



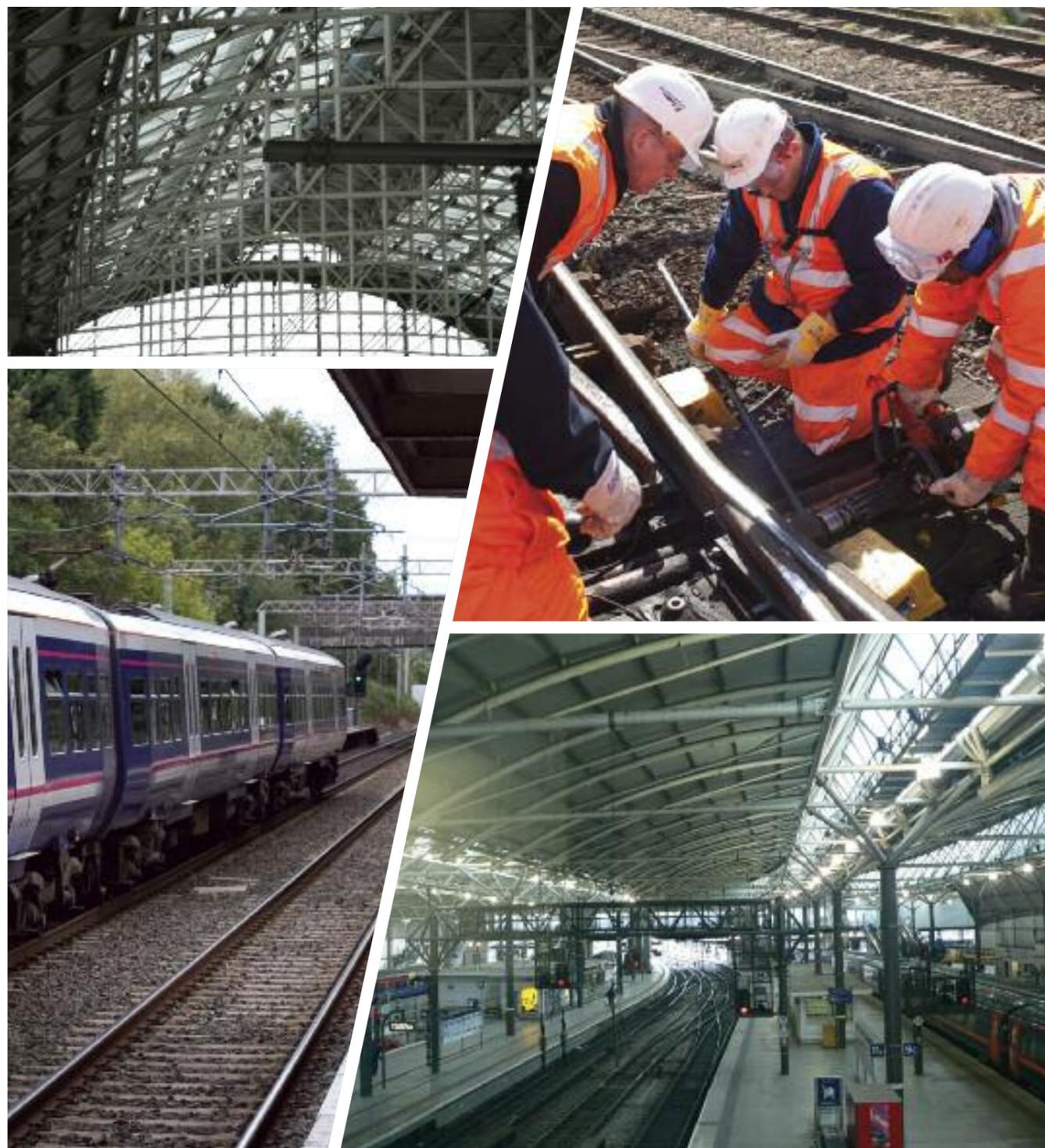
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Manchester Hub Rail Study



Executive summary

- The last ten years has seen a transformation in rail across the North of England, with more passengers choosing to travel by train.
- Hundreds more trains now run every day, and they are safer and more reliable than ever before.
- With significant economic growth in the North, and people prepared to commute further to work, more people now prefer to travel by train than on congested roads or by plane.
- Enhancements to the rail network such as additional and faster north south services from the upgrade of the West Coast Main Line as well as improved safety, performance and reliability have supported this modal shift.
- The North's city region economies are forecast to continue to grow and we are making significant investment in new infrastructure before 2014. This will result in even more people choosing rail as the quickest, most environmentally friendly and easiest way to travel.

The challenge

- Fast and reliable links between the North's city regions are essential to support growth of jobs and businesses. Growth in rail commuting into the North's city centres will support their sustainable growth.
- Also vital to the future economic prosperity of the North are improved links to ports and airports. Manchester Airport is the UK's largest airport outside the South East.
- Even with planned investment, the North's strategic road network is forecast to become more congested with journeys taking longer and being more unreliable.
- We want to meet this challenge by enabling train operators to provide faster, more frequent and more reliable train services than ever before, right the way across the North.

Achieving the ambition

- To support this, we need to provide the capacity on the rail network to enable journeys to be made reliably:
 - within the city regions
 - between city regions
 - and to ports and airports.

- The major barriers to achieving these are:
 - (i) limited capacity and railway conflicts in Manchester, through which the majority of rail services that run across the North pass
 - (ii) slower journey times including the lack of facilities for fast services to overtake stopping services on the major routes across the North.
- These barriers limit the degree to which rail can support the North's sustainable economic growth.
- Work undertaken by the Northern Way indicates that removing these barriers is vital for the continued economic prosperity of the North.
- The Manchester Hub is the most significant rail bottleneck in the North. Constraints there affect commuter services, services that link the North's city regions, services to and from Manchester Airport (the North's most important international gateway) and they limit the growth of rail freight.
- The study has been carried out in two phases;
 - Phase One led by the Northern Way has identified the economic case for enhancement to the Manchester Hub and the improvements to rail services that would drive this economic growth. These are described as conditional outputs.
 - Phase Two led by Network Rail has identified value for money interventions to address the gaps between the capability of the network in 2014 and the capability required to deliver the conditional outputs.
- The conditional outputs identified by the Northern Way in Phase One relate to:
 - Capacity to meet growth forecast to 2019 and 2030
 - Carbon reduction
 - Performance
 - Journey times between Manchester and adjoining Northern cities
 - Connections between towns and growth areas of Greater Manchester
 - Connectivity to deliver economic benefit
 - Frequency of service to Manchester Airport
 - Service interval and frequency on trans Pennine routes

- North/South capacity
- Freight.

The solution

- Network Rail has identified a preferred solution that delivers excellent value for money and provides the opportunity for faster, more frequent and more reliable services, freeing up capacity and providing for future growth in demand.
- Working with the Department for Transport, First TransPennine Express, Northern Rail, DB Schenker and Greater Manchester Passenger Transport Executive as well as the Northern Way, we have identified a strategy which will:
 - increase platform capacity in central Manchester
 - remove conflicts which use up much valuable capacity
 - increase capacity on key lines across Manchester and on major routes across the North.
- Following detailed consideration of alternatives, Network Rail identified two strategic options to provide the capability to achieve the conditional outputs: one to allow greater use of Manchester Piccadilly; the other greater use of Manchester Victoria.
- Our work demonstrates that the Manchester Victoria option offers better value for money and greater benefits at a lower capital cost.
- The preferred option involves:
 - A new section of railway west of Manchester city centre at Ordsall, to allow trains to travel from Manchester Victoria to both Manchester Piccadilly and Manchester Airport stations.
 - Major improvements to Manchester Victoria allowing many more services to use the station and providing improved facilities for passengers.
 - New tracks on the North trans Pennine line between Leeds and Liverpool and on the Hope Valley between Sheffield and Manchester to allow fast trains between the major towns and cities of the north to overtake slower trains.
- The Department for Transport, First TransPennine Express, Northern Rail, DB Schenker, Greater Manchester Passenger Transport Executive, and the Northern Way support this preferred option as the best way of resolving the Manchester Hub problem.

Faster, more frequent and more reliable services

- Our preferred option provides the capability for significant improvements to rail services across the North, including inter-regional, commuter and freight services.
- For inter-regional services the opportunity is created to:
 - increase the frequency of train services between major cities in the North
 - provide direct train services between cities in the North where currently passengers change trains in Manchester
 - reduce journey times across the North
 - provide new direct links between Northern cities and Manchester Airport.
- This will provide the opportunity to:
 - improve journey times on the North trans Pennine route, reducing journey times for passengers between the North East, Yorkshire and the Humber and Manchester, Liverpool and other destinations west of Manchester
 - improve journey times from Sheffield and the East Midlands to Manchester, Manchester Airport, Liverpool and other destinations west of Manchester
 - provide direct journeys from Bradford, Halifax and the Calder Valley to Manchester Airport and destinations west of Manchester
 - provide direct services from Chester to destinations beyond Manchester
 - reduce delays to services across the north of England.
- On key Manchester commuter corridors the opportunity is created to:
 - enable more commuter and local services to run throughout the day
 - make commuter and local services faster than ever before
 - introduce 15 minute frequency services between Manchester Victoria, Manchester Oxford Road, Manchester Piccadilly and Manchester Airport improving end-to-end journey times by making Manchester city centre more accessible by rail
 - connect north east Manchester into the wider rail network by running through Manchester Victoria.
- For freight operations the study provides the opportunity to:
 - double capacity into the Trafford Park terminals
 - provide capacity for traffic to planned new freight terminals.

Next steps

- The work undertaken forms part of our planning process for Control Period 5 (CP5) between 2014 and 2019.
- Network Rail will continue to work with the rail industry and stakeholders to develop the preferred option set out here, including the further electrification proposals with a view to inclusion as a specified scheme in the 2012 High Level Output Specification.
- Our strategy has been developed to provide further opportunities beyond Control Period 5 (2014 to 2019). These include:
 - even greater capacity on the network
 - reducing journey times even further
 - allowing for the arrival of a future high speed line into Manchester or other service improvements to services from London, Birmingham and the South.
- By doing this, we can continue to provide the faster, more frequent and more reliable services that underpin the sustainable economic growth of the North of England.

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Chapter 1 Background



1.1 Introduction

The Manchester Hub is the network of rail corridors that link and cross in and around the centre of Manchester. The Manchester Hub is the most significant rail bottleneck in the North of England. It limits the capacity, performance and connectivity of commuter and longer distance passenger services terminating in Manchester or passing through the Hub. It therefore adversely affects journeys between the North's city regions. It also limits the number of trains, from across the North and beyond, that can serve Manchester Airport, the North's principal airport, as well as those that can access important distribution centres for freight.

On 4th October 2007, the then Department for Transport Minister of State, Rosie Winterton, responding to the work of the Northern Way, asked Network Rail to undertake a study to develop proposals to enhance the capacity and functionality of the Manchester Hub. The Manchester Hub Study has been undertaken in two phases. This was overseen by a Department for Transport (DfT)-chaired Sponsors' Group, the other members being the Northern Way, Greater Manchester Integrated Transport Authority/Passenger Transport Executive (GMITA/PTE), Manchester City Council, Government Office of the North West (GONW) and Network Rail.

The Sponsors' Group agreed a two phase approach to the study:

- Phase One led by the Northern Way identified the economic case for enhancement to the Manchester Hub and the improvements to rail services that would drive economic growth, which are described as conditional outputs.
- Phase Two led by Network Rail identified value for money interventions to address the gaps between the capability of the network in 2014 and the capability required to deliver the conditional outputs. In terms of Network Rail's project development process interventions are developed to a GRIP1¹ level of detail.

The Northern Way concluded Phase One in their report "Manchester Hub Conditional Output Statement" in April 2009. The Northern Way's report can be downloaded from their website www.thenorthernway.co.uk.

1.2 Stakeholder participation

The process adopted for Phase Two of the study was designed to be inclusive. It involved active partnership working between industry parties and wider regional stakeholders through a Steering Group and sub groups involving; DfT, DB Schenker, Northern Rail, First TransPennine Express, GMPTE, Government Office of the North West (GONW) and the Northern Way, with Freightliner, Arriva Trains Wales, CrossCountry, East Midlands Trains, Virgin Trains, and Merseytravel (Merseyside PTE) joining a subgroup to work at a detailed level. There was also extensive consultation with a wider group of stakeholders through a series of workshops held during the study period.

This process included identification of the potential infrastructure interventions and creation of a service specification which was designed to identify the network capability required to meet the conditional outputs.

1.3 Document structure

Chapter 2 describes the geographic scope of the study and the planning context within which it has been developed.

Chapter 3 summarises the capabilities of the network as they are planned to be at the end of Control Period 4 (2009-2014) and the usage of the routes within the area, drawing on input from key industry stakeholders, and highlighting particular issues.

Chapter 4 discusses anticipated changes in supply and demand identified in Phase One of the study and the factors identified as important to driving economic growth and identified in the conditional outputs.

Chapter 5 analyses the gaps between the network capability in 2014 and that required to deliver the conditional outputs. This chapter draws the analysis together into two strategic options for the Manchester Hub.

Chapter 6 evaluates the strategic options to identify a recommended option for the Manchester Hub for implementation in Control Period 5 (2014-2019) and beyond.

Chapter 7 outlines the recommended strategy for further development to enhance services across the north of England through the Manchester Hub.

¹GRIP; Guide to Railway Investment Projects, Network Rail's project development framework where 1 represents the earliest stage and GRIP 3 represents identification of a single option for design and implementation.

Chapter 8 describes the opportunities for improvements to rail services as a result of the preferred option.

Appendix A identifies the various stakeholder meetings

Appendix B identifies the infrastructure interventions evaluated

Appendix C outlines the train service modelling to test the concept of the Manchester Hub

Chapter 2

Dimensions



2.1 Purpose

The purpose of this, the Phase Two of the Manchester Hub Study is to take the work done by the Northern Way, and then;

- identify the gaps between the capability of the network in 2014 and the capability required to deliver the conditional outputs
- identify the value for money interventions to address these gaps.

2.2 Stakeholders

The study involved two main groups of stakeholders. These were the Steering Group and the Wider Stakeholder Group. The Steering Group met every six to eight weeks to monitor progress and guide future work. The Steering Group consisted of members from the following organisations:

- Network Rail
 - Department for Transport (DfT)
 - The Northern Way
 - Northern Rail
 - First TransPennine Express
 - DB Schenker
 - Greater Manchester Passenger Transport Executive (GMPTE)
 - Government Office of the North West (GONW)
- The Wider Stakeholder Group included a wide range of stakeholders and consisted of the rail industry (passenger and freight operators), as well as local and regional authorities with transport responsibilities. The Wider Stakeholder Group met on several occasions to be updated and give feedback on progress. The membership of this group is shown below.
- Merseytravel
 - South Yorkshire Passenger Transport Executive
 - Manchester Airport
 - Association of North East Councils
 - Association of Train Operating Companies
 - North West Development Agency

- Lancashire County Council
- Freight Transport Association
- Central Salford Urban Regeneration Company
- Yorkshire Forward
- Halton Borough Council
- Metro (West Yorkshire Passenger Transport Executive)
- Greater Manchester Integrated Transport Authority
- Office of Rail Regulation
- 4NW
- GONW
- Yorkshire and Humber Assembly
- North West Rail Campaign
- The Northern Way
- Peel Ports
- DfT
- Derbyshire County Council
- Blackburn with Darwen Borough Council
- Warrington Borough Council
- Cheshire East Council
- Cheshire West and Chester Council
- Arriva Trains Wales
- Freightliner
- Northern Rail
- TransPennine Express
- Virgin Trains
- CrossCountry
- East Midlands Trains
- DB Schenker.

In addition, working groups were constituted that met on various occasions to develop options and the service level specification. The organisations involved in these are shown below:

- Arriva Trains Wales
- Freightliner
- Northern Rail
- First TransPennine Express
- Virgin Trains
- CrossCountry
- East Midlands Trains
- DB Schenker
- GMPTE
- Merseytravel.

The details of the groups meetings are at Appendix A.

2.3. Timeframe and linkages to other studies

There are a number of other studies and projects which have an interface with the Manchester Hub study.

- The Manchester Hub study builds on the North West and Yorkshire and Humber Route Utilisation Strategies (RUSs).
- Trans Pennine linespeed improvements being developed by Network Rail to reduce journey times between Leeds, Manchester and Liverpool for delivery by 2014 as detailed in the DfT's 2007 White Paper.
- Work on the future timetables for the West Coast Main Line has continued in parallel with this study. The emerging outputs especially at Stafford have formed the basis for the timetabling of traffic from the south in the Hub study.
- The New Lines report published by Network Rail and the HS2 study has guided the understanding of potential high speed options that the Manchester Hub Study needs to take into account.
- The Network RUS Electrification has been published during the Hub study. To avoid duplication, the Hub study has avoided interventions that involve electrification. However the synergies will be identified in future development phases.
- The Northern RUS is one of the second generation of RUSs, due to be published for consultation in 2010. This RUS will address issues that impact upon a wider area across the North. The outputs of the Hub study will form a part of this RUS.

- The submissions to the DfT for Control Period 5 (2014 – 2019) and beyond are expected to be in 2011/12, with the Initial Strategic Business Plan submission due in Summer 2011.
- A series of Delivering a Sustainable Transport System (DaSTS) studies are taking place across the study area which include; Trans Pennine, Access to Manchester, Access to Leeds and North West Connectivity.
- In addition, three franchises operating in the Hub area are due for specification and reletting in the near future: Virgin (2012), First TransPennine Express (2012) and Northern Rail (2013). The outputs of the study can influence the DfT's work in determining the specification of the future services to be operated in the Hub area.

