of transport benefits over 60 years supported by the potential to deliver over £30m of agglomeration benefits per year as well as supporting housing growth



4.2 PROBLEMS AND OPPORTUNITIES

Whilst demand has grown over time, service patterns across the city have become increasingly 'fixed', with opportunities for running inter-urban services, that run for up to 50 miles, across the city to improve cross region connectivity being missed. This potentially limits the opportunities for the economies in the region to interact. Longer distance inter-urban services often see limitations imposed on their development by the need to cut across the "grain" of the rail network where they cross or share capacity with the major radial mainlines, such as the East or West Coast Mainlines.

With capacity for growth limited at the end of the routes, many of the inter-urban services in the area are forced to act as both a strategic inter-urban service and as a local stopping service. This compromise position further limits the development of the rail network as there is an inability to separate and fully develop the two types of service, in turn limiting the positive social and economic impacts of rail services.

This issue of multi-purpose regional rail services exists across much of the rail network and acts as a constraint to growing rail mode share. The compromises presented by these services include:

- Low frequencies for short journeys
- Increased journey times for medium and long distance passengers
- Train length driven by small stations, leading in turn to insufficient capacity

In the past, when demand was lower, these multi-purpose services made sense as a method for delivering inter-urban and local services cheaply. However in many cases they have outgrown their usefulness.

Providing capacity at key pinch points to develop these services has a number of advantages that could help transform these routes:

- They allow inter-urban and local services to be operated separately;
- They provide improved service resilience, allowing services to operate more punctually;
- They reduce journey times for long distance services;
- Capacity can be provided for more new local rail stations which will improve access to the rail network and encourage mode shift;
- There is an opportunity to improve connectivity across the city region.

By addressing these issues the routes affected will be able to better address wider objectives around mode shift, access to labour markets, agglomeration impacts and environmental benefits. The opening of new local rail stations will make accessing jobs in central Birmingham more plausible for more of the population, helping to improve access to opportunity. New stations would go beyond just commuters, the areas served would be more attractive and viable places to live with better access to leisure and education opportunities. The development of more rail capacity would also serve to release additional capacity on the road network for those trips new trips created by development that have to be made by car.

The improvements would also have strategic benefits as the improvements in punctuality of services in Birmingham, a key node in both local and national rail networks would help to incrementally improve performance across the network as a whole, helping to improve existing and potential passengers perceptions of the rail network.

4.3 THE PROJECT

The centrepiece of the proposed project involves incorporating an existing underused freight route into the passenger rail network. Historically the route has been used to bypass the main city centre station and, in doing so, passes over the approaches to the second city centre station. By providing a short link line the freight route could be directly linked to the second station where space exists to provide extra platforms, enabling four rail corridors, two on each side of the city, to be linked.

It then becomes possible to divert a number of services that presently terminate at the main station into the second station, in turn freeing capacity at the main station for other purposes. Furthermore, it will also allow services from the east and west that presently terminate in the city centre to be linked, providing new direct long distance rail links. This will benefit train operators as well as long distance passengers, since planning for through rather than terminating services will help improve rolling stock utilisation.

The additional capacity the scheme produces will allow the operation of a number of new local services to the east and west of the city, helping reduce the journey times of inter-urban services and improving service frequencies at local stations. Initially only operating at a half hourly frequency, these could be developed further over time. At a number of existing stations these new local services will transform the rail offering for towns, which for many years have relied on low frequency longer distance services for their main rail access to the city, where their peers on other routes have had high frequency dedicated local stopping services. Overall the scheme would allow up to an additional 10 trains per hour to operate across the city, an increase of 15%.

The centrepiece of the project is in fact only a catalyst for a range of supporting schemes that will help to realise the full potential of the project. The operation of new local rail services will provide the opportunity to open eight rail stations, helping to improve rail connectivity across both the city itself and the city region.

These new stations will fall into two groups. The first group would be a number of stations in areas close to the city centre where improved rail access will help to address local congestion issues and also facilitate inner city regeneration. A number of these stations would be located close to some of the busiest and slowest road corridors in the region. For example a journey that by rail might take a little over 10 minutes can take between 20 and 40 minutes in the morning peak period by road. The opening of new stations would speed up local journeys that shifted to rail and relive other journeys using the corridor where rail isn't an option. These inner city stations would be served by two new local stopping services giving a combined frequency of four trains per hour.

The second group of stations will be outer suburban stations where the delivery of new stations will promote mode shift and reduce the pressure on the strategic road network in the area. These stations may also facilitate the delivery of housing through the provision of sustainable transport options, helping to address the regions housing growth targets. Each route will be served by two trains per hour, with the potential to increase this further in the future. Like the inner city stations the journey time impacts especially in the peaks would be substantial. For example a rail journey of 15 minutes could replace a car journey in the peak of between 25 and 55 minutes – not just is rail quicker overall but it provides a much more consistent and reliable journey time.