2.4. Geography

The geographical scope of the study area has been limited to make sure that the focus is on studying the flows across the key railway constraints. The geographical area included in the study is bounded by but does not include:

- Stoke-on-Trent
- Crewe
- Chester
- Liverpool Lime Street
- Wigan
- Preston
- Blackburn
- Leeds
- Sheffield.

Where appropriate, issues at the periphery will be dealt with by the Northern RUS. Benefits from the interventions will accrue to the wider area of the North.

Figure 2.1 shows the geographic extent of passenger and freight services coming from or going to the Hub study area where the benefits of enhancements across the Manchester Hub will accrue.

Figure 2.1 Train services and Manchester Hub

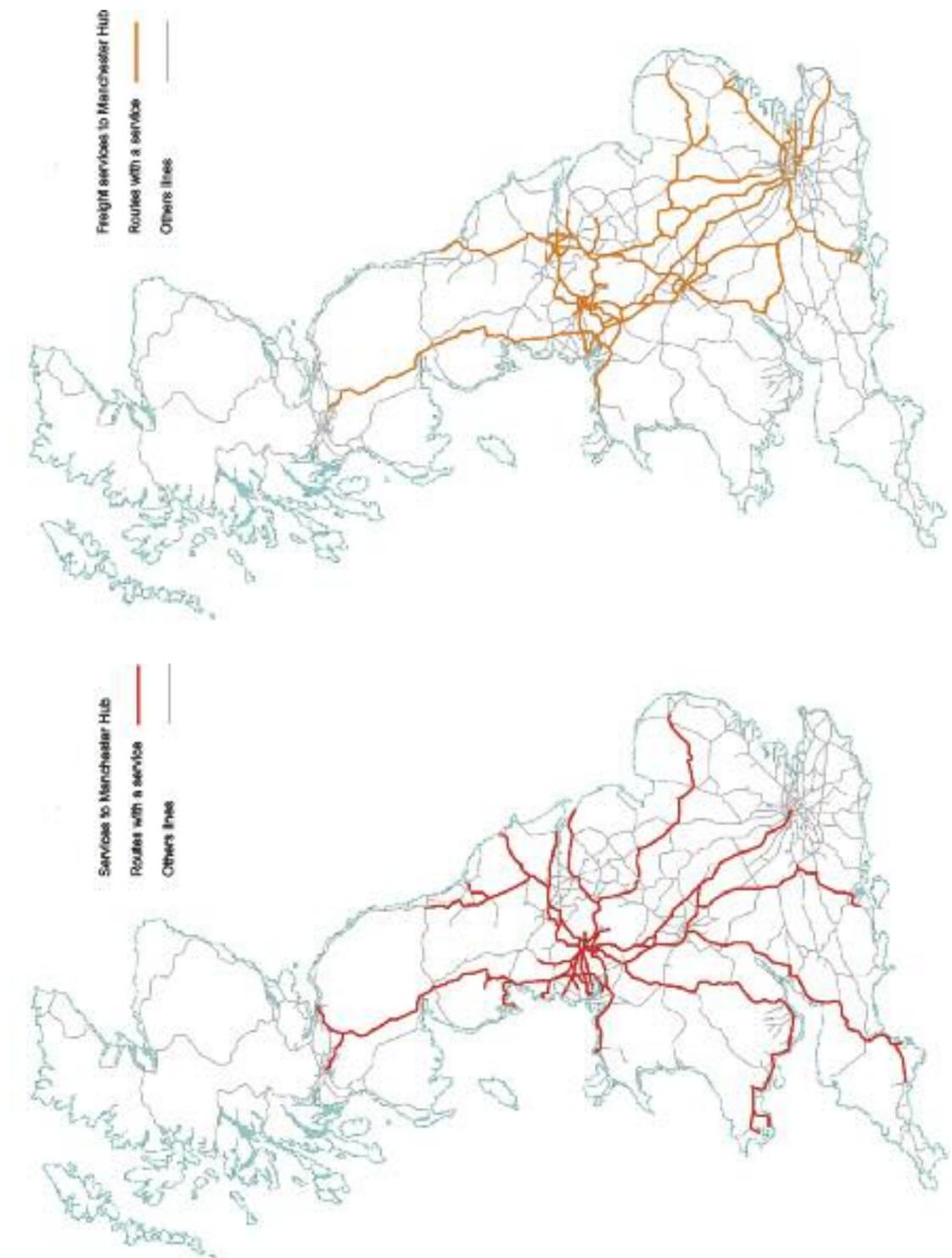


Figure 2.2 Shows the area of the study for infrastructure intervention: in-scope shown in red and out of scope shown in blue

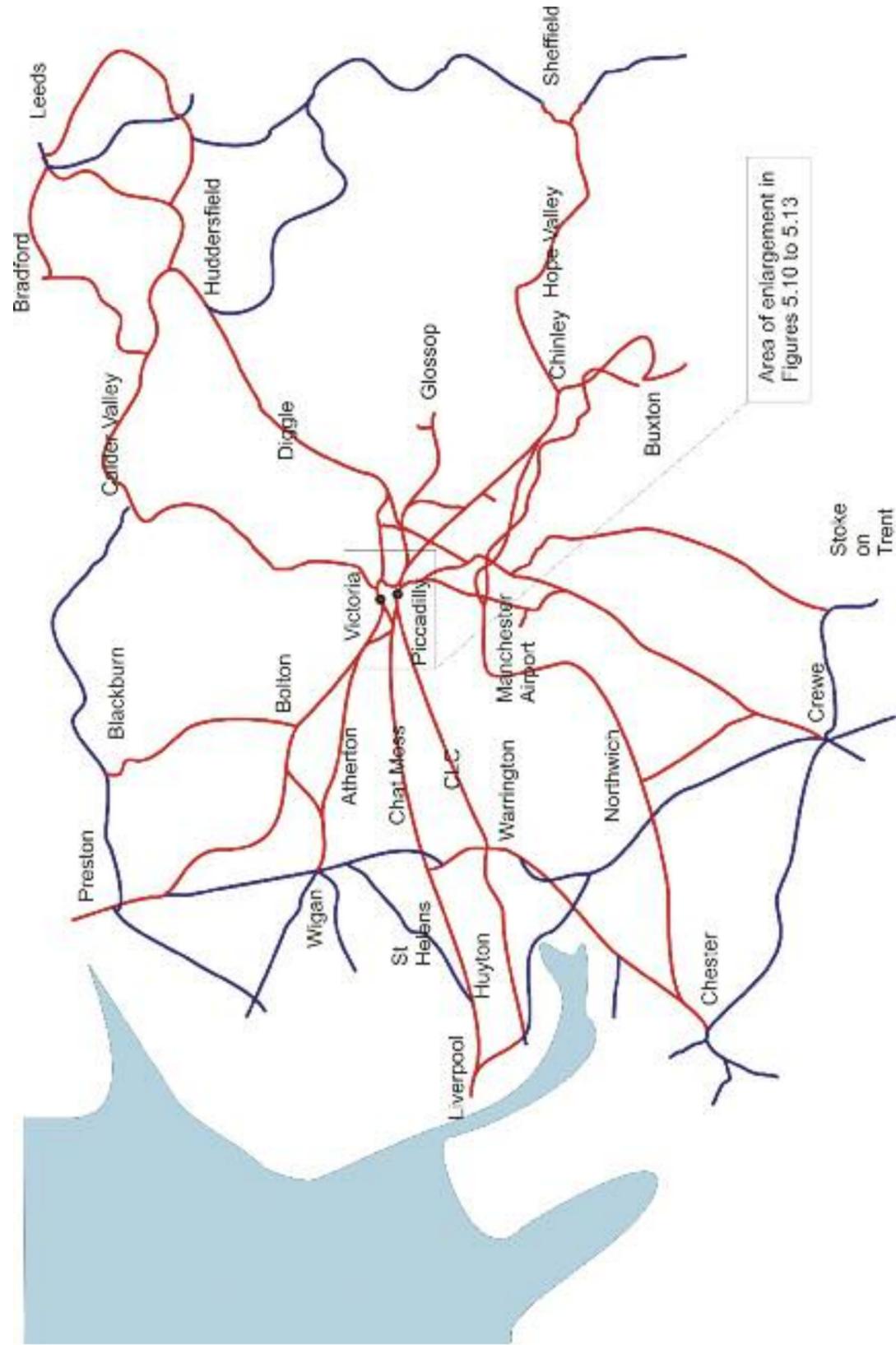
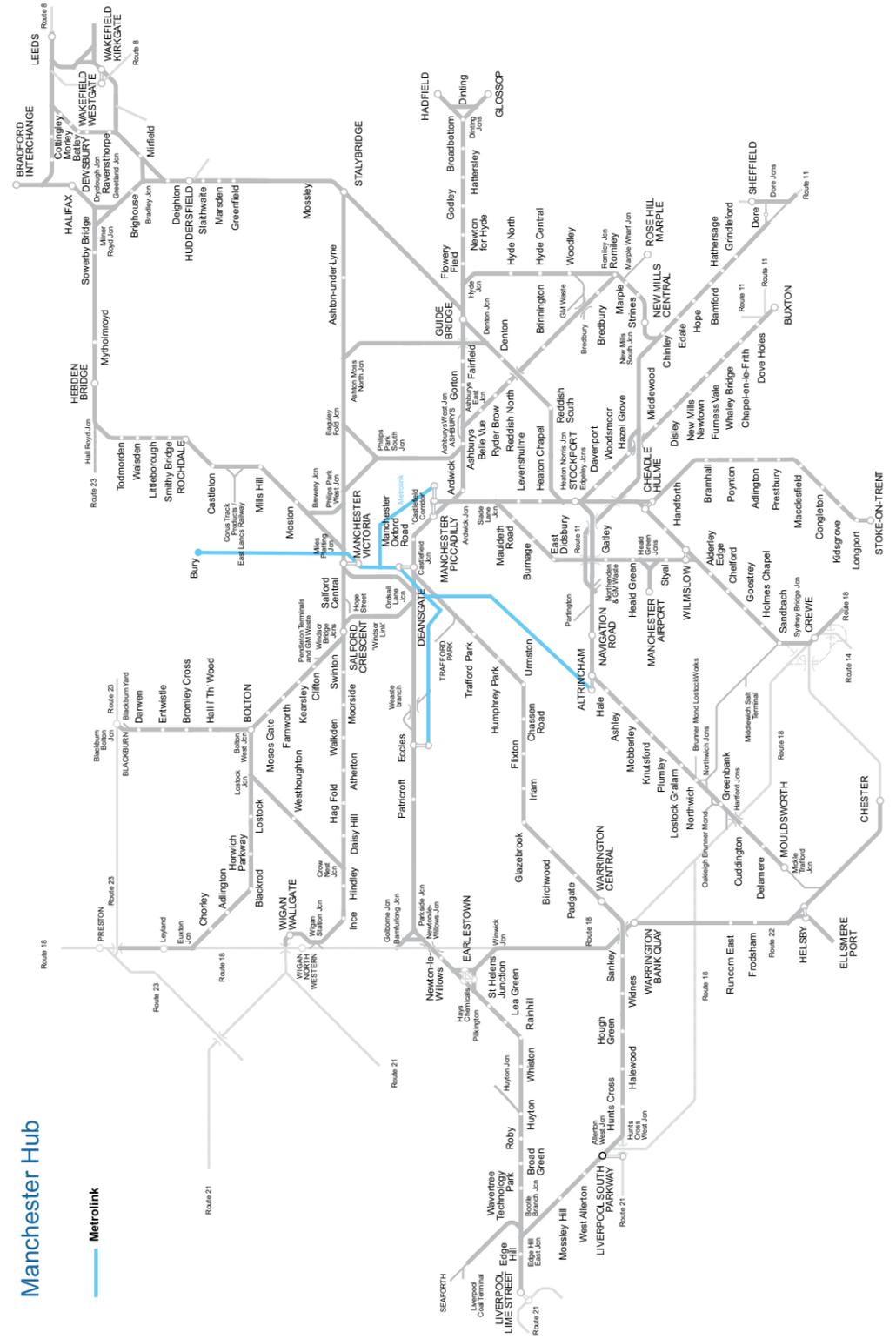
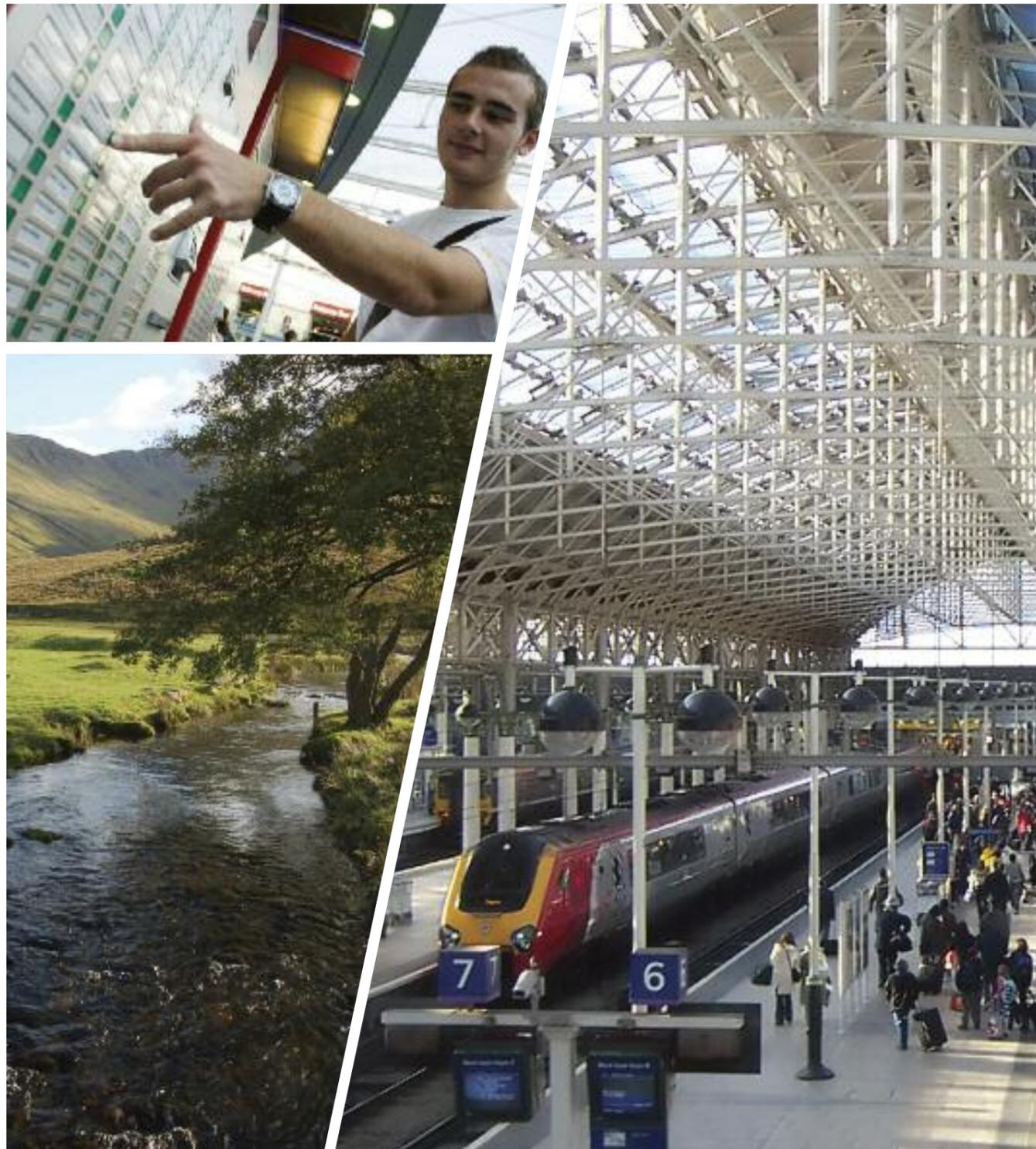


Figure 2.3 Schematic of the study area



Chapter 3

Baseline capacity



3.1 Baseline

The delivery of the Manchester Hub is not envisaged before the start of Control Period 5. The baseline service structure and infrastructure for the study has therefore been taken to be 2014. As a result the baseline for the capability of the rail network includes all the commitments in Control Period 4.

3.2 Train operators

Whilst the baseline is 2014, the passenger train operators and their franchise specifications as at 2014 are not yet known. Similarly the operation of any current or future open access operators is not known. Consequently it has been assumed that the current operators and services continue, except where there are known changes. At present, seven franchised passenger train operators and six freight train operators run services over the lines covered by the study area.

These are:

3.2.1 Northern Rail

Northern Rail operates the majority of the services and stations in this area, and is the only operator to run services on all Manchester corridors. Northern is the operator of all but one of the local services in the Hub area. The Northern franchise runs to 2013, with final two years subject to performance targets being achieved.

3.2.2 First TransPennine Express

First TransPennine Express (TPE) operates interurban services with limited stops, notably across the Pennines towards Leeds and Sheffield and beyond, and northwards to Preston and beyond. The key hubs for TPE in the study area are Manchester Airport and Manchester Piccadilly. The current franchise was awarded in February 2004 and runs until 2012.

3.2.3 Arriva Trains Wales

Arriva Trains Wales (ATW) operates services from Wales into Manchester Piccadilly via both Stockport and Warrington. Despite its inter-regional nature, the service from North Wales is in effect the 'local' service from Chester via Warrington Bank Quay. The franchise is due to run until 2018.

3.2.4 East Midlands Trains

East Midlands Trains operates services in the study area from Liverpool Lime Street towards Sheffield and beyond via Manchester Piccadilly and the Hope Valley. The franchise was awarded in 2007 and is due to expire in 2015.

3.2.5 CrossCountry

CrossCountry operates services in the study area from the south and south west of England, through the West Midlands to Manchester Piccadilly. The franchise was awarded for a nine-year period from 2007.