Whilst the density of the local rail network will be improved by helping to address local connectivity issues, longer distance inter-urban services will see a reduction in journey times of around 10 minutes for journeys to the city centre. For services crossing the city centre journey time reductions might be as much as 50 minutes through a combination of reduced in-vehicle journey times and the removal of the need to connect between services with the associated interchange time. In addition, the option would also reduce the inconvenience to passengers of having to change trains, developing these links would help to support connectivity across the region providing a more interconnected economy.

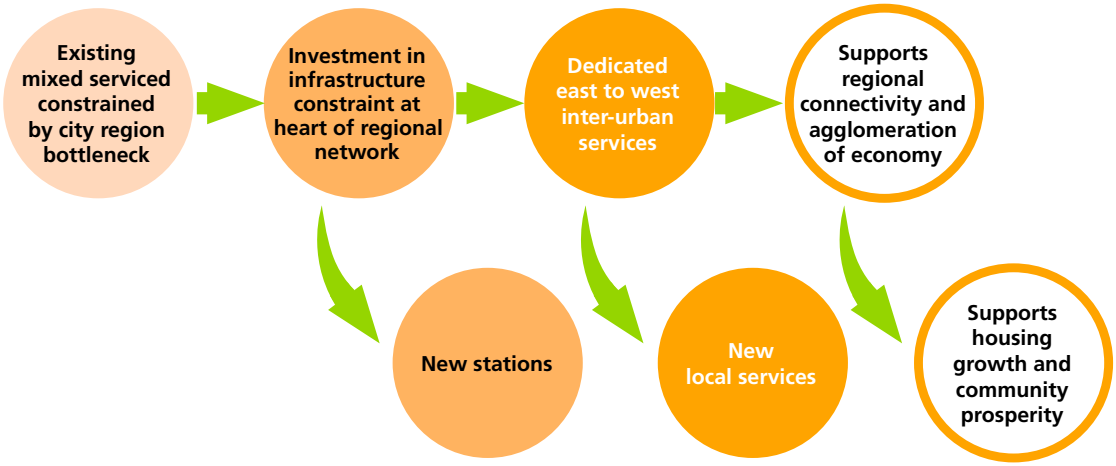
Overall the project will remove the compromise between inter-urban and local services and provide the city with much improved east–west connectivity for inter-urban services, supporting a developing local rail network by improving accessibility through the opening of new stations. All of this will help to make better use of existing capacity, both in terms of under-utilised assets in the centre of the area and on routes where development has been limited by bottlenecks elsewhere.

4.4 IMPACTS

Being at the centre of a busy network, this inter urban link has a broad range of impacts across the region that it serves. Longer distance services benefit from journey time reductions whilst new local services provide a more joined up urban rail network across the key city. The impacts also accrue to a range of beneficiaries, long distance passengers benefit from faster services whilst residents surrounding the key city benefit from access to new stations and improved local services. Improved access to the rail network, promoting mode shift, will in turn help reduce congestion for remaining users of the road network across the region. Finally rail operators will be able to improve the efficiency of their operation, whilst also benefiting from increased revenue generated by improved services – this will have a further effect on any operational subsidy required support existing services or where services are already profitable they will be able to further increase premium payments to central government.

The increased capacity of the network as a result of the intervention will also have further non transport related impacts. The new urban services will help to support more sustainable patterns of transit based development, with new stations providing the opportunity to provide additional residential development with high quality access to the key city centre. The improvements to services will also help to stimulate the economy. Rail services can help to support agglomeration impacts, where the economies of different settlements benefit from their proximity to each other, and in particular where the spatial concentration of economic activity gives rise to increasing returns in production. Some sectors of the economy are more sensitive to agglomeration than others with producer and consumer services, typically based in in city centres being especially sensitive, thus placing rail in a strong position to help strengthen the economies of the key city centres across the region.

Infrastructure intervention to segment inter-urban and local rail markets



4.4.1 Scheme Costs

The scheme costs associated with this case study are significant and have two main components. The first component is the transformational delivery of the new chord linking the freight lines with the city centre station. In addition to the chords themselves this work includes upgrades to the freight only route and new platforms and running lines around the station. The estimated cost of this stage of the work is around £300m at current prices. The second component of the work takes advantage of the additional capacity available for local

rail services and delivers eight new stations both across the inner city area but also across the wider city region area. The cost of delivering these station is around £80m at current prices.

The present value of schemes costs (discounted to 2010 values) is £563m when both the capital costs of the scheme and the operating costs of additional services are considered.

Whilst these are clearly significant investments they represent a network improvement that brings local services on four different corridors up to a standard similar to that on other routes in the area.

4.4.2 Scheme Benefits

The scheme will deliver significant benefits to the rail network across the city region. It is estimated that the scheme will deliver approaching 1 million additional trips per annum from existing stations on the network as a result of journey time reductions and frequency improvements, a one off increase in demand of 22%. In addition to this the eight new stations would bring around 1.29m additional passenger per annum, reflecting the step change in connectivity provided from areas with a high population but a poor rail access. Being focussed on a key urban centre around 40% of these trips will be abstracted from car, bringing a useful decongestion benefit for remaining road users and improving the environment. The table below illustrates the source of the benefits of the scheme.

Table 4.1 Case Study 3 Total Benefits

BENEFIT TYPE	DISCOUNTED VALUE £M
Value of Time savings	£504
Decongestion & Environment	£429
Total	£933

It can be seen that over a sixty year appraisal period the benefits of the scheme are extremely large at over £933m. These benefits are likely to be an underestimate of the full extent of the transport benefits. For example the released capacity at the existing major station in the city will be reused for other services that have not been included in this assessment. Whilst the impacts may not be as dramatic they would help to increase capacity on existing routes and reduce levels of overcrowding which would further add to the transport impacts of the scheme and spread impacts further across the region. The table below presents a summary appraisal of the scheme.

Table 4.2 Case Study 3 Appraisal Summary

BENEFIT TYPE	DISCOUNTED VALUE £M AND BCR
Present Value of Costs (after passenger revenue deducted from costs)	£260
Present Value of Benefits	£933
Net Present Value	£673
Benefit Cost Ratio	3.58

The table above shows that the scheme would represent high value for money with a Benefit Cost Ratio in excess of 3.58 based on transport impacts alone.

4.4.3 Wider Outcomes

However the impact of the scheme would go well beyond transport benefits alone. The development of local services would be likely to facilitate more targeted and sustainable housing development across the area, this in turn would drive further demand for rail services creating a virtuous circle as services were developed further, a case of transit based development. It would also help to address the major cities existing severe housing shortage, which in the long run could act as a constraint to continuing economic growth. A focus on a transit orientated growth corridor to be developed alongside these new stations could help to deliver 40,000 homes in the medium to long term.

Improvements to inter urban services would have a different impact, by bringing cities across the region closer together it would be possible to realise agglomeration benefits, with an initial estimate suggesting a total value to the economy of around £35m of additional GVA each year being possible, based on the combination of journey time and frequency improvements. Linking services across the city centre would help to strengthen the connectivity of the rail network across the region and help to support a more balanced and inter connected regional economy.

Improved rail connectivity and new stations will help to make secondary regional centres and smaller towns and villages more attractive places to live or work, potentially helping to reverse a spiral of decline in smaller centres by helping to bring more income and investment.

A final impact of this scheme which sits outside of its more obvious benefits is the added flexibility that the infrastructure delivers. Whilst the scheme brings an obvious immediate benefit to capacity it also brings more flexibility in the longer term planning of services. Over the coming decades it is possible that the pattern of demand across the region may shift or grow in different ways – the opening of these chords will allow that to be accommodated through more flexible changes to service structures and patterns, helping to further de-constrain the shape of the network.

4.5 CONCLUSIONS

This case study has a very direct focus on addressing capacity constraints and bottlenecks at the very heart of a city regions rail network. The scheme proposed delivers a piece of key infrastructure that allows regional rail services to flourish by segmenting the inter-urban and local rail markets allowing each to deliver a more tailored service. The scheme has two main phases the first focused on removing a bottleneck whilst the second seeks to improve access to the network.

The scheme has a myriad of benefits not all of which have been quantified here. Whilst there are direct transport impacts on rail users on the corridors directly impacted there are also benefits to rail users elsewhere on the network from increased capacity into major stations. The scheme also brings around 1m new rail users to the network. Finally the scheme also delivers long term flexibility in network planning.

Beyond transport the scheme also acts as a catalyst for sustaining growth across the city region. New stations in particular will stimulate housing development that has the potential to be more sustainable than car based development, whilst improvements to inter urban services will help support the growth of the economy by moving city centres closer together bringing with it agglomeration benefits, helping economic growth in the future.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5 CASE STUDY 4: NETWORK TRANSFORMATION

5.1 CONTEXT

Case Study 4 is based around proposals for investment in the Valley Lines in South Wales and features the total upgrade of an existing urban rail network situated in a major city region, aimed to link communities and transform the local economy. Today, the university city is a hub for financial, business and government services and a popular tourist destination, but historically its position as a logistics hub allowed its coal industry to flourish. Since the decline in the coal industry in the 20th century, its dockland area has undergone major regeneration.

The output of the city region economy is currently in the region of 80% of the UK average and is performing less well than other comparable UK cities, highlighting the significant scope for improvement with the right investment. Despite this economic underperformance, there is projected to be significant population increase, with commuting into the urban centre up 14% in the last ten years. There is also a significant workforce across the rest of the city region, highlighting the need for a region-wide network. By 2030, the population of the city region is estimated to be around 1.5 million and it is forecast to grow quicker than any other UK city over the next 20 years.