3.2.6 Virgin Trains

Virgin Trains operates services from London Euston to Manchester Piccadilly, Liverpool Lime Street, and Preston and beyond in the study area. The franchise was awarded for a 15-year period from 1997 to 2012.

3.2.7 Merseyrail Electrics

Merseyrail operates services on the electrified Merseyrail system focused on Liverpool. These interface with the study area at Hunts Cross. The concession is due to expire in July 2028.

3.2.8 DB Schenker

DB Schenker runs services for a wide range of freight markets. Of particular interest to the study are the bulk flows out of Liverpool docks, intermodal containers to and from Trafford Park and aggregates from the Peak District.

3.2.9 Freightliner

Freightliner has two divisions:

- Freightliner Limited hauls container traffic, predominantly in the deep sea market. It operates services out of Garston, Ditton and Trafford Park termini
- Freightliner Heavy Haul is a significant conveyor of bulk goods, predominantly coal, construction materials and petroleum, and also operates infrastructure services. It operates out of the Peak District, and also carries the Manchester waste traffic.

3.2.10 First GB Railfreight

First GB Railfreight operates services to Fiddlers Ferry from Liverpool Bulk Terminal and Ellesmere Port.

3.2.11 Fastline Freight

Fastline Freight operates services out of Liverpool Bulk Terminal.

3.2.12 Other freight operators

Direct Rail Services and Colas Rail both operate on the West Coast Main Line and occasionally in the study area. Serco and West Coast Railway both have access contracts allowing them to operate on the study area.

3.3 Current pattern of services

Broadly, there is a standard hourly pattern of passenger train services, with an hourly pattern of freight paths, not all of which are used. The impact of the peak varies by location/corridor. Some see the same level of service but with longer trains, some see the off peak level of service, with an overlay of additional services, and some see a completely different pattern of services.

Figure 3.1 is a schematic that indicates the level of service seen in a standard hour on the study area.

3.4 Rail network in the study area

The principal physical characteristics that impact on the study and have been considered are:

- planning headways
- loops / four tracking
- linespeeds
- junction turnout speeds
- electrification
- Metrolink.

3.4.1 Planning headways

The headway is a measure of how closely (in time) one train can follow another. Within the study area, headways vary from two minutes along the Castlefield corridor to six minutes at Milner Royd Junction, and even more on some single line sections. Most notable of the single lines are parts of the busy section between Bolton and Blackburn, and between Stockport and Chester. In both instances the presence of multiple single line sections on the same route makes timing services more difficult than would otherwise be the case. Single lines restrict the number of services that can run and are generally a performance risk. There are a number of lines where the headways vary along the route. In some cases, this suits the service pattern and train type, however, it can limit capacity reducing the ability to alter the timetable, recover from perturbation, or use the route for diversions. This is the case on the Atherton line, and along the Calder Valley.

Figure 3.2 shows that there is very little two minute headway, but a good portion of three and four minute headways. However, there are significant portions of the area that either have absolute block signalling or have headways longer than four minutes.

3.4.2 Loops and four-tracking

Capacity is determined not just by headways but also by the ability for trains to pass each other, particularly fast trains to overtake slow ones. Figure 3.3 shows that in the study area there are relatively few opportunities for one train to pass another; there is little four track railway, and few loops. Where there are loops, they are in many instances not readily useable in both directions.

3.4.3 Line speeds

The prevailing linespeed in most route sections is between 50mph and 75mph, although there are significant portions that are only 50mph or less. All of the passenger rolling stock currently used in the study area, however, is capable of at least 75mph, with the electric units and the interurban diesel units capable of 90mph and above. Very little of the study area is capable of more than 75mph for all passenger services. Whilst a good portion of the Hope Valley is faster for Sprinter units¹, class 185 units which constitute half of the fast passenger services are not able to make use of that higher speed. There are a number of routes along which the linespeed varies. This can be inefficient in terms of capacity and journey time, depending on unit types and stopping patterns. In some cases the speed profile has been tailored to a historic stopping pattern, and consequently perpetuates this historic stopping pattern. This is especially true for the interurban services, which do not stop as regularly as local services, and consequently – all other things permitting (such as clearances and track alignment) would be capable of reaching speeds much higher than the current maximum.

There is a Control Period 4 (CP4) scheme to improve speeds between Liverpool and Manchester via Chat Moss and between Manchester and Leeds. Reductions in journey times between these cities are a move towards the Department for Transport's (DfT's) White Paper target journey time of 30 minutes between Liverpool Lime Street and Manchester Oxford Road via Chat Moss and 43 minutes between Manchester and Leeds. The details of the outputs of that work have not been determined at the stage of this report going to press and are expected in summer 2010.

3.4.4 Junction turnout speeds

As well as being affected by the speed of plain line, journey time is also affected by the need to slow down at junctions. The majority of the junction turnout speeds are 35mph and below. Deceleration from linespeed and subsequent acceleration back to linespeed after crossing a junction costs time and capacity. The slower the turnout speed, the greater the impact. In some cases, the requirement for approach control on the signalling impacts journey time and decreases capacity further.

¹A category of passenger diesel multiple unit.