A legacy of the region's coal industry is the large and compact urban rail network that currently serves the city region and forms a good base for developing a comprehensive and modern rapid transit 'Metro' network. The existing rail network links the urban core with the densely populated, economically deprived former mining communities that make up the city region.

5.2 PROBLEMS AND OPPORTUNITIES

The network has a number of constraints and opportunities for investment that currently restrict the economic growth of the city region.

The lines serving the urban core suffer from signalling and infrastructure constraints and many of the newly regenerated and most densely populated communities are poorly served by rail. The routes are particularly constrained where they meet at the city centre stations, with the track layout funnelling five different routes into only two platforms.

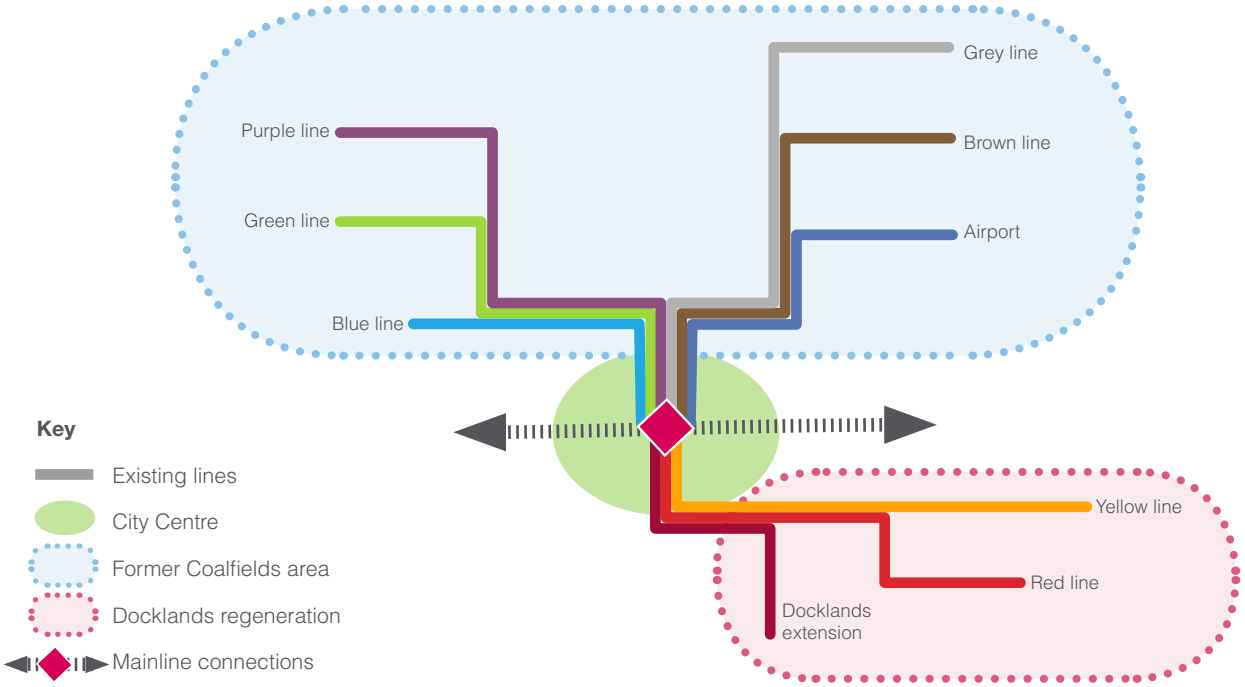
CASE STUDY 4:

Key Features

- Regional economy undergoing substantial restructuring and an emerging new centre of economic gravity
- Large and growing regional commuter base
- Extensive historic rail network but with significant capacity limitations
- Phased programme of development across whole network including:
  - Core high frequency service
  - Partial conversion to light rail
  - Tram-train pilot
  - Re-doubling of track
  - New stations and park and ride
- Costs: Initial phases circa £80m. Full programme over 20+years up to £1bn
- Quantified Benefits: Up to £3.6Bn of transport benefits over sixty years supporting a broader economic transformation

Despite these constraints, the existing urban rail network continues to experience above trend growth in rail patronage with some stations seeing growth of over 90% in the last 10 years.

The network is currently restricted by numerous single track sections in the outer reaches of the network which limit service development and are a source of unreliability especially at peak times. In addition much of the signalling and track infrastructure is life expired and in need of renewal. Furthermore, no part of the network is currently electrified and, as a result, runs older diesel rolling stock. These trains suffer from poor acceleration lengthening journey times on routes with a high density of stops but are also old, increasingly unreliable and are poorly laid out making them uncomfortable to use – presenting a poor image with little to aspire to. Electrification would bring faster, quieter and more reliable trains presenting a much more positive and aspirational image and would have lower operating costs improving the efficiency of the service for many years to come.



Across much of the network, these constraints currently limit the improvement of service frequency, leading to many communities being served at relatively low frequencies. There are also sections of freight line in the core network which have the potential to be converted for passenger services, freeing up capacity on existing lines and increasing the potential for service enhancement.

The existing network is currently an entirely heavy rail operation, which doesn't currently provide the high density rapid transit system required in the urban core. There is the potential for conversion of some of the existing heavy rail lines to an alternative metro-style light rail operation, including on-street running in the urban core and regenerated docklands area.

Additionally, whilst the existing network provides links between the urban core and the wider settlements of the city region, there is limited east-west cross-community connectivity, limiting the opportunities and potential for many of these areas.

There is evidence to suggest that significant investment in the capacity and reach of a city region's transport network can support not only more employment across the region, but 'higher value' employment activities and the economic benefits these trends can provide.

The programme would unlock numerous local development opportunities in the wider city region and create a larger network of more prosperous communities connected by a cohesive and sustainable transit system. The catchment of the regional transport network is intended to increase by 60%, and the scope for a wider 'transit-oriented development' approach in the region, with high density residential development focused around key transport hubs in the network, would be greatly enhanced by the scheme. This approach would also have benefits in terms of land-use values and the promotion of sustainable living.

The urban core would have unconstrained access to local labour markets and allow for the transformational growth of a nationally significant city regional economy. The upgrade would

deliver a cohesive and sustainable intra-regional rail network, addressing local issues around accessibility-related deprivation and lack of suitable alternative modes of transport.

Finally whilst the key changes to the network are driven by physical interventions there is also an opportunity to link an upgraded network with interventions in the ticketing and fares system to provide a seamless and attractive network. Along with wholescale route upgrades there is the opportunity to deliver an integrated multi modal ticketing system. Using Smartcard contactless technology it would be possible to make the public transport trips seamless and hassle free. Through a combination of high frequency services and a simple to use fare system it would be possible to encourage people to broaden their travel horizons and access opportunities. With an intensive simple to use system it would be easier to encourage consistent use of public transport and reduce dependency on car use.

5.3 THE PROJECT

The project is a total network upgrade that would seek to resolve the capacity, accessibility, service frequency and reliability issues that currently exist. The upgrade would involve significant infrastructure improvements, including electrification, signalling, new lines and stations and the implementation of light rail services on new and existing routes. The vision is to create a “turn up and go” experience for passengers with smart ticket integration across the entire network. The network upgrade would be delivered incrementally.

The first phase of the investment has already been delivered at a cost of £77m and focused on identifying and delivering a number of “quick wins”. These included the extension of an existing line, new stations and some line capacity improvements. This is supported by a £200m package of improvements delivered by Network Rail, including signalling and infrastructure improvements across the existing network to improve capacity and reliability. These early interventions serve to form the basis for more ambitious network upgrades in future phases of the scheme.

The second phase of work would take advantage of the physical isolation of many of the routes from the rest of the rail network to reinvent the operations and geography of the routes. Being remote from the rest of the network provides the potential for developing a high density tram-train network. Where previously the focus of the historic heavy rail network has been linking coal mines to industry and ports, the focus of the modern network is accessing the regenerated city centres. A tram-train network using the existing heavy rail infrastructure in the outer area, and new light rail infrastructure to access the city centres would acknowledge this shift in focus.

Such routes would be upgraded and electrified to provide high frequency stopping services along the routes, use of lighter weight rolling stock will help reduce journey times. The tram-train operation would terminate in the city centre providing better access to jobs and services.

Phase 3 will build upon this release of capacity at the mainline station. With many of the suburban services converted to tram-trains it will be possible to improve the service on other suburban routes. This would be achieved using heavy rail technologies with electrification of the routes and new rolling stock to provide higher frequency and faster services and allowing the possibility of developing new stations serving previously isolated communities in the outer reaches of the city region.

Such a programme of work would be likely to cost around £1bn phased over perhaps 20 years, but delivering a network that would have shifted from running a network making the best of legacy infrastructure to one focused on meeting the needs of a modern City Region.

5.4 IMPACTS

The programme of work outlined above is a transformational package of improvements and upgrades, and requires a significant amount of investment and a lengthy construction period. A number of corridors are targeted in the programme, with differing profiles and requirements, and different upgrade proposals as a result. As a result of its scale, the project would have to be implemented in a phased approach, over a 10 to 15 year period.

The appraisal of this scheme has been conducted using a Department for Transport WebTAG-based approach, and the monetary benefits have been quantified in terms of value of time savings, decongestion and passenger revenue. Passenger demand forecasting for all elements of the scheme has been conducted using standard rail industry guidance.

WHAT IS A TRAM-TRAIN?