Figure 3.1

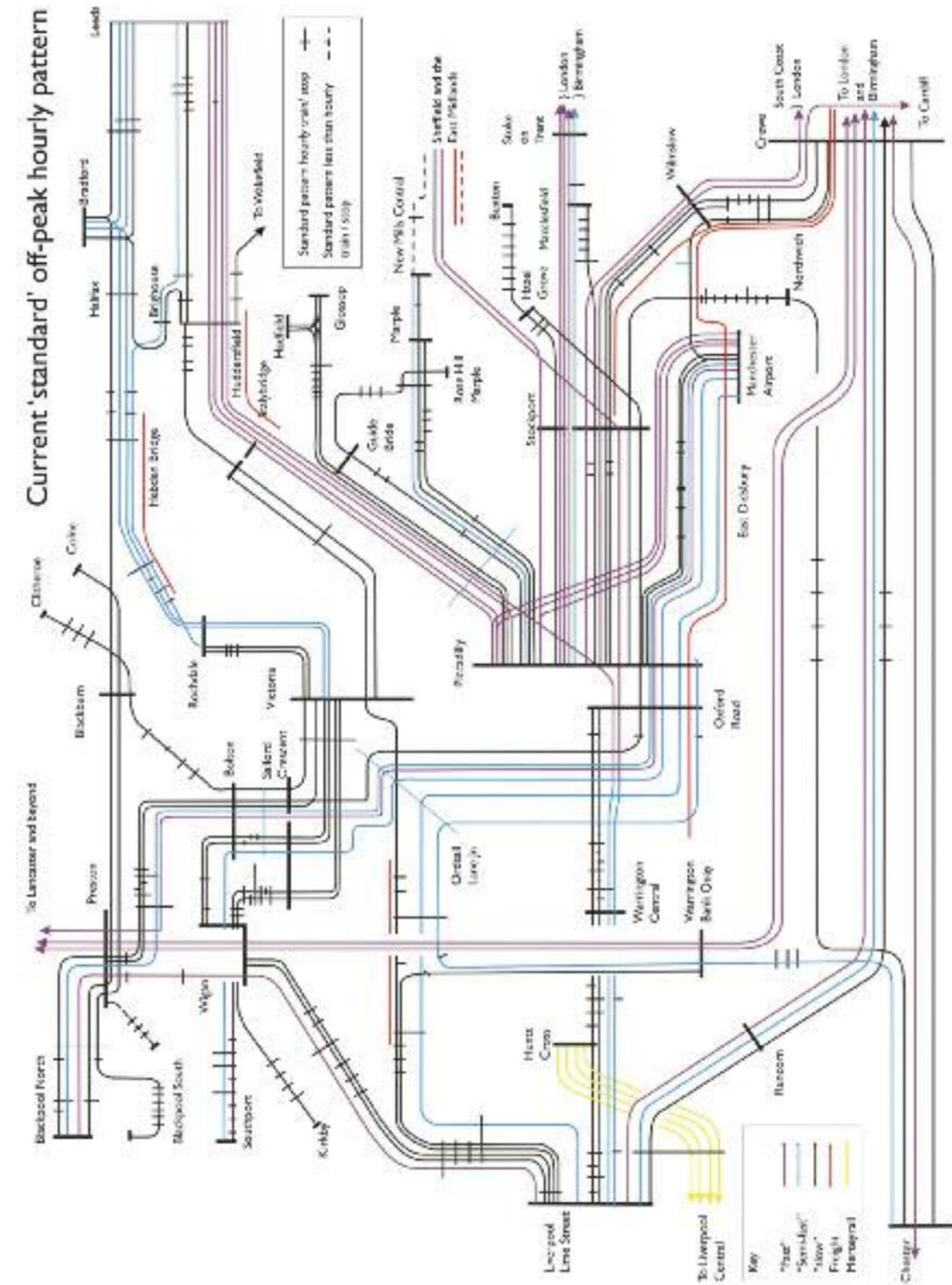


Figure 3.2 Headways in the study area

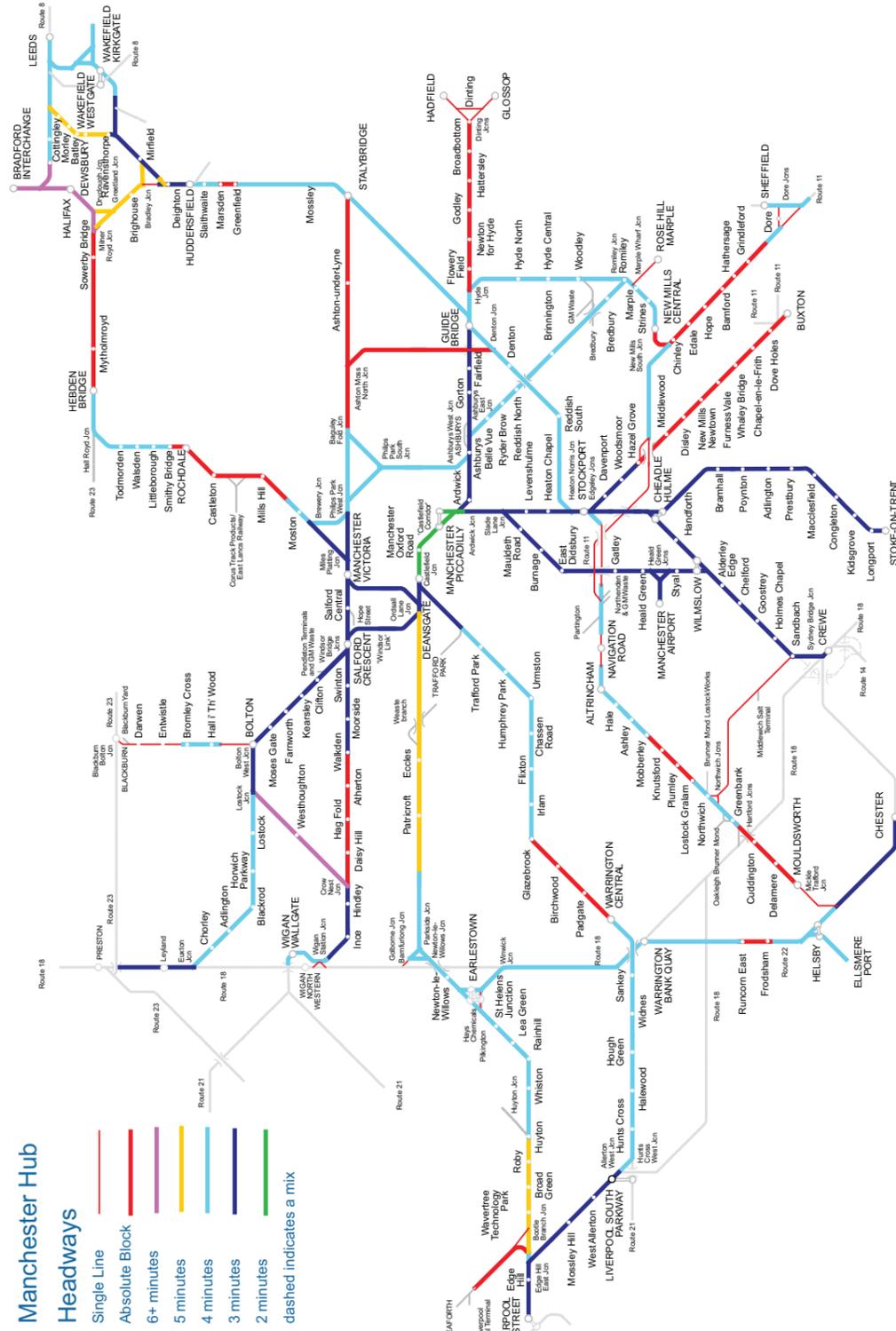


Figure 3.3 Loops and four-tracking

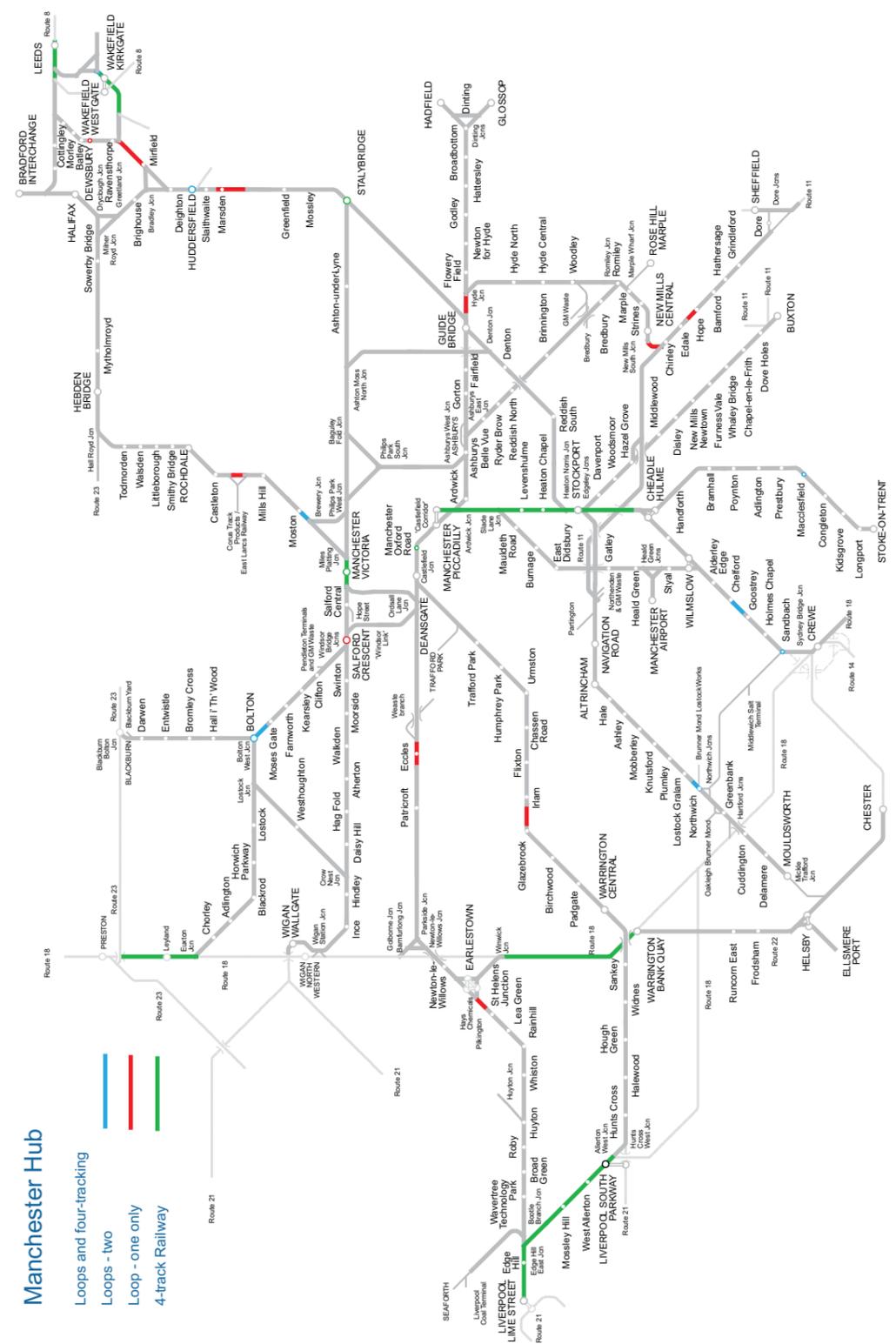


Figure 3.4 Linespeeds

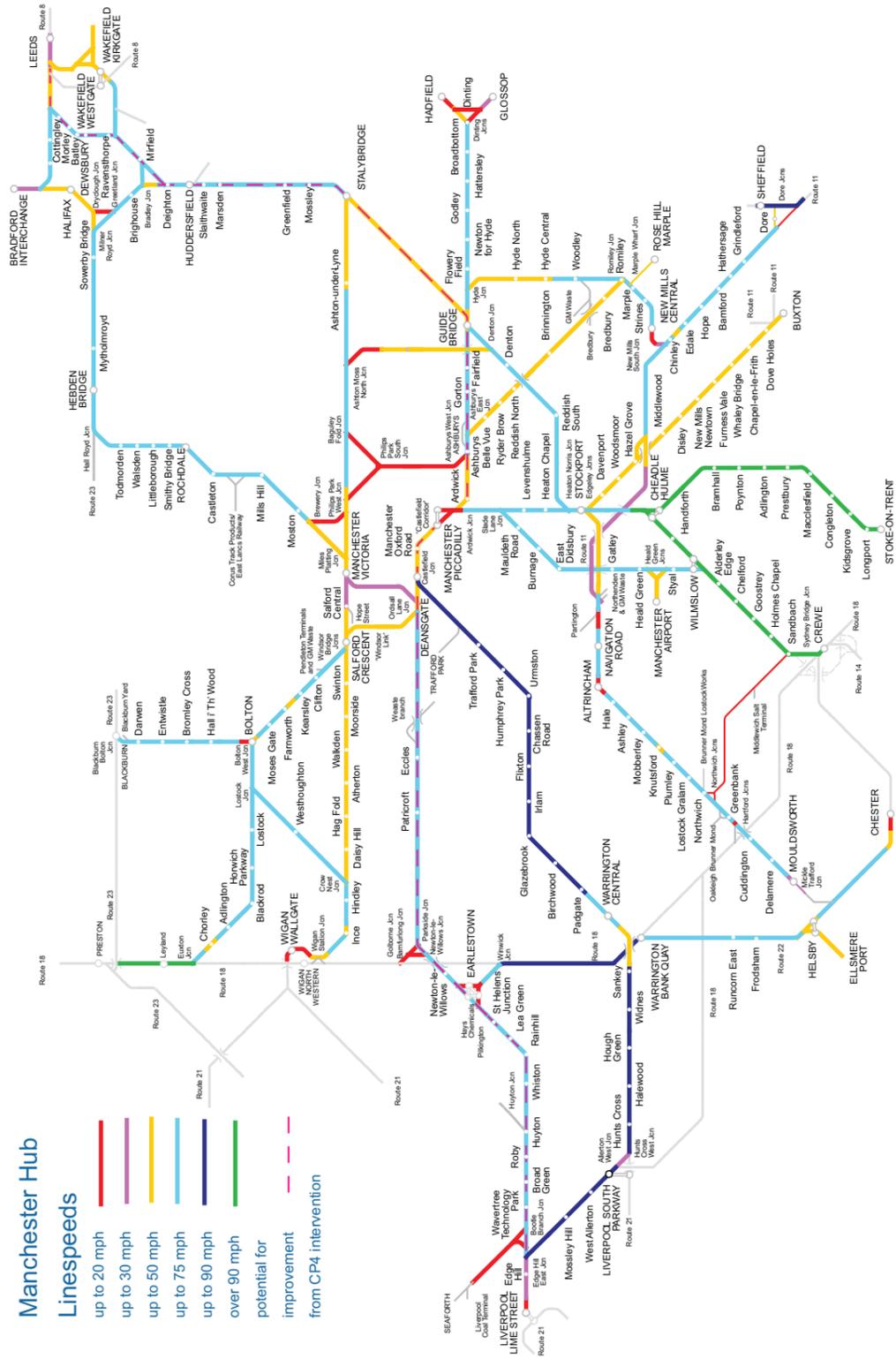
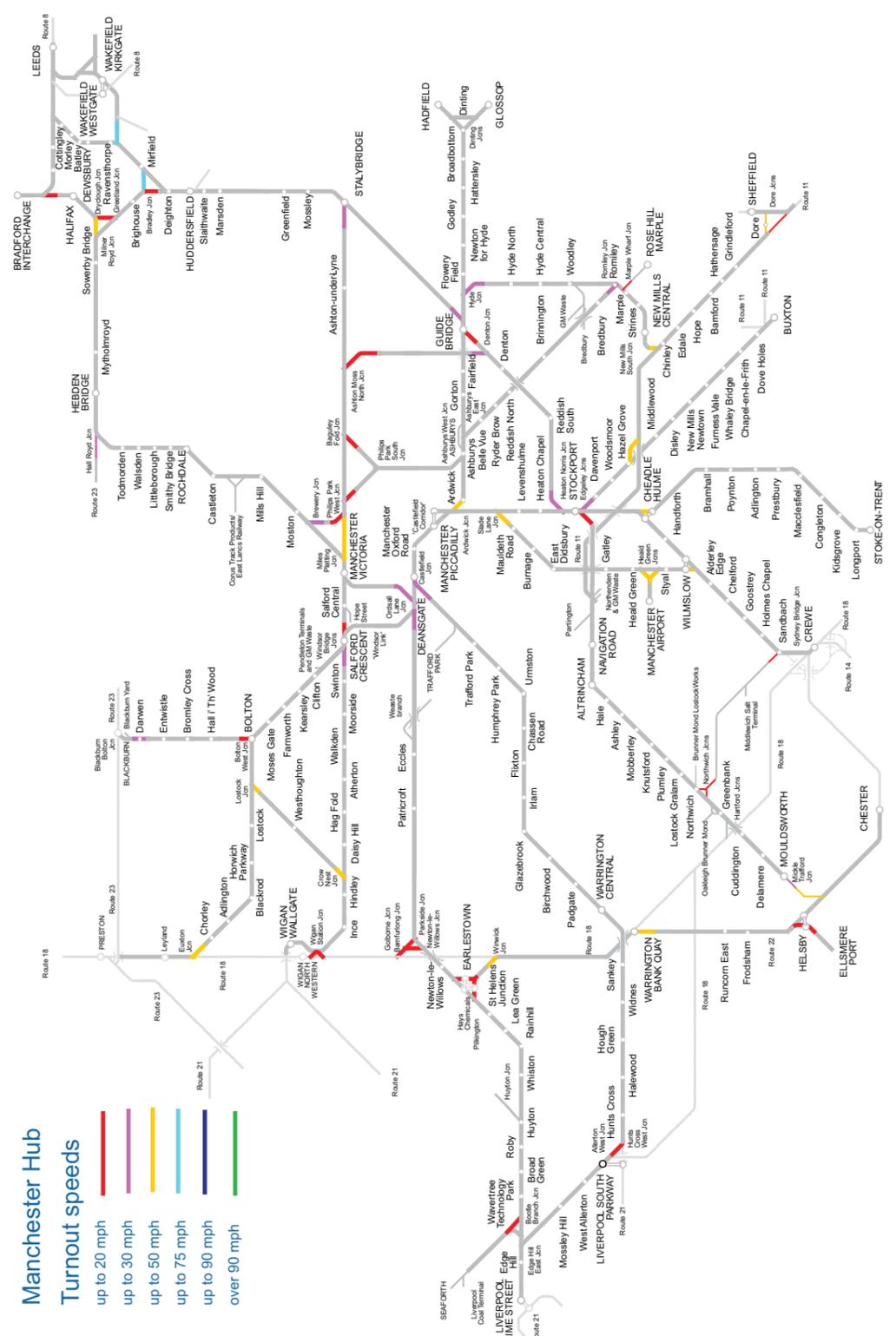


Figure 3.5 Turnout speeds



3.4.5 Electrification

There is limited electrification within the study area. Through the middle of the area runs the electrified West Coast Main Line, with electrified branches connecting Liverpool and Manchester with the West Midlands and London. None of these three routes – the main line and the two branches – currently has a fully electrified diversionary route. Electrified services also run on local routes from Manchester southwards along the Styal line and to Stoke-on-Trent and Crewe, as well as to Hadfield/Glossop in the east. This means that there are few economies of scale for the electric train fleet. In July 2009 the DfT announced that the Chat Moss route, Liverpool to Manchester via Newton-le-Willows, will be electrified by 2014. At the conclusion of the study in December 2009 the DfT announced the further electrification of the routes from Huyton to Wigan and Manchester to Blackpool via Preston.

3.4.6 Metrolink

As well as the existing Metrolink network, there is the authorised and funded expansion phase 3a, and in addition the Greater Manchester Transport Fund programme to carry out part of phase 3b. This sees the following additions to the network open for traffic in 2013:

- an increase in the number of vehicles to allow more 4-car operation
- the former heavy rail Oldham Loop brought onto the Metrolink network with extension into Oldham and Rochdale town centres
- a line extended from the terminal Metrolink platforms at Manchester Piccadilly on to Droylsden and Ashton-under-Lyne
- a new branch off the Altrincham line between Trafford Bar and Old Trafford extending through Chorlton-cum-Hardy to East Didsbury
- a spur off the Eccles line between Harbour City and Broadway to Media City.

In addition but not delivered before 2014 are the extension to Manchester Airport and increased capacity through the city centre.

3.5 Analysis of baseline infrastructure capacity

3.5.1 Theory of constraints

Theory of Constraints (ToC) is a methodology for understanding capacity by considering the system and inter-relationships between individual constraints. The methodology has two stages.

1. Review capacity use at individual constraint;
2. Reviews a line of route to identify the inter-relationships between capacity use at individual constraints and the resultant 'spare' capacity along a line of route for a sample hour.

The presence of 'spare' capacity does not necessarily indicate capacity exists for additional services but that it may be possible to create it.

Within the Manchester Hub study area there is a complex pattern of capacity use involving multiple centres (e.g. Manchester Piccadilly, Manchester Victoria and Manchester Airport), numerous radial routes, a mix of services of different types and a large number of capacity constraints. Generally, constraints close to Manchester are characterised by high volumes of traffic and on radial routes by high headways but with a lower volume of mixed traffic.

Overall capacity use is high at many of the individual constraints even in off-peak periods reflecting infrastructure layout and the requirements of the various services. Both Manchester Victoria and Manchester Piccadilly are used in a 'non-optimal' way by some services. At Manchester Victoria for example, a substantial proportion of the capacity of its 'through' platforms is used by terminating services. At Manchester Piccadilly, services between the North East and Manchester Airport use the 'terminal' platforms in order to reverse direction.

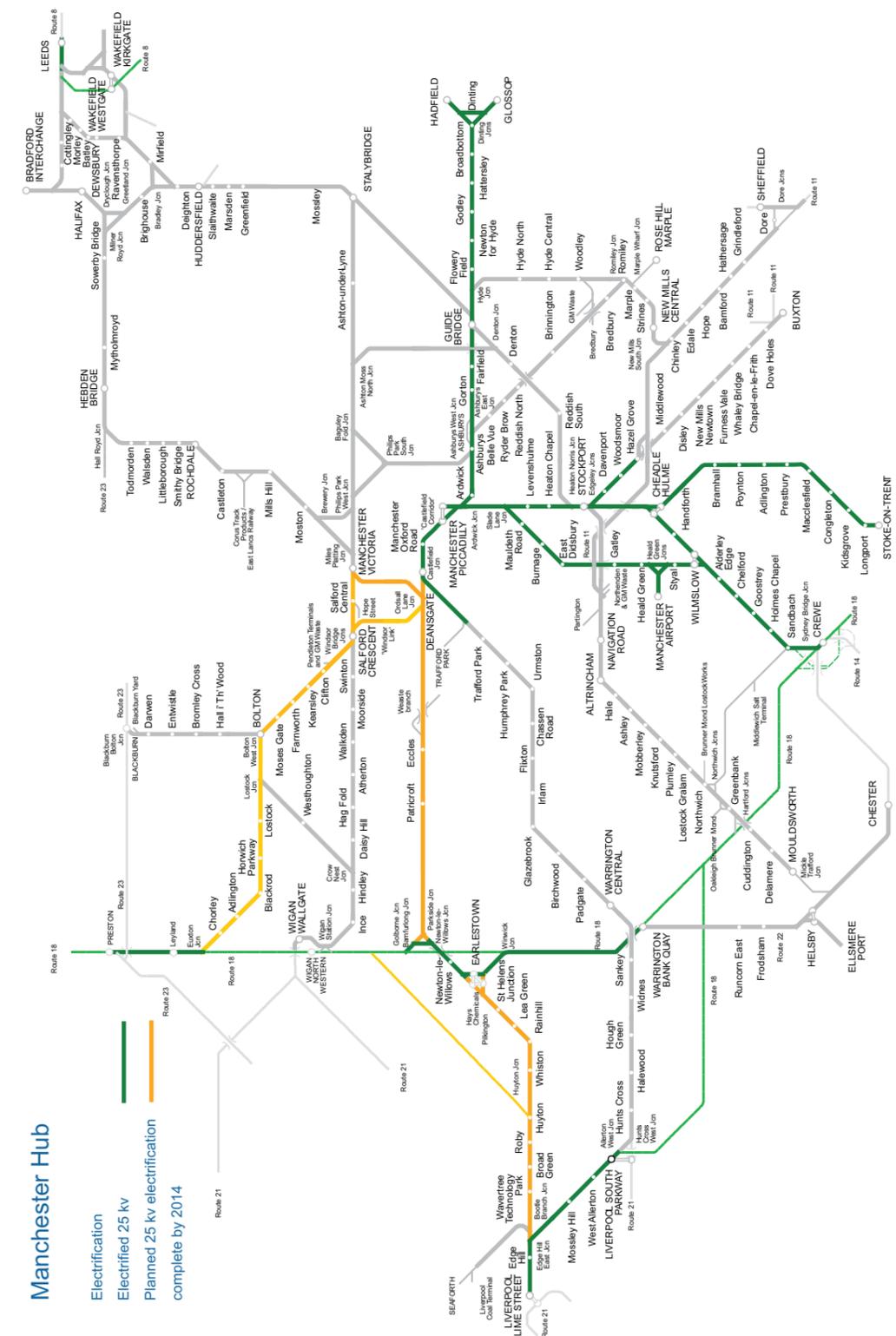
The pattern of traffic and the layout of infrastructure results in a large number of conflicting moves through out the study area. A substantial amount of capacity is saved through timetabling parallel moves, which has wider implications for capacity as the timings of services in opposite directions become linked. However, even with parallel moves many locations are highly congested.

Many routes are affected by more than one constraint and these are often of different types. Nearer to Manchester each constraint has an impact on a number of different flows, which means that their impact on overall capacity use is widespread. The close proximity of some constraints to each other also has a significant impact on route capacity. The combination of the complex pattern of capacity use and the existence of a number of significant constraints produces a very high capacity use on many of the routes in the study area.

Figure 3.8 shows the overall level of used capacity on the key lines of route into Manchester in the morning high-peak (08:00-09:00). Whilst some individual lines of route have less than 100 percent utilisation this is in practice unusable for additional services.

The analysis concludes that the inter-relationship of constraints is such that there is no single intervention that will unlock the Manchester Hub. The enhancement of services will require a strategy of interventions across the core area and radial routes.

Figure 3.6 Electrification



Manchester Hub

Electrification
 Electrified 25 kv
 Planned 25 kv electrification
 Planned 25 kv electrification complete by 2014

Figure 3.7 The scope of Metrolink operation

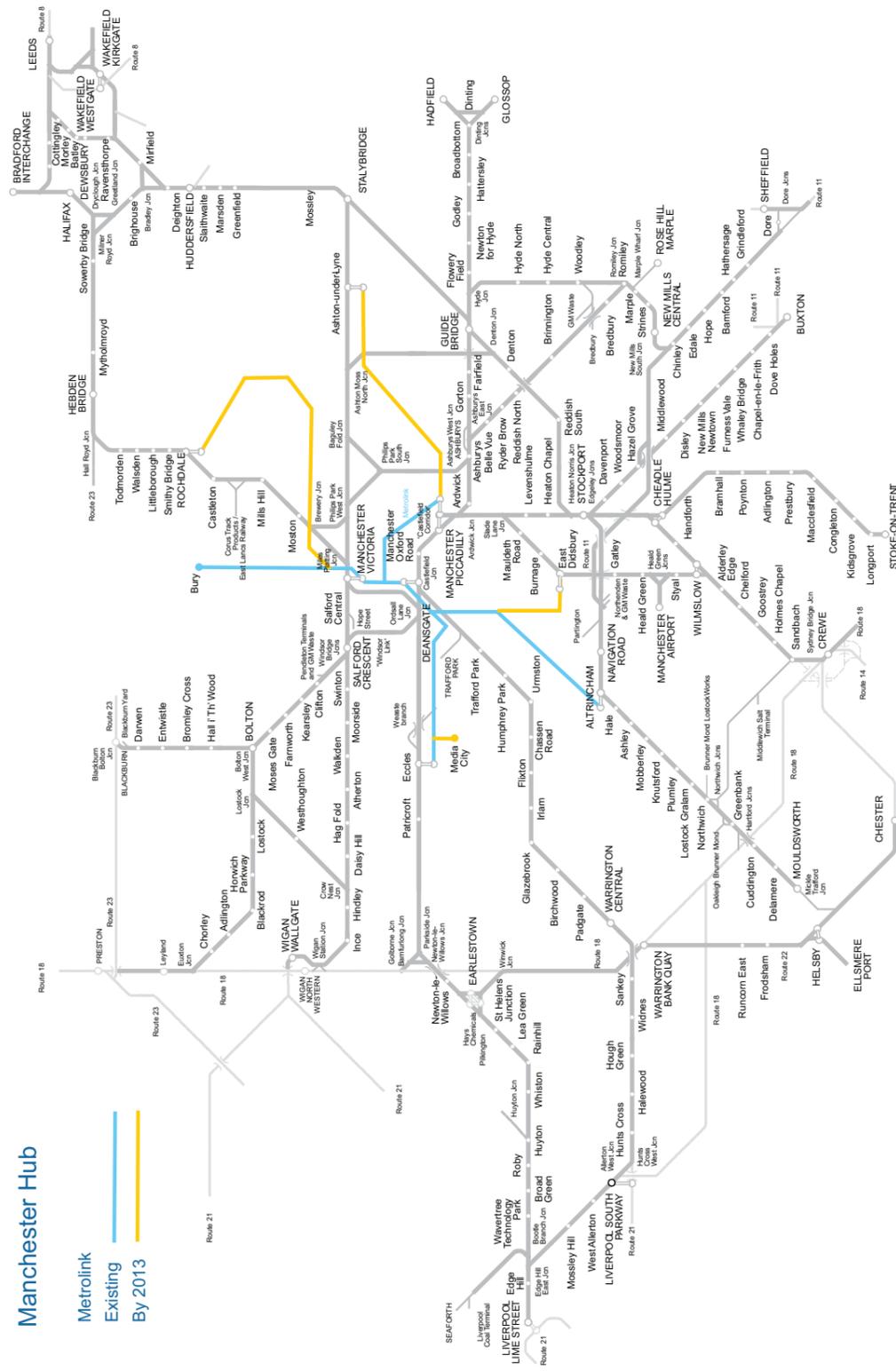
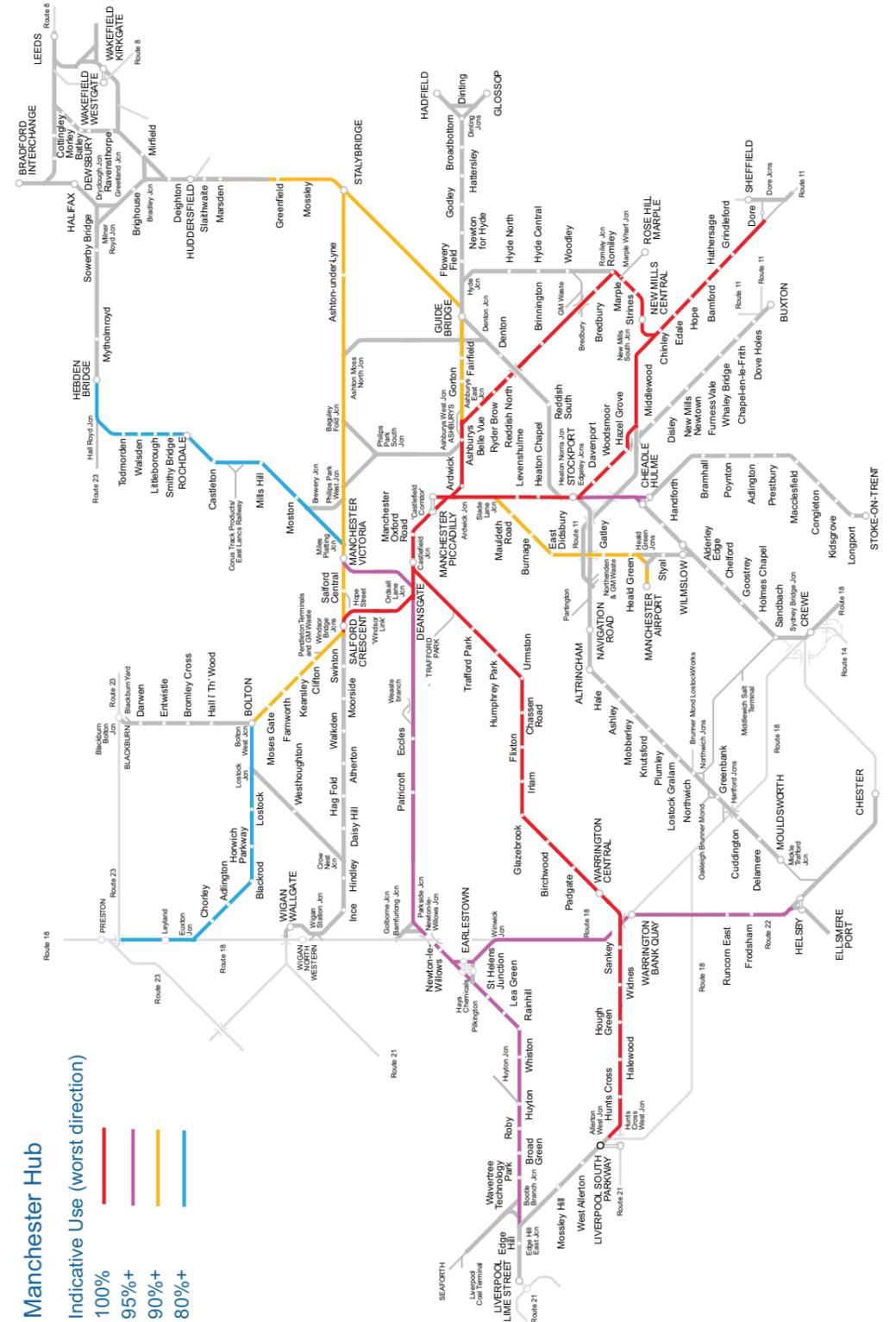