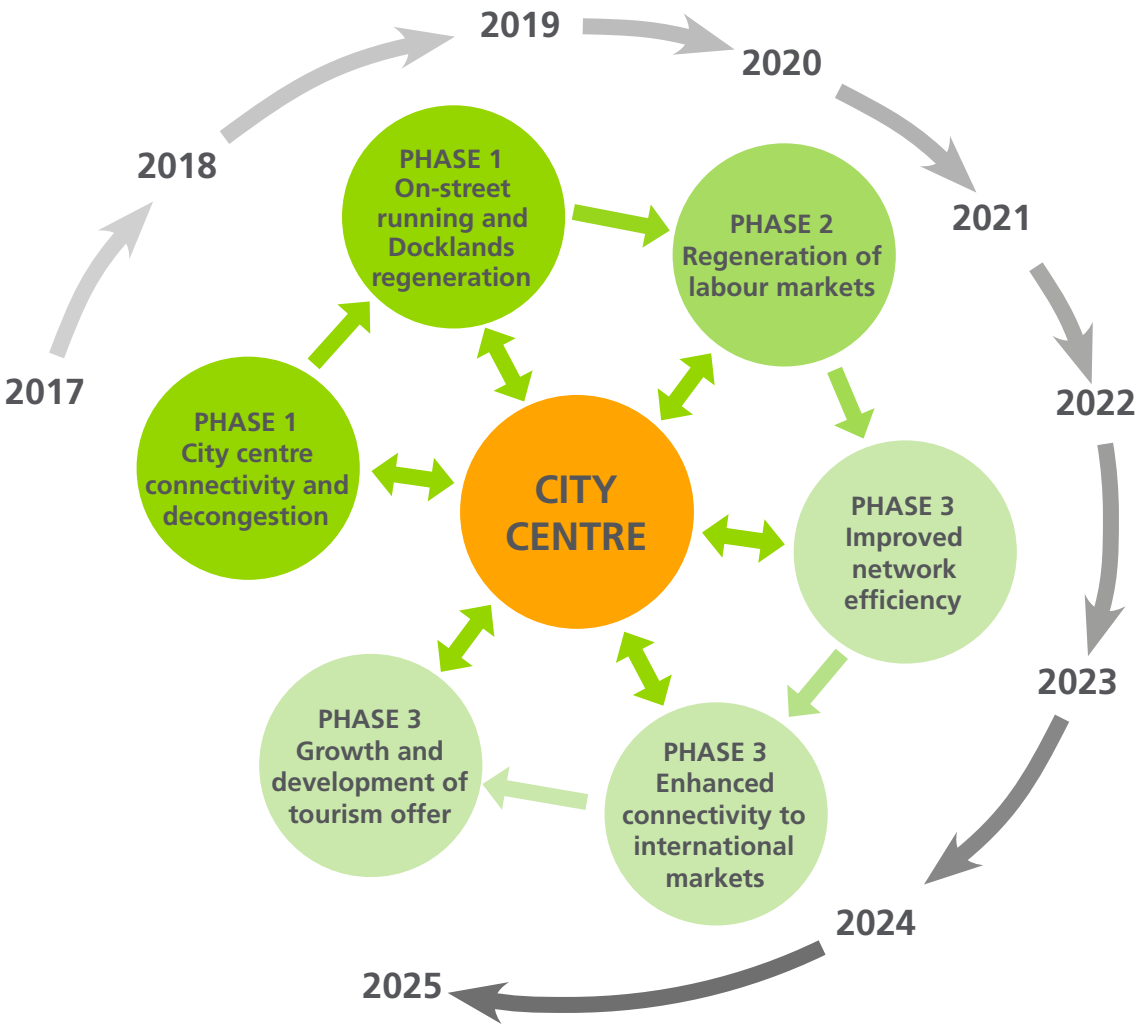
A tram-train is a rapid transit system where trams operate on both urban tramway networks and mainline rail lines which are shared with heavy rail rolling stock. Tram-train operation combines the superior flexibility and accessibility of a tram with the greater speed and comfort of a conventional train.

Costs for each phase have been calculated based on similar light rail, tram-train and conventional electrification scheme examples from the UK and Europe. These cost estimates incorporate track doubling where required, electrification infrastructure, signalling, new stations and on-street tramway platforms, new rolling stock and future operating costs as a result of increased service levels.

The sections below break down the scheme into its separate investment and construction phases, describing the profile, characteristics and value for money case for each.

5.4.1 Phase 1 – City Centre Investment and Connectivity

The first phase involves the conversion of two key commuter routes in the network that currently link the urban core with wider settlements, and is seen as the first step in achieving a comprehensive, modern ‘Metro’ network. The Red Line is a 10km corridor to be converted to a light rail tram system. The longer Yellow Line is more suited for conversion to a European-style tram-train system.