Figure 3.8 Theory of Constraints; Theoretical use of capacity 08:00 – 09:00 hours



3.5.2 Manchester Piccadilly terminal platforms

The Theory of Constraints (ThoC) work identified that on average platforms 1 - 12 are 69 percent used, only taking into account whether or not a platform is occupied. This average is depressed by the low use of platforms 10 -12 due to the single lead access. Platforms 1 - 9 have over 80 percent as an all day average. In addition, there is a significant use of platforms by more than one train at a time, especially at peak times.

The use of platforms 4 - 8 is dominated by long distance services occupying platforms for around half an hour. The use of platforms 1 - 3 is dominated by local services and trains to and from Manchester Airport all with relatively short layovers. Platforms 4 - 8 are used on average by two trains an hour, platforms 1 - 3 by almost four trains an hour.

The analysis of platforms 1 - 4 indicates that as trains are lengthened and current vehicles are replaced with 23 metre length vehicles the multiple use by two or more services becomes problematic. Coupled with the need to maintain capacity at levels consistent with a resilient timetable, for which the ThoC study suggests the current 80 percent on conventional signalling should not be exceeded. The analysis of train lengthening suggests that significant extra services will require additional platform capacity.

3.5.3 Castlefield Corridor

The Castlefield Corridor between Castlefield Jn and Piccadilly East Jn is the key route for services crossing Manchester.

The maximum capacity of the corridor is derived from the through platforms at Manchester Piccadilly where there is two minutes reoccupation and two minutes dwell. In practice, Manchester Oxford Road platforms are used in the same way as Manchester Piccadilly's, partly because there is no need to do otherwise and partly because the existing layout restricts the use of parallel moves there. This fact limits trains to being four minutes apart between Manchester Piccadilly and Castlefield Jn.

3.5.4 Manchester Airport

In a manner similar to Manchester Piccadilly, the signalling at Manchester Airport station allows two trains to be put into the same platform, a facility which is used frequently. The signalling controls at Manchester Airport station that allow multiple trains into the platforms prevent this happening for six-car operation. Thus as train lengthening takes place through Control Period 5 (CP5) and additional services require to access Manchester Airport it will become increasingly difficult to operate the station with the existing three platforms.

3.6 Planned work

The opportunity for enhancing the railway is greatly improved if there is synergy with planned renewals works. Where there is no renewal on the horizon, then the enhancement scheme would have to pay for and justify the full cost of the alteration. The most significant discipline for this is signalling, where a major proportion of the overall cost is in design and testing, and the increment on that from individual items will be relatively small. Unfortunately, for the majority of the area of the study, there are few renewals for the foreseeable future that could be a catalyst for efficiency.

3.6.1 Committed infrastructure schemes

The following schemes are committed and have been assumed to have been implemented ahead of any work as a result of this study. As such they have been taken to form a part of the baseline:

- Liverpool – Manchester (via Chat Moss) electrification (from Edge Hill to Victoria and Castlefield Junction)
- Stalybridge remodelling
- Metrolink extensions to Rochdale, Ashton-under-Lyne and East Didsbury
- extension of London to Manchester services to 11 vehicles (signalling/platform works)
- W10 freight gauge clearance on the Chat Moss route
- Greater Manchester and Yorkshire High Level Output Specification (HLOS) interventions:
 - platform lengthening necessary for Control Period 4 (CP4)
 - additional Northern stabling
 - Salford Crescent improvements
 - linespeed improvements (Liverpool – Manchester - Leeds).

In future development work on the Manchester Hub the recently announced electrification between Manchester and Blackpool via Preston and Huyton to Wigan will be included although not due for completion by 2014.

3.6.2 Expected renewals

The following renewals items, shown in Figure 3.9, are expected within the time horizon of any implementation of the Hub study, and hence offer opportunities for value for money enhancements as an incremental cost:

3.6.2.1 CP5 signalling and switch and crossing renewals

- Allerton Jn
- Earlestown Jns
- Bamfurlong Jn
- Ashburys West Jn
- Woodley Jn
- Helsby Jn
- Dore Jn.

3.6.2.2 Control Period 6 (CP6) signalling renewals

- Todmorden
- Smithy Bridge
- Vitriol Works
- Ashton Moss North Jn
- Dore
- Milner Royd
- Norton
- Frodsham
- Mickle Trafford
- Ashburys.

3.6.2.3 Control Period 7 (CP7) signalling renewals

- Astley
- Baguley Fold
- Diggle Jn
- Guide Bridge
- Romiley Jn
- New Mills Central
- Tooty Tunnel East
- Huddersfield area.

3.6.2.4 Control Period 8 (CP8) signalling renewals

- Edge Hill
- Liverpool Lime Street
- Chester
- Chinley.

3.6.3 Metrolink

Beyond the extensions due for opening in 2013, there are further extensions currently expected to be made at various stages in terms of procurement and commitment. Some are expected to be opened in 2015; others have yet to gain Transport and Works Act Order powers. The options below are expected to have been brought into use by 2016, but there are other options beyond these which are at an earlier stage of development.

- extend from Chorlton-cum-Hardy to Manchester Airport
- create a second route between Cornbrook and Manchester Victoria.

3.6.4 Other aspirations

There are other aspirations for improved services in the study area driving infrastructure interventions, such as reinstating a curve at Todmorden, and extending the passing loop at Darwen to achieve a new service from Burnley to Manchester and more frequent services to Blackburn. Currently there is no commitment to build these or other aspirations and therefore they have not been included in the base infrastructure.

3.7 Baseline growth

3.7.1 Freight

The Freight Route Utilisation Strategy (RUS) identified that the 2004/05 level of traffic to Trafford Park was around 17 to 22 intermodal trains a day, with a prediction that by 2014/15 that would become 29 a day. The RUS also identified that the 2008 timetable allowed for 33 freight paths a day to Trafford Park.

3.7.2 Passenger

The July 2007 White Paper: Delivering a Sustainable Railway identified that Government wished the railway industry to deliver capacity to deal with additional passenger demand equating to an average of three and a half percent per year between 2007/08 and 2013/14. Figure 3.10 identifies the level of passenger traffic in 2007/08 split by corridor, and illustrates the level of passenger traffic in 2013/14 if demand on each of the corridors increases by the average 3.5 percent in the intervening years.

Figure 3.9 Planned and expected S&C and signalling renewals and enhancements

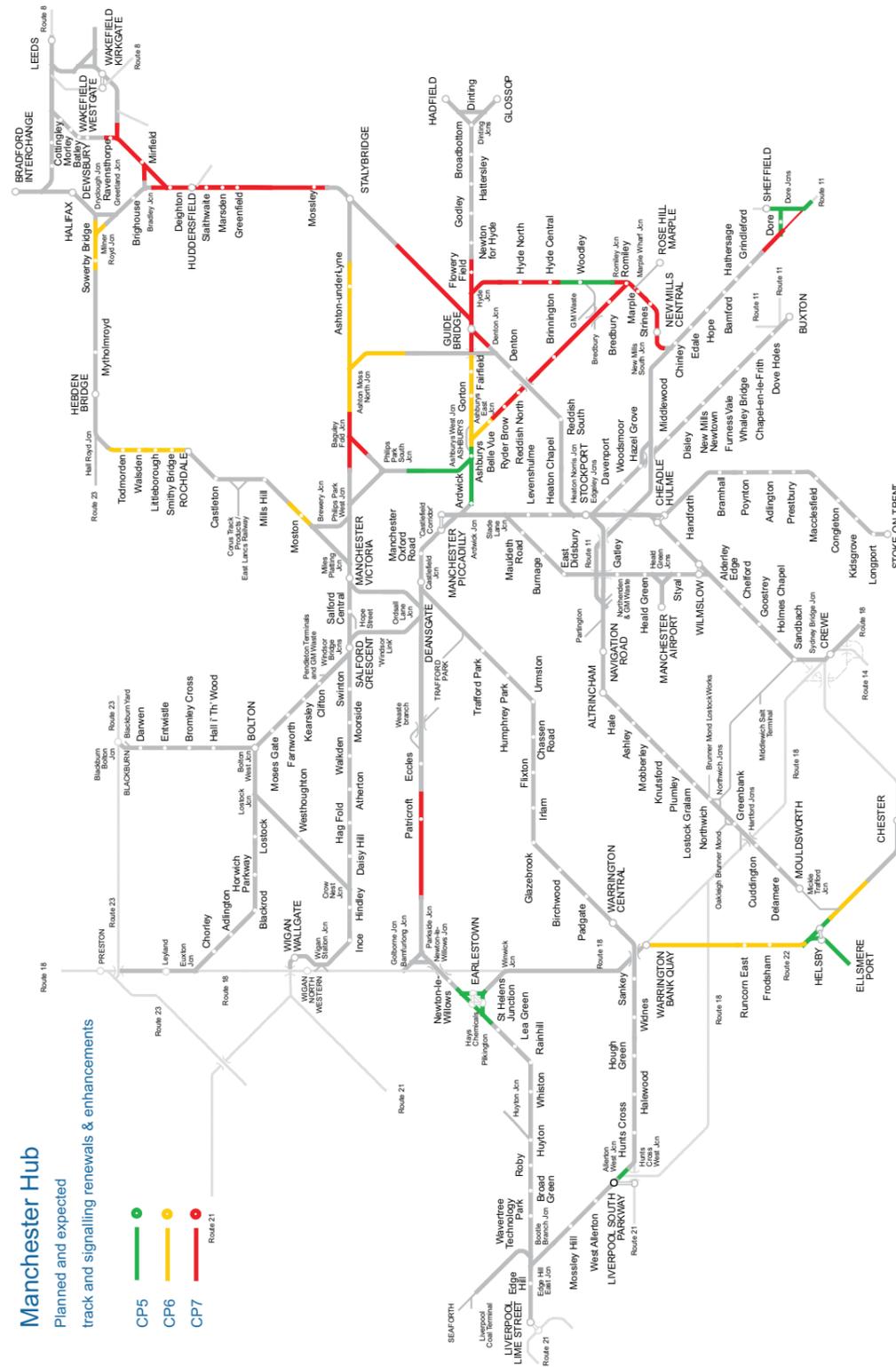


Figure 3.10 Baseline passenger growth

Corridor	Corridor journeys (m) 2007/08	Corridor journeys (m) 2013/14
1 Southport via Wigan	3.5	4.3
2 Preston and the North via Bolton	16	19.7
3 Blackburn	1.8	2.2
4 Bradford via Rochdale	3	3.7
5 Yorkshire and the Humber & the North East via Leeds	17.1	21.0
6 Glossop / Hadfield	1.5	1.8
7 Marple / Romiley	1.3	1.6
8 Yorkshire & the East Midlands via Sheffield	8.6	10.6
9 Buxton	1.9	2.3
10 London, Birmingham and the South (via WCML)	39.1	48.1
11 Manchester Airport	2.3	2.8
12 Chester via Northwich	2.1	2.6
13 Liverpool via Irlam	1.6	2.0
14 Liverpool / Chester via Warrington	5.5	6.8
Total	105.3	129.4

Chapter 4 Drivers for change



4.1 Manchester Hub Phase One study¹

4.1.1 Phase One of the Manchester Hub study was led by the Northern Way. The Phase One report identifies the importance to the North's sustainable economic growth of improvements to rail services across the North. It identifies the potential benefits that addressing the Manchester Hub problem can bring to the whole of the North.

4.1.2 As the Phase One report shows, the evidence base underpinning the economic case for addressing the Manchester Hub problem is strong. In particular, the Phase One report establishes that:

- City region economies drive regional and national growth, which was also recognised by the Manchester Independent Economic Review. The North's city regions perform below the national average and are not meeting their full potential. The Government has set out its vision that each region should perform to its full economic potential.
- To support economic growth there needs to be adequate capacity, so that journeys can be made reliably and with reasonable journey times;
 - within city regions
 - between city regions
 - to access international gateways.
- Enhancing connectivity within the North's city regions, between the North's city regions and to international gateways will accelerate the North's economic growth.
- Enhancing the trans Pennine corridor will support the growth of Manchester and Leeds, the North's two largest city regions as well as Sheffield and will benefit the wider North.
- Manchester's rail network has facilitated the city's sustainable economic growth by supporting the growth of city centre employment. However, on-train crowding and the current scope and reach of the network limits the scope for future growth.
- Linking areas of economic need with locations with stronger economic growth supports the stronger areas by extending labour markets, while at the same time facilitating spill over effects into the weaker areas.

- Manchester Airport delivers substantial economic benefits to the North which will grow as the Airport grows. Surface access capacity is the most significant constraint to the Airport's future growth. Increasing public transport mode share is the preferred way to overcome these constraints.
- The North's ports provide substantial economic benefit to the North which will grow as the throughput grows. Growth in the throughput of intermodal containers combined with increasing congestion on the strategic road network will increase the demand to move containers by rail.
- The North's eight City Region Development Programmes have the specific function of specifying how the key economic drivers (the city regions) can exploit their own strengths to deliver accelerated economic growth. They explicitly recognise the importance of expanding the Manchester labour market through transport enhancements to support commuting, enhancing the transport links between the main centres of each region, and access to Manchester Airport.
- The strategic road network across the Pennines and around Manchester experiences network stress and congestion. Even with committed and planned investment this will worsen over time. The trans Pennine rail links and commuter rail links to Manchester experience crowding. On trans Pennine routes in particular there is limited capacity to cater for additional growth.
- The Northern Way has identified the Manchester Hub as the most significant rail bottleneck in the North and so the most significant rail impediment to maximising economic growth. This is because it constrains the growth of rail commuter services, rail links between the North's city regions and between the North and the South, rail links to Manchester Airport and rail freight.

4.2 Economic scenarios

4.2.1 The Phase One study establishes two economic scenarios of growth in the North. The two scenarios are called 'Trend' and 'Trend Plus':

- The 'Trend' scenario took the Government's economic and planning assumptions and used these to determine the economic growth in the study area

¹Manchester Hub Conditional Output Statement, The Northern Way, April 2009

- The 'Trend Plus' scenario represents the successful achievement of the three northern Regional Economic Strategies, along with all eight City Regions' Development Programmes. The 'Trend Plus' scenario effectively sees the growth in the 'Trend' scenario happen earlier rather than generate some fundamentally different conditions. Consequently solutions that are credible in the 'Trend' scenario are also credible in 'Trend Plus'.