Phase 1 also includes significant investment in on-street track infrastructure in the city centre, the extension of the Metro network into the city's docklands and the upgrade of an existing short heavy rail link to electrified light rail operation, connecting the city centre with a nearby resort and commuter town. This additional upgrade releases much needed capacity in the city centre station for the new high frequency Metro services of Phase 1, and provides light rail access to key city centre locations by installing on-street track and stations. It is a necessary capacity intervention and future-proofs the network in anticipation of further phases as the overall scheme develops.

Phase 1 is designed to facilitate fast and efficient city centre movement and tackle congestion in the urban hub of the city region. An efficient inter and intra city region transport network is essential to a successful modern economy, and tackling city centre accessibility and connectivity is the primary objective in this first phase of the Metro investment. A fully connected and accessible city centre would be able to attract high value job sectors and enhance access to skills and opportunities to boost the city region economy.

A comparison of existing service levels and the proposed future service based on tram and tram-train operation are outlined below.

Table 5.1 Phase 1 services

ORIGIN STATION	SERVICES TO CITY CENTRE STATION	
	EXISTING	FUTURE 'METRO'
Red Line terminus	2 trains per hour (tph)	6tph
Yellow Line terminus	1tph	4tph
Yellow Line intermediate stop	4tph	6tph
City centre district station	8tph	12tph
Resort town station	4tph	12tph

The service and journey time improvements implemented result in an annual passenger flow increase of 4.5 million on the Phase 1 corridors. The monetised benefits of the scheme over a 60 year appraisal are summarised below.

Table 5.2 Phase 1 benefits

BENEFIT TYPE	DISCOUNTED VALUE £M
Revenue	£110
Value of Time savings	£732
Decongestion & Environment	£51
Total	£893

It is also worth noting that there are benefits from proposed new city centre stations through the capture of new passengers in these areas and new journeys currently not possible by rail that have not been quantified in this appraisal.

5.4.2 Phase 2 – Regeneration and Resurgence of City Region Labour Markets

The second phase of the programme focuses on connecting the newly unlocked potential of the urban core with key wider labour markets of the city region. Phase 2 achieves a fully-fledged city region Metro that seamlessly connects the enhanced employment, training and leisure opportunities of the city centre with its primary population centres in order to maximise GVA output and further inward investment.

The economically deprived rural and suburban communities that Phase 2 reaches would experience an uplift in affluent residents and commercial investment as their enhanced connectivity to the city centre makes them attractive commuter towns for city workers. The enhanced productivity and subsequent prosperity of the city centre as a result of the Metro investment would flow back along these new rapid transit corridors and into these deprived areas, boosting housing markets, local business and tourism.

Phase 2 would also help to forge a culture of sustainable travel throughout the city region by creating an integrated network that provides a realistic alternative to the private car for commute and leisure journeys. The investment would create a high density of stations along high frequency, rapid transit corridors, continuing the decongestion and movement efficiency targets of Phase 1.

Phase 2 continues the roll-out of tram-train operation on three additional commuter corridors which connect the city centre with outlying communities in the city region. The scheme provides electrified track (and the doubling of single track sections) to facilitate the running of tram-train rolling stock that can operate on both existing heavy rail lines and the new city centre tramways implemented in Phase 1.

An outline of the service level improvements implemented in Phase 2 are presented below.

Table 5.3 Phase 2 services

ORIGIN STATION	SERVICES TO CITY CENTRE STATION	
	EXISTING	FUTURE 'METRO'
Blue Line terminus	2tph	3tph
Green Line terminus	2tph	3tph
Purple Line terminus	2tph	3tph

The increased frequencies and journey time benefits of the tram-train investment drives passenger growth of around 1 million per annum across all three corridors. The monetised benefits of the scheme over a 60 year appraisal are summarised below.

Table 5.4 Phase 2 benefits

BENEFIT TYPE	DISCOUNTED VALUE £M
Revenue	£112
Value of Time savings	£320
Decongestion & Environment	£52
Total	£484

5.4.3 Phase 3 – Network Efficiency, International Markets and Tourism

Phase 3 targets three further rail corridors in the city region, seeking to improve the capacity and efficiency of these lines. As these routes are more closely intertwined with the rest of the rail network compared to the Phase 1 & 2 routes, Phase 3 will remain as a heavy rail operation.

Phase 3 would be a conventional electrification scheme with new stations added at key potential commuter locations that are not currently served by the rail network. The electrification investment would allow for reduced headways between services, shorter journey times and more modern and comfortable rolling stock.

A key destination included in this phase is the city region's international airport, which has its own rail station. With a current service of one train per hour from the airport to the city centre, the rail network is not performing its key function in providing high quality sustainable access to the airport and maximising the airport's potential to boost the region's economy. Phase 3 would increase this service to six trains per hour, with a reduced journey time, so the airport can better perform its function as a key international gateway and vibrant economic hub, thereby raising the profile of the city region as an attractive location for high value business and tourism.

A successful and well-connected airport would have the potential to become a sustainable local employment centre and hub for inward international investment which, with the enhanced rail link to the city centre and the deprived suburban areas, would boost the entire city region economy.