For each scenario, forecasts for Gross Value Added (GVA), population, households, workplace employment, residence based employment, and unemployment have been derived. These with other transport-related variables (rail cost, car ownership, car time, bus cost and bus time) formed the inputs to a rail demand forecasting model. The model is comprised of a number of modules:

- MOIRA:** The standard railway modelling tool MOIRA was used to predict the impact of improved train services.
- Airport Demand Model:** Demand identified as being as a result of growth at Manchester Airport.
- New Flows Model:** Benefit from creating new flows through Manchester.
- Crowding Model:** To identify the benefits from providing less crowded travel.
- Freight Model:** To identify the benefits from growth in container traffic.
- Wider Economic Benefits Model:** To identify the benefits to the wider northern economy from resultant improvements in agglomeration, labour markets and imperfect competition.

The Sponsors' Group agreed that these models would be used in the Phase Two appraisal to understand the potential impacts of rail service improvements. Further details of the two economic scenarios and the modelling approach can be found in the Phase One technical reports which are available on the Northern Way's website.

Figure 4.1 shows the levels of exogenous growth by rail corridor that the economic models suggested would be present.

From Figure 4.1 it can be seen that within the North, commuter and interurban services on the five corridors to Yorkshire and the Humber and North East via Leeds, Preston and the North via Bolton, Yorkshire and the Humber and East Midlands via Sheffield and the two to Liverpool dominate rail demand on services that use the Manchester Hub. The West Coast Main Line (WCML) corridor to the south is the largest of all. In the Trend and Trend Plus scenarios these corridors provide the largest quantity of forecast growth.

In the Trend and Trend Plus scenarios the fastest rate of growth is projected to occur on corridors where

commuting to Manchester is the dominant flow. The corridors to Marple/Romiley, Buxton and Manchester Airport corridors have the highest rates of growth in the Trend scenario. In the Trend Plus scenario, the corridors to Bradford via Rochdale, Marple/Romiley and Buxton have the highest growth rates. Greater Manchester Passenger Transport Executive (GMPTE) evidence suggests the most significant growth in commuting into Manchester has been on routes including Bolton, Rochdale and Stalybridge².

Recent rail forecasting work carried out by the Department for Transport (DfT) with Northern Passenger Transport Executives (PTEs) has shown that previous forecasts tended to underestimate growth on commuter routes. This work, whilst not yet complete, appears to support levels of growth in excess of the "Trend" scenario.

GMPTE has carried out additional work to assess the Gross Value Added to the Northern economy by facilitating such connections as those contained in the Hub work. This work identifies that there are significant positive impacts beyond those identified by the Northern Way. This work specifically considers the impact that improved rail connections have on influencing economic decisions including; locations of businesses, changes in the sectoral mix, where people choose to live and work, and the impacts these changes have on business productivities levels. GMPTE intend to publish this work separately.

4.3 The conditional outputs

4.3.1 From a combination of the economic evidence base and modelling the Phase One work identified 10 conditional outputs for rail service improvements across the Manchester Hub. These outputs are described as conditional because their realisation depends on it being found possible in Phase Two to identify interventions that are both affordable and represent value for money.

The Phase One report identifies 10 conditional outputs that the solution should seek to meet. These are;

1. Capacity and flexibility
2. Carbon reduction
3. Performance
4. Journey times
5. Growth centres in Greater Manchester
6. Connectivity to deliver economic benefits
7. Manchester Airport
8. Trans Pennine
9. North South links and High Speed Rail
10. Freight

²Greater Manchester Transport Unit; Annual station count

Figure 4.1 Passenger growth rates

Corridor	Trend				Trend Plus				
	Corridor Journeys (m) 2007/08 to 2019/20	Growth 2007/08 to 2019/20	Average Growth Rate 2007/08 to 2019/20	Corridor Journeys (m) 2029/30	Growth 2007/08 to 2029/30	Average Growth Rate 2007/08 to 2029/30	Corridor Journeys (m) 2029/30	Growth 2007/08 to 2029/30	Average Growth Rate 2007/08 to 2029/30
1 Southport via Wigan	3.50	38.0%	2.7%	5.59	59.7%	1.8%	6.60	88.6%	3.8%
2 Preston and the North via Bolton	16.00	39.0%	2.8%	27.29	70.6%	2.5%	29.19	82.4%	3.3%
3 Blackburn	1.80	35.0%	2.5%	2.73	51.7%	1.4%	3.09	71.6%	2.9%
4 Bradford via Rochdale	3.00	44.0%	3.1%	5.01	67.0%	1.9%	6.23	107.7%	4.6%
5 Yorkshire and the Humber & the North East via Leeds	17.10	31.0%	2.3%	26.76	56.5%	2.1%	34.89	104.0%	5.1%
6 Glossop / Hadfield	1.50	41.0%	2.9%	2.61	74.0%	2.6%	3.06	104.1%	4.5%
7 Marple / Romiley	1.30	49.0%	3.4%	2.48	90.7%	3.2%	2.88	121.5%	5.1%
8 Yorkshire & the East Midlands via Sheffield	8.60	44.0%	3.1%	16.12	87.5%	3.3%	18.77	118.3%	5.2%
9 Buxton	1.90	49.0%	3.4%	3.00	57.8%	0.8%	3.42	79.9%	2.5%
10 London, Birmingham and the South (via WCML)	39.10	41.0%	2.9%	71.00	81.6%	3.1%	75.19	92.3%	3.8%
11 Manchester Airport	2.30	49.0%	3.4%	3.95	71.6%	1.9%	4.21	83.2%	2.7%
12 Chester via Northwich	2.10	38.0%	2.7%	4.36	107.8%	4.9%	5.43	158.4%	7.4%
13 Liverpool via Irlam	1.60	34.0%	2.5%	2.28	42.8%	0.8%	2.60	62.7%	2.3%
14 Liverpool / Chester via Warrington	5.50	30.0%	2.2%	8.21	49.3%	1.6%	9.63	75.0%	3.4%
Total	105.30	39.0%	2.8%	181.39	72.3%	2.6%	205.25	94.9%	4.1%

4.3.2 Capacity and flexibility

Capacity needs to be provided to accommodate the forecast growth in the various scenarios, with average load factors no worse than implied by the capacity metrics for 2013/14 in Manchester in the 2007 High Level Output Specification (HLOS).

4.3.3 Carbon reduction

To contribute to the trajectory of reduced carbon emissions as set at a national level.

4.3.4 Performance

Network performance that the delay minutes on franchised services in the Manchester area should be not worsened and kept consistent with the HLOS and national targets.

4.3.5 Journey times

The following targets for journey times to and from Manchester were identified.

- Leeds 40 minutes
- Bradford 50 minutes
- Sheffield 40 minutes
- Liverpool 30 minutes
- Preston 30 minutes.

4.3.6 Growth centres in Greater Manchester

4.3.6.1 To support the growth and regeneration of the Manchester/Salford Regional Centre, from each principal rail corridor³ (as shown in figure 4.3) to each sub-area⁴ within the Regional Centre (as shown in figure 4.2) there should be:

- a direct rail service; or
- a service that requires no more than a single interchange for onward travel by rail, Metrolink or Metroshuttle.

4.3.6.2 To support growth outside the regional centre, between each principal rail corridor and Salford Quays there should be a service that requires no more than a single interchange for onward travel by rail, Metrolink or Metroshuttle.

4.3.6.3 To support growth elsewhere in Greater Manchester between each principal rail corridor and each of the key town centres⁵ there should either be:

- a direct rail service; or
- a service that requires no more than a single interchange for onward travel by rail, or Metrolink.

4.3.7 Connectivity to deliver economic benefits

Economic analysis in Phase One showed that cross city movements deliver significant incremental benefits. All principal rail corridors to be connected if possible to the same Manchester city centre station, as well as other central area stations where appropriate for the travel market.

4.3.8 Manchester Airport

- account needs to be taken of links between the airport and North Wales and the East and West Midlands
- direct services to Manchester Airport of at least an hourly frequency (half hourly in the case of North Trans Pennine) between each of the principal rail corridors on a seven day a week basis, with a service start and finish time giving 95 percent of all air passengers the option of using rail for their inbound and outbound journeys connecting the airport with the northern city regions.

4.3.9 Trans Pennine

The trans Pennine corridors form the spine of the city region to city region links. There should be a high frequency, high quality, regular interval core express service that links all the Northern City Regions, meeting the journey time and performance targets and:

- Leeds – Manchester: 15 minute interval (or better)
- Sheffield – Manchester: 20 minute interval
- Bradford/Halifax - Manchester: 30 minute interval.

4.3.10 North South links and High Speed Rail

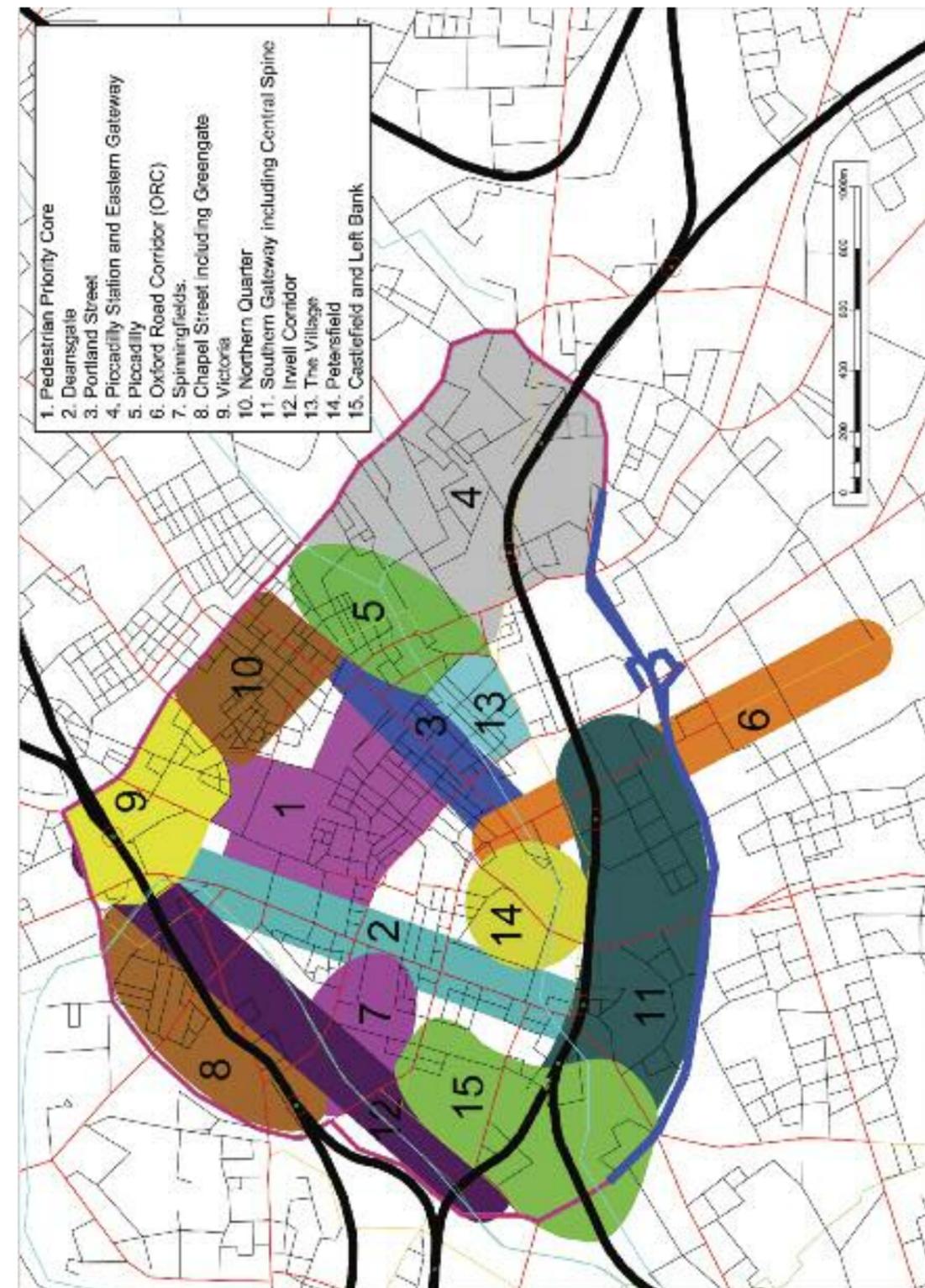
To meet the forecasts and requirements for a doubling of West Coast Main Line demand by 2026, and with such provision as indicated as being appropriate by the National Networks Strategy Group.

4.3.11 Freight

Provision for a doubling of freight tonnage from existing and new origins and destinations to/from multi-modal terminals at Trafford Park and elsewhere in the North West by 2030.

It is identifying affordable and value for money interventions to bridge the gap between the capability of the rail network in 2014 and the capability required to deliver these conditional outputs that forms the challenge for this Phase Two study.

Figure 4.2 Sub-areas in the Manchester regional centre



³ The principal rail corridors are: Corridor 2 (serving Preston); Corridor 4 (serving Bradford/Halifax); Corridor 5 (serving Newcastle/Tees Valley/Hull/Leeds); Corridor 8 (service Sheffield/ South Humber/ and the East Midlands); Corridor 10 (serving London / Birmingham); Corridor 13 (serving Liverpool); Corridor 14 (service Liverpool/North Wales/Chester), Corridor 11 (Manchester Airport)

⁴ The Regional Centre comprises the following sub areas: Central Business District, Retail Core, Eastern Gateway, Piccadilly Gateway, Oxford Road Corridor, Spinningfields, Chapel Street, Victoria, Northern Quarter, Southern gateway, The Village, Petersfield, Castletield, Left Bank, Chinatown: see 2008 draft Regional Transport Strategy

⁵ The key town centres are: Ashton-under-Lyne, Oldham, Rochdale, Bury, Bolton, Wigan, Altrincham and Stockport

Chapter 5 Gaps and options



5.1 Conditional outputs

The Manchester Hub Conditional Output Statement¹ identified the key outputs that were to be addressed. Figure 5.1 summarises the requirements and identifies how these relate into gaps.

Figure 5.1 Gaps vs. Conditional Outputs

Requirement	Gap
<p>1. Capacity and flexibility Adequate capacity needs to be provided to accommodate Trend growth to 2019/20 in longer distance, commuting and other local rail journeys, with average crowding being no greater than implied by the capacity metrics for 2013/14 for Manchester in the Department for Transport's 2007 High Level Output Specification (HLOS) for the rail industry.</p>	<p>The level of crowding at the end of 2014 is specified in the HLOS, and the industry has identified a need for a greater number of peak vehicle arrivals to meet that. Further passenger growth is predicted beyond 2014, and for the capacity metrics to be met, further peak vehicle arrivals will be required in the HLOS that will cover the period to 2029.</p>
<p>For the Trend scenario after 2019/20 and in relation to the Trend Plus scenario, the identified Manchester Hub proposal should be 'future-proofed' to accommodate these higher growth rates without a requirement for further major infrastructure works beyond the identified proposals but through measures such as train lengthening.</p>	<p>This gap needs to be addressed by further peak vehicle arrivals.</p>
<p>2. Carbon reduction The net effect of the Manchester Hub proposals on the overall carbon trajectory for the transport sector which in due course will be adopted by Government should be demonstrated.</p>	<p>Subject to a separate analysis of the carbon impact in the appraisal.</p>
<p>If possible, the effect of Manchester Hub in terms of in-service operation should be to contribute to the trajectory of reduced carbon emissions as set in national level overall targets for the transport sector.</p>	
<p>3. Performance Network performance should be such that delay minutes on franchised services in the Manchester area will not be worsened by meeting the Manchester Hub Conditional Outputs and that the performance of franchised rail services in the Manchester area is kept consistent with the High Level Output Specification and in line with targets set nationally.</p>	<p>Interventions in Control Period 4 (CP4) will address this. The Manchester Hub interventions must at worst be performance neutral.</p>
<p>In respect of Airport services, as the available evidence is that good reliability and performance is of particular significance to encourage rail use by airline passengers, the conditional requirement is to improve performance further as a priority.</p>	<p>The creation of the third platform at Manchester Airport in Control Period 3 (CP3) along with the CP4 performance plans will have a major impact by 2014. Manchester Hub interventions should seek further resilience.</p>

¹Manchester Hub Conditional Output Statement, The Northern Way, April 2009

Requirement	Gap
<p>4. Journey times These are target journey times for the key corridors, from a Manchester City Centre station (either Victoria or Piccadilly) to the principal adjoining city regions:</p> <ul style="list-style-type: none"> Leeds 40 minutes Bradford 50 minutes Sheffield 40 minutes Chester 40 minutes Liverpool 30 minutes Preston 30 minutes. 	<p>The current public times are shown below.</p> <ul style="list-style-type: none"> 54 minutes² 60 minutes 48 minutes 63 minutes 47 minutes² 39 minutes
<p>5. Growth centres in Greater Manchester From each principal rail corridor to each sub-area within the Regional Centre there should be either a direct rail service or a service that requires no more than a single interchange for onward travel by rail, Metrolink or Metroshuttle.</p>	<p>The Calder Valley does not link to the Village</p>
<p>From each principal rail corridor to each of the key town centres, there should be either a direct rail service or a service that requires no more than a single interchange, by rail or Metrolink.</p>	<p>Calder Valley does not give a link to Stockport</p>
<p>From each principal rail corridor to Salford Quays there should be a service that requires no more than a single interchange by bus or Metrolink</p>	<p>Calder Valley does not reach the Metrolink service to Eccles for connection to Salford Quays</p>
<p>6. Connectivity to deliver economic benefits All principal corridors to be connected if possible to the same station in Manchester city centre for easy passenger transfer (or through cross Manchester operation), as well as other central area stations appropriate to the travel market.</p>	<p>Calder Valley services do not reach Manchester Piccadilly, all others do.</p>
<p>The improved connectivity should therefore be used:</p> <ul style="list-style-type: none"> (a) where possible, to promote direct cross city movements (for which train service provision and hence franchising costs will also generally experience cost efficiencies), or (b) where this cannot be done, to facilitate convenient passenger interchange. This is best done at a single Manchester city centre station to avoid circuitous, time consuming/counter-intuitive routing. 	<p>Not all corridors connect to the same single station.</p>

²Note excludes improvements resulting from the Trans Pennine linespeed improvement scheme works in CP4

Requirement	Gap
<p>7. Manchester Airport The requirement is for direct services of at least hourly interval service frequency in each of the principal corridors (30 minutes in the case of the Yorkshire and the Humber and North East via Leeds corridor)...</p> <p>... on a 7 day/week basis ...</p> <p>... with service start and finish time giving 95% of air passengers the option of using rail for their journeys to or from the airport</p>	<p>The Calder Valley, Chester and the CLC have no direct service to Manchester Airport, and the corridor to the south has only got one if the local service from Crewe is counted as sufficient.</p> <p>Not a gap</p> <p>This implies either a constant availability of services for arrivals between 03:00 and 00:00 or constant arrivals other than for periodic longer closures. The current maintenance regime allows periodic longer closures that meet this level of infrastructure availability. However, services are currently not specified to meet the level required.</p>
<p>8. Trans Pennine Leeds – Manchester a 15 minute interval service (or better)</p> <p>Sheffield – Manchester a 20 minute service interval</p> <p>Bradford/Halifax – Manchester a 30 minute service interval</p>	<p>Currently 4 trains per hour (tph) – a few minutes off even interval</p> <p>Currently 30 minute interval</p> <p>Currently 2 tph a few minutes off interval</p>
<p>9. North South Links and High Speed Rail To meet forecasts and requirements for a doubling of West Coast Main Line demand by 2026</p> <p>... with such provision as indicated as being appropriate by the National Networks Strategy Group, to accommodate High Speed 2 (HS2) options to and beyond central Manchester, together with a possible parkway station</p>	<p>Current West Coast Main Line (WCML) capacity insufficient but being addressed by WCML Route Utilisation Strategy (RUS) and work at Stafford</p> <p>The subsequent guidance from the Department for Transport (DfT) was that the Hub Should not close off options.</p>
<p>10. Freight Provision for a doubling of freight tonnage from existing and new origins and destinations to/from the multi-modal terminals at Trafford Park and elsewhere in the North West by 2030.</p>	<p>Additional paths will be required</p>

5.2. Gaps in capacity

The Conditional Output Statement identified expected growth in rail demand. In order to accommodate that growth and still maintain the HLOS crowding metrics additional vehicles will be required. These vehicles could be used to extend the length of existing services, or could be used to operate additional services.

There have been concerns regarding demand forecasting of commuter flows into Northern cities. Recent rail forecasting work carried out by DfT with Northern Passenger Transport Executives (PTEs) has shown that previous forecasts tend to underestimate growth on commuter routes. This work, whilst not yet complete, appears to support growth in excess of the “Trend” scenario and the output when complete will form an input to the Northern RUS.

Failure to deliver the forecast capacity into Northern cities will constrain their growth.

5.3 Gaps in journey time

The Conditional Output Statement specifies six destinations journey times from Manchester, with improvements ranging from between eight and 23 minutes depending on the corridor. Addressing these will involve identifying value for money interventions to address maximum speeds, slow speed restrictions and stopping patterns.

5.4 Gaps in growth centres and connectivity in Greater Manchester

The gaps in the area of growth centres in Manchester City Centre principally relate to the fact that the Calder Valley corridor does not connect with the locations and corridors that are not accessible from Manchester Victoria.

5.5 Gaps in connectivity

The Phase One work identified that connectivity is a significant driver of economic benefit. Improved connectivity comes from existing services to Manchester working through to a destination beyond, new services creating new links across the centre of Manchester and good interchange to improve connections. Currently there are inter-regional services that come to Manchester and stop, there are inter-regional centres that are not linked, and the interchange at Piccadilly has to allow for time to travel between the main train shed and the island platforms.

5.6 Gaps in airport links

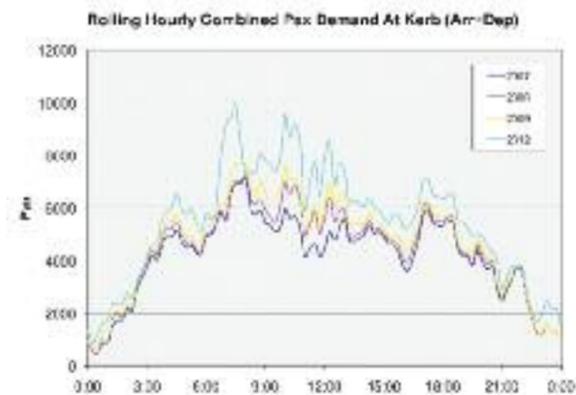
There are two gaps in respect of Manchester Airport.

- The CLC and Calder Valley corridors do not have a through link to Manchester Airport

- The service provision does not allow 95 percent of air passengers the opportunity to use rail for their journeys to and from the airport.

Data from Manchester Airport indicates that the level of arrivals at ‘kerbside’ at Manchester Airport is shown in Figure 5.2, which is the time air passengers choose to arrive for flights or depart having landed at Manchester Airport.

Figure 5.2 Demand at kerb-side (source Manchester Airport)



Analysis of Figure 5.2 identifies that if all passengers in a period of time, on every day of the year have access to a service, then 95 percent availability means that services must arrive and depart between 03.00 hours and midnight or that services run 24 hours a day and the infrastructure would need to be available for 95 percent of the year.

Analysis of the existing possession regime shows that the network is currently available for 95 percent of the time. As such the infrastructure is available to meet this conditional output should service specifiers identify the business case to take up the opportunity. Current use of overnight services reflects the impact of journey times by road during the uncongested late hours.

5.7 The gap in specified trans Pennine frequencies.

The specified frequency for Leeds and Bradford are met and the services are almost on pattern, and can be made to be so. The gap for these corridors is about maintaining the existing pattern. For the Hope Valley corridor the specification is for 20 minute frequency when there are only two services an hour currently.

5.8 Gap for north south routes, and high speed rail

This issue is wider than the Manchester Hub, and other work is being progressed elsewhere to address it. As such the requirements the West Coast Main Line have been based on the separate work being undertaken by Network Rail and the timetable associated with the enhancement of the West Coast Main Line in the Stafford area.

In terms of being able to accommodate High Speed options to and beyond central Manchester, together with a possible parkway station, the guidance from the DfT has been for the recommendations not to close off possible options for high speed rail.

5.9 Gap for freight

For freight the conditional output concentrated on container traffic, and specified a doubling of tonnage. The container terminal on the Hub area is Trafford Park with Seaforth adjacent to the geographic scope and with planned new terminals at Port Salford and Parkside, on the Chat Moss route between Newton-le-Willows and Patricroft.

Currently there is broadly only one path an hour for container traffic to Trafford Park. The gap has been taken to be creating a second path in the standard hour to and from Trafford Park, providing two paths an hour to Liverpool docks and to make sure that there is scope for freight to get to Port Salford and/or Parkside. This provides sufficient capacity to meet the rail industry 2030 freight forecasts.

5.10 Options to address gaps

5.10.1 “Do nothing”

The “do nothing” option is to carry on as now, and that there is no change to the service provided, both in terms of timetable and train length. This means then trains will become more crowded, people will not be able to travel and the crowding targets no longer be met. This runs contrary to current Government policy and does not meet the challenge of the conditional outputs so has not been taken further.

5.10.2 “Do minimum”

The “do minimum” option is to provide sufficient additional vehicles for existing services such that the government’s crowding targets continue to be met into the future. As well as the additional vehicles and their peak mileage, there would necessarily be associated works such as platform lengthening to accommodate the longer trains and depot and stabling works to allow the trains to be kept on the network. As mentioned in section 3.5 the analysis indicates that this train lengthening would in Control Period 5 (CP5) platform require additional platforms at Manchester Airport and Manchester Piccadilly. This provision of extra capacity for people on trains is very important but without further improvements much of the potential benefit is missed. The Phase One study identified this crowding relief represents only 18 percent of the potential benefits.

5.10.3 “Do more”

The challenge for the Northern economy, as identified by the Phase One study requires improvements beyond the “do minimum” in order to capture benefits to the Northern economy. It is the operation of an increased level of service with a wider range of through linkages,

better connections and infrastructure enhancements to allow that pattern to operate.

It is clear from the Theory of Constraints work that running such additional services cannot be done without providing new infrastructure, and that there is no single intervention that provides the solution, meaning a strategy of interventions will be required. The particular interventions required depend on the pattern of services chosen to meet the outputs – some depend on the nature of services on particular radial routes and some will depend on how services are routed across the centre.

5.10.4 Interface between “Do Minimum” and “Do more”

In dealing with peak crowding the “do minimum” option lengthens peak trains and adds incremental additional peak services. The improved frequencies of the “do more” option also require additional vehicles. It could be that the additional vehicles required for the improved frequencies are at the wrong time and place to meet the crowding metric of the “do minimum” option. This would mean that all the vehicles for the increased frequency are in addition to any required for meeting HLOS. This pessimistic view has been assumed for the purposes of the economic analysis.

Alternatively, it could be that the additional vehicles for the increased all-day frequency are at the right time and place to help address crowding in the peak. In effect using the benefits of the increased frequencies and a wider range of through workings could help to meet the crowding metric. In this case the additional vehicle lease cost and the peak mileage would not be attributable to the Hub scheme. This optimisation will be progressed with stakeholders in later development stages for the Manchester Hub.

5.11 Analysis of strategic options

Having identified the gaps in the rail services and taking into account the capacity gaps identified, a range of infrastructure interventions was identified to provide the capability for rail service improvements to address these gaps and deliver the benefits.

These infrastructure interventions are required to address the issues of capacity and capability in the centre of Manchester and on the radial routes. Full details of all the infrastructure interventions considered are shown in Appendix B. In many instances there was more than one way of providing the capability and alternatives were only progressed to the point where it was clear which was better for the circumstances being considered.

5.11.1 The centre of Manchester

There are three key issues to be addressed in the central area:

East West and North South services crossing on the approach to Piccadilly

Manchester Piccadilly platform capacity

Capacity to cross Manchester via the Castlefield corridor.

5.11.2 Crossing moves on the approach to Manchester Piccadilly

The congestion at Manchester Piccadilly comes from crossing moves from two main sources: trains going between Platforms 13 and 14 and Ashburys (and, to a lesser extent, Hazel Grove), and trains going between Manchester Airport and Ashburys (and, to a lesser extent, Hazel Grove). Both sets of trains cross the whole layout between Ardwick and Manchester Piccadilly. Conceptually there are two main options to overcome the congestion from the crossing moves:

- option 1 - grade separation of some sort such that trains making the move are not interacting with trains going between the train shed and Stockport, or
- option 2 - physical rerouting such that there are no crossing moves between Manchester Piccadilly and Ardwick through rerouting of inter-regional services to Manchester Victoria and provision of a link between Manchester Victoria, Manchester Piccadilly and thence Manchester Airport through the Ordsall Chord.

Figure 5.3 Schematic showing existing crossing moves at Manchester Piccadilly North trans Pennine – Manchester Airport (green) and North trans Pennine – Liverpool (red)

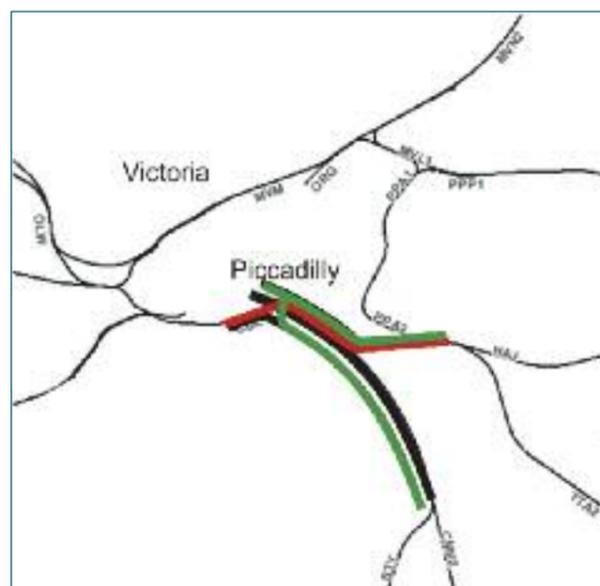


Figure 5.4 Schematic showing impact of an Ardwick – Slow lines Flyover on crossing moves at Manchester Piccadilly: North trans Pennine – Manchester Airport (green) and North trans Pennine - Liverpool (red)

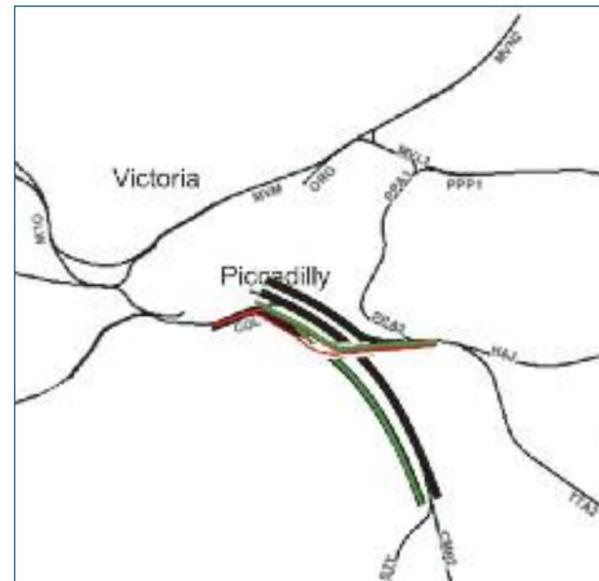


Figure 5.5 Schematic showing impact of Ardwick Eastern Flyover - a Fast lines – New East lines flyover on crossing moves at Manchester Piccadilly: North trans Pennine – Manchester Airport (green) and North trans Pennine – Liverpool (red)

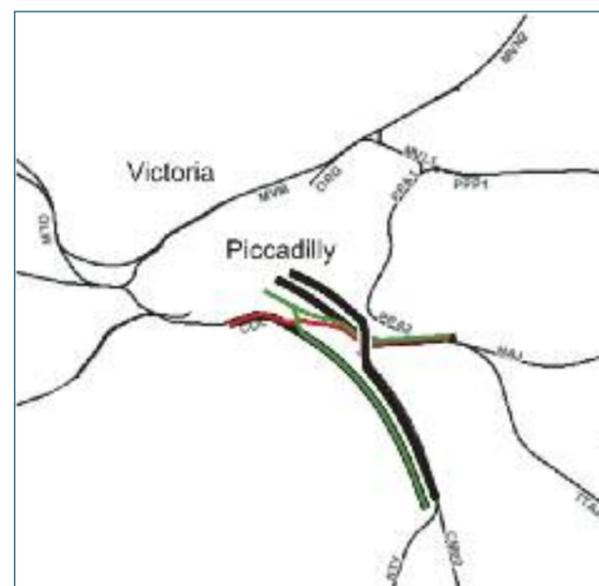
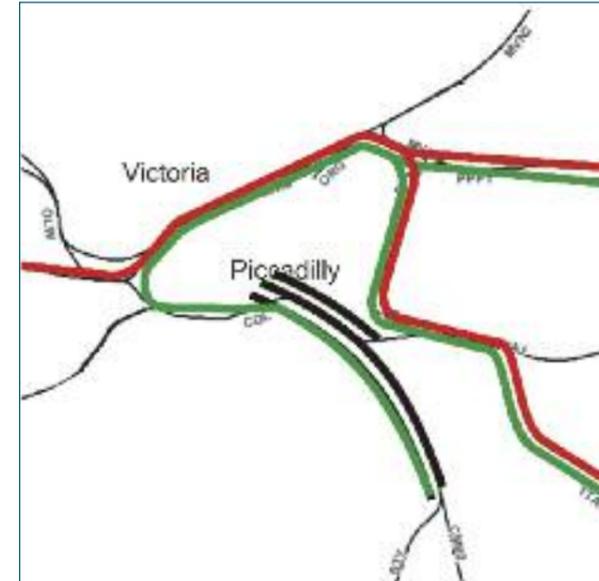


Figure 5.6 Schematic showing impact of re-routing away from Manchester Piccadilly to Manchester Victoria the crossing services: North trans Pennine – Manchester Airport (green) and trans Pennine and Sheffield - Liverpool (red)



The solution of grade separation on the approaches to Piccadilly continues to have all the existing services on broadly their existing pattern, and Manchester Piccadilly remains the prime focus of rail connections. The latter solution of rerouting changes the emphasis such that both Manchester Piccadilly and Manchester Victoria become important interchange stations. These options are shown diagrammatically at figures 5.10, 5.11, 5.12 and 5.13.

Analysis of the crossing moves associated with each of the options indicates that only the Ardwick Flyover, or diversion of services to Manchester Victoria with an Ordsall Chord allow delivery of the service specification. The Ardwick Eastern Flyover was a variation on the Ardwick Flyover that was considered. Whilst having a reduced capital cost over the original version, with the new service level it had a greater level of conflicts than currently and therefore did not provide the necessary capacity.

5.11.3 Manchester Piccadilly platform occupancy

Platform occupation at Manchester Piccadilly is an issue as operating longer trains restricts the ability to operate multiple trains in one platform. Trains from many of the corridors do have the option of being directed at either Manchester Piccadilly or Manchester Victoria. However, a key constraint is that traffic from Manchester Airport and from Warrington Central must go to Manchester Piccadilly.