An outline of the service level improvements implemented in Phase 3 are presented below.

Table 5.5 Phase 3 services

ORIGIN STATION	SERVICES TO CITY CENTRE STATION	
	EXISTING	FUTURE 'METRO'
Grey Line terminus	1tph	4tph
Brown Line terminus	1tph	4tph
International airport station	1tph	6tph

Electrification and re-signalling achieves journey time savings across all stations, driving an annual passenger demand growth of over 3.6 million. Over a 60 year appraisal, the improvements in Phase 3 achieve the monetised benefits outlined below.

Table 5.6 Phase 3 benefits

BENEFIT TYPE	DISCOUNTED VALUE £M
Revenue	£534
Value of Time savings	£2,195
Decongestion & Environment	£257
Total	£2,986

5.4.4 Appraisal Summary

The table below outlines the total costs, benefits and the central BCR for the whole scheme. These are built up out of all phased elements of the project from a period beginning 2017 to 2025. All phases have been appraised over 60 years in accordance with WebTAG guidance. The central BCR is 3.00 which indicates that the scheme would represent high value for money. The nature of a network transformation is that it is possible to share the costs of critical pieces of infrastructure across benefits from different phases – the total value is greater than the sum of the parts.

Table 5.7 Case Study 4 appraisal summary

COST AND BENEFIT	DISCOUNTED VALUE £M AND BCR
Total Costs (after revenue deducted)	£1,202
Total Benefits	£3,608
Net Present Value	£2,406
Benefit Cost Ratio	3.00

5.5 CONCLUSIONS

The completion of a network transformation is a lengthy and complex process. However it will produce a reinvigorated network fit to support the wider objectives of the area it serves. By taking a network wide approach it is possible to deliver a step change in the quality and quantity of services in the case through the introduction of a different technology in the form of tram-train.

The implementation of Phase 1 provides a 'turn up and go' 10 minute headway for most of the stations along the two lines. The new rolling stock and light rail infrastructure improves journey times and journey quality and offers a bespoke rapid commuter service which the current operation fails to provide.

Key regeneration, employment and tourism development around the docks and industry hubs is unlocked, providing a rapid transit network serving the urban core. It also facilitates the implementation of future phases, providing the necessary infrastructure and capacity to enable the core network to manage the increased service levels.

Phase 2 continues the conversion of historic commuter lines, with many single track sections, running outdated rolling stock into a high frequency tram-train system to create a 'Metro' style network for the wider city region. As in Phase 1, journey times, journey quality and reliability of service would all be improved compared to the current situation, but the ultimate objective would be to enhance the accessibility of deprived communities, facilitating the much needed growth of the city region economy.

Phase 3 is a more conventional electrification scheme, but achieves similar accessibility and connectivity benefits of Phases 1 and 2. A 10 minute headway for services connecting to the city region's international airport is achieved and, while not specifically quantified in the appraisal, enhanced connectivity between the urban core and the airport will improve access to jobs, business opportunities and inward international investment for the city region economy.

All the suburban communities served by the new city region Metro will enjoy greater accessibility to jobs, retail and leisure, acting as a regeneration catalyst for these disconnected locations. The urban core will also experience an economic boost as its access to labour markets is enhanced.

6 CONCLUSIONS

This report has looked at four different case studies of investment in the UK rail network. They represent a diverse range of investment covering different types of investment, geographies and economies.

Each case study has shown a different type of investment. Case Study 1 has shown how regional rail could support the regeneration of an area through the reintroduction of passenger services on an existing freight railway. This also shows how there can be scope for investment in existing underutilised infrastructure.

Case Study 2 looks at the transformation of a congested urban railway to provide sufficient capacity to allow a city region to grow. Investment in electrification and rolling stock would provide capacity that would support the delivery of housing growth and promote mode shift from the car to rail, in turn reducing road congestion across the area.

The third case study looks at making better use of underutilised infrastructure to deliver greater capacity, helping to segment regional and urban services so that both service types can strengthen their offer to the markets they serve. This will help to promote a shift from car to rail for inter urban services and also allow new stations to open served by urban rail services and helping to promote more sustainable development around the new stations.

The final case study demonstrates the impact of a long and sustained period of phased investment across an entire network. This utilises tram-train technologies to best serve an area with a number of smaller settlements which are isolated from the rest of the rail network. Whilst this would be a major investment it would provide a transformational change to the local transport network enabling a significant increase in the size of the city region's labour market and making it easier for residents of outlying areas to reach the city centre.

Whilst representing a diverse mixture of routes, services and investments all the case studies have been shown to represent high value for money, illustrating the importance and potential impact of investment in the regional rail network. But this merely covers the benefits that are readily quantified, the real value of the investment goes far beyond this and shows how regional rail can be an effective conduit for facilitating regeneration, economic growth and environmental improvement.

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