Overcoming platform occupation congestion at Manchester Piccadilly points to three potential options:

- creating more platform capacity by freeing up access to the existing poorly used platforms (9 - 12) to make better use of them, this delivers most capacity when linked to the Ardwick Flyover

- providing more platform capacity by creating additional platforms to the east of the current platforms, which facilitates an Ardwick Eastern Flyover
- or reducing the need for more platforms by diverting the trans Pennine trains to Manchester Victoria. This involves trains to Manchester Airport using an Ordsall Chord.

5.11.4 Cross Manchester Flows

The ability to path flows across Manchester is constrained by the capacity of two key corridors: the Castlefield corridor and Manchester Victoria. As identified by section 3.5.3 the capacity on the Castlefield corridor is constrained by the Manchester Piccadilly through platforms.

On the Castlefield corridor provision of two additional through platforms at Manchester Piccadilly immediately to the south of the existing platforms 13 and 14, hence known as 15 and 16, allows trains to arrive in one platform while another train is departing in the same direction from another. This intervention with minor works at Manchester Oxford Road to operate in the same manner increases the effective capacity to allow trains to be planned to run three minutes apart rather than the existing four minutes apart.

As an alternative the removal of the two freight paths by diverting freight traffic to the west out of Trafford Park to allow more passenger services on the Castlefield Corridor was evaluated. This would involve a new entrance to allow all services to arrive and depart from the west and a link to the WCML from the CLC corridor either via Glazebrook and Kenyon or Padgate and Dallam. This option was significantly more costly than the additional through platforms at Manchester Piccadilly and as such was not progressed at this stage. It does however remain an option should growth justify further enhancement at a later stage.

Capacity at Manchester Victoria is currently constrained by the use of through platforms for terminating trains. This can be addressed by increased use of through working services or by creation of west facing bay platforms to the north of the layout. The capacity of the through platforms can be improved through a differential linespeed of 35mph for passenger trains, which reduces the current planning headway from three minutes to two minutes.

Whilst rerouting North trans Pennine – Manchester Airport services through Manchester Victoria does avoid the crossing move conflicts at Manchester Piccadilly, such services do use up capacity both on the Castlefield corridor and at Manchester Victoria. Thus for some services there is a trade-off between capacity at Manchester Piccadilly and cross – Manchester capacity.

5.11.5 Radial Routes

The service pattern and consequent corridor interventions that were modelled were broadly the same for each option. For many of the long distance or inter-regional services there was interaction between adjacent areas in the analysis of options. For each of the corridors the following interventions were identified;

- For the services from the south
 - additional services have been routed to other corridors to avoid costly interventions between Edgeley and Ardwick.
- For the Sheffield services, and East Manchester services,
 - doubling Dore Station Jn to Dore West Jn and loops at Grindleford to let extra fast trains run between Sheffield/East Midlands and cities in the north west; these services would operate in pairs half hourly
 - loops at Chinley to allow the extra fast trains to be sent via Marple, thereby avoiding constraints between Edgeley and Slade Lane. Such loops would allow commuter services to be extended to Chinley from New Mills Central and or Hazel Grove
 - for the Manchester Piccadilly based solution the level of service at Ashburys required four tracking of Ashburys - Guide Bridge; whereas a Manchester Victoria based solution required linespeed improvements on the Marple line, but by taking the North trans Pennine services away from the Ashburys – Guide Bridge corridor this option leaves flexibility for more commuter services there.
- On the North trans Pennine route from the North East, Yorkshire and the Humber
 - to facilitate an increased frequency and hence running fast services an additional loop is required at Dewsbury and four-tracking between Diggle and Marsden using the disused bores of Standege tunnel
 - the new bay platform at Stalybridge created in CP4 allows flexibility in operating commuter services to Manchester Victoria and Manchester Piccadilly with this higher frequency inter-regional service.
- For the Calder Valley
 - to facilitate increased frequency of inter-regional services a bay platform is required at Rochdale, which facilitates an increased frequency of commuter services.
- On the route to Bolton and Preston
 - none, as additional inter-regional services from Preston are routed via the Chat Moss route and West Coast Main Line.
 - this provides scope to adjust stopping patterns of the remaining services to reflect the needs of the commuter railway.
- On the route to Liverpool
 - to achieve the fastest journey time at least two inter-regional services go via the Chat Moss route. The Manchester Victoria based option involves all fast trains being routed this way, which combined with the need to overtake the stopping service led to four tracking between Roby – Huyton and abolition of the level crossing at Astley. In opting to enhance

the service around Manchester Piccadilly only two fast services went via the Chat Moss route, which requires signalling work in the Roby area.

- On the route to Chester via Chat Moss
 - none
- On the route via Northwich
 - none, existing infrastructure allows a doubling of services to Altrincham.

5.11.6 Journey time improvements

In considering the opportunity to achieve the journey time target between Manchester and Liverpool; it was identified that with electrification in CP4 improving the speed of local services and raising to 90 mph the line speed between Huyton and Astley signal box fast services are provided with the opportunity for a 33 minute journey time between Liverpool Lime Street and Manchester Victoria or Manchester Oxford Road. Whilst the trans Pennine linespeed scheme would be developed and implemented in CP4 it was pessimistically assumed that the costs of this linespeed improvement would be included in the Hub appraisal.

On the North trans Pennine route the scheme to deliver journey time improvements for trains from the North East, West Yorkshire and the Humber was not sufficiently developed to provide a baseline for analysis. This aspect of the Hub intervention will be reviewed once the scheme identifies a single option for delivery in CP4, which is expected to be in June 2010, to establish the further improvements that can be justified. However the impact of the capacity interventions at Dewsbury and between Marsden and Diggle is designed to improve journey times by providing the opportunity for a pattern of four fast and two semi-fast services.

Value for money opportunities were identified for incremental journey time improvements to/from South Yorkshire/East Midlands of up to five minutes based on covering the cost of the intervention. On other corridors incremental linespeed improvements may be available by combination with plain line track renewals, which will be reviewed on an ongoing basis by Network Rail during CP4. On all corridors it is important to note that as passenger numbers grow the business case for further incremental linespeed improvements will improve.

5.11.7 Strategic options

The results of this analysis produce two strategic options for addressing the challenges of the Manchester Hub based around the interventions in the central area; Option 1 to allow greater use of Manchester Piccadilly and Option 2 to allow greater use of Manchester Victoria. For each option a list of the interventions and a diagram showing their locations is overleaf:

- **Option 1 (see Figure 5.7)**
 - Ardwick Flyover
 - Platforms 15 &16 at Manchester piccadilly with improved access to Platforms 9 - 12
 - Four track Ashburys – Guide Bridge
 - Signalling improvements at Roby
 - Manchester Oxford Road platform and signalling improvements
 - Chinley loops
 - Grindleford loops
 - Dore Jn redoubling
 - Four track Marsden – Diggle
 - Dewsbury Up Loop
 - Chat Moss route linespeed improvements
 - Manchester Airport additional platform
 - Rochdale bay platform
- **Option 2 (see Figure 5.8)**
 - Platforms 15 & 16 at Manchester Piccadilly
 - Improved headways at Manchester Victoria
 - Manchester Victoria western bay platforms
 - Improved passenger environment at Manchester Victoria station
 - Ordsall Chord
 - Marple linespeed improvements
 - Four track Broad Green - Huyton
 - Oxford Road platform and signalling improvements
 - Chinley loops
 - Grindleford loops
 - Dore Jn redoubling
 - Four track Marsden – Diggle
 - Dewsbury Up Loop
 - Signalling headway improvements on the Chat Moss route at Astley
 - Chat Moss route linespeed improvements
 - Manchester Airport additional platform
 - Rochdale bay platform

5.11.8 Manchester city centre

Further analysis of ultimate destinations in the city centre was carried out by Greater Manchester Passenger Transport Executive (GMPTE). This showed that the ability to reach all of Manchester Piccadilly, Manchester Oxford Road and Manchester Victoria from all of the corridors produced an overall benefit.

The potential to unlock regeneration benefits through a 15 minute frequency service serving Manchester Victoria, Salford Central, Manchester Oxford Road and Manchester Piccadilly from Manchester Airport was noted if platforms were reinstated on the Liverpool lines at Salford Central. It is noted that stakeholders believe Salford Central could unlock significant regeneration benefit and this could form an aspect of the further feasibility.

5.11.9 Opportunities for service improvements

The two strategic options provide the opportunity to improve rail services across the North to meet the challenges identified. A test timetable was developed to allow the appraisal of the strategic options, which is shown in Appendix C, but should not be taken as justification for a particular timetable at this stage. The details of the opportunities presented by the preferred option are shown in **Chapter 8**.

Inter-regional/trans Pennine frequencies and journey times

- The two options provide the opportunity for the frequencies specified in the conditional outputs to Leeds (six trains per hour) and Bradford (two trains per hour). In the case of Sheffield for four trains per hour but that these would run as two pairs, one each from South Yorkshire and the East Midlands, to facilitate the freight flows on the Hope Valley.
- The two strategies provide the opportunity for significant improvement in frequency of trans Pennine services across the North. This greater frequency reduces the waiting time for passengers, which is reflected in improvements to the generalised journey time.
- The potential for additional services to run on the radial routes and across Manchester city centre provides opportunities for additional direct connections across the North. For example with up to six fast/semi-fast services on the North trans Pennine route this gives additional direct connections that could be made compared to the current timetable. Connections that might be considered include Chester to Leeds, Sheffield to Preston etc.
- The opportunity to increase the frequency of services also presents the opportunity for improved connections where direct links are not utilised, which can further improve a passenger's journey time.
- Significant opportunities for journey time improvements are available through both options. All journeys to Liverpool benefit from reduced journey times on the Chat Moss route. Journeys from Sheffield and the East

Figure 5.7 Option 1 interventions

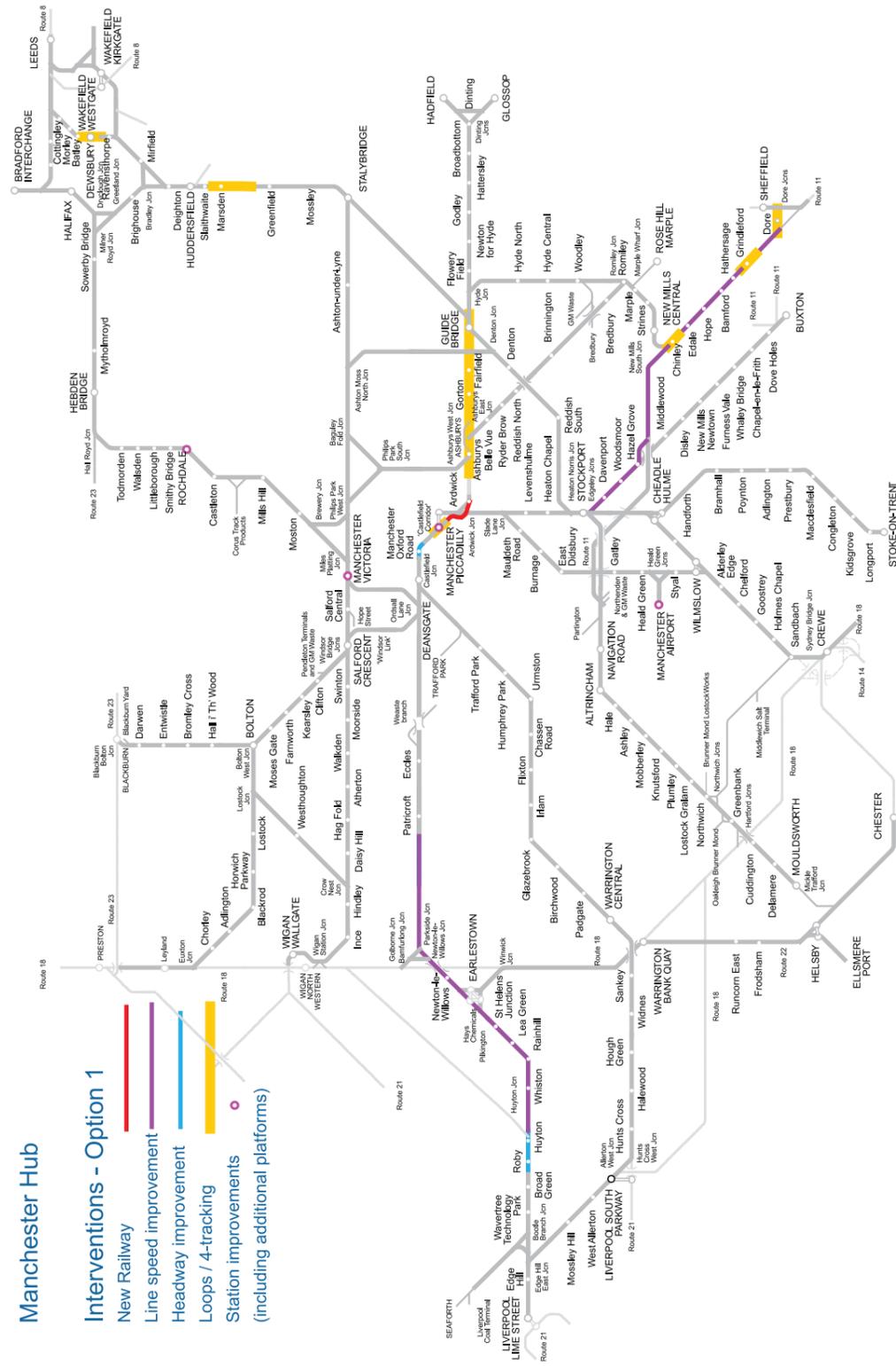
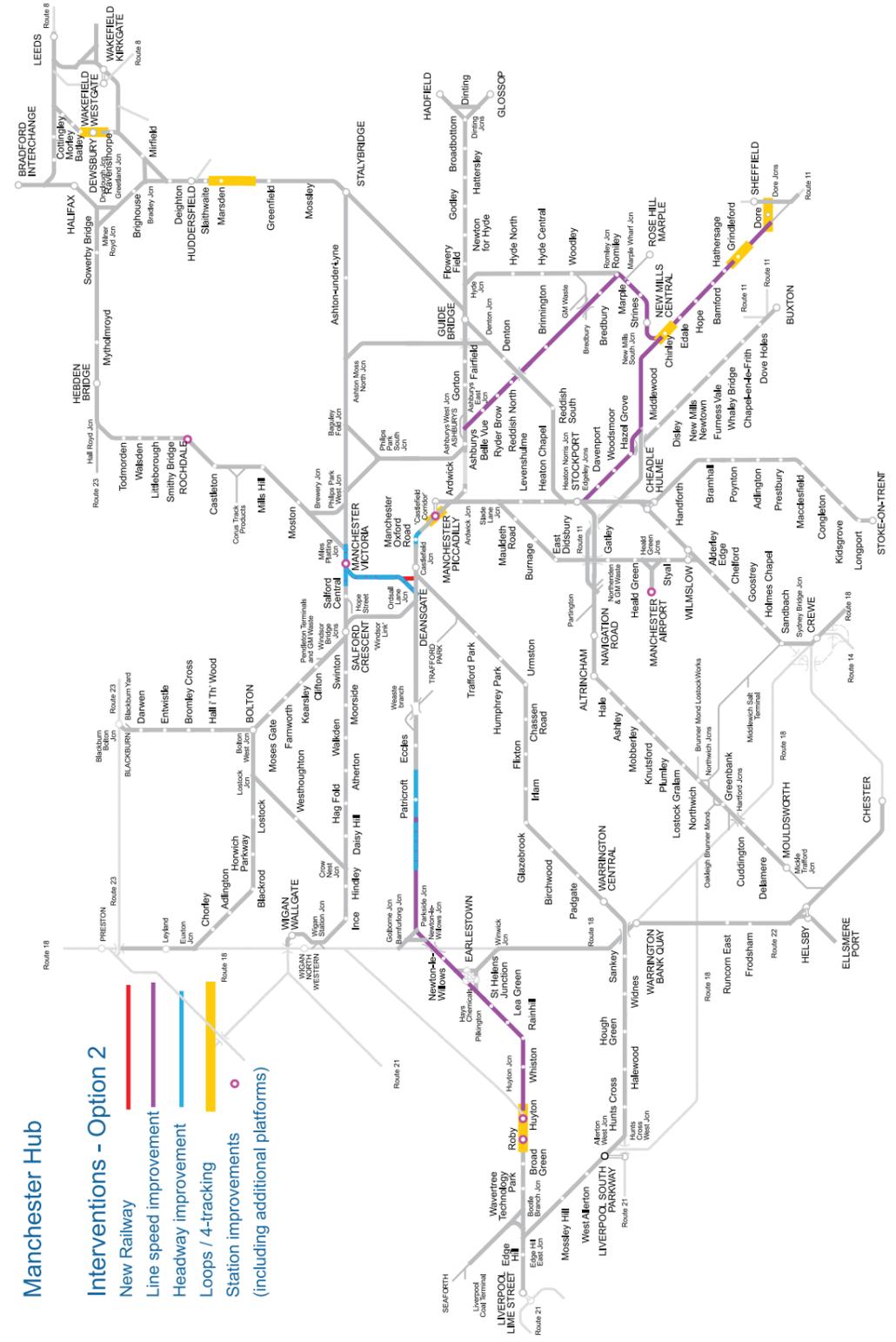


Figure 5.8 Option 2 interventions



Midlands have the opportunity to benefit from up to five minutes improvement. In Option 2 passengers from Yorkshire, the North East and Humber benefit from a five minutes reduction in journey time to Manchester and their onward journey from routeing via Manchester Victoria, except for Manchester Airport where routeing via Ordsall is four minutes longer than in Option 1.

Key commuter corridors

- The opportunity exists to increase the frequency of service on many key corridors both in the peak and off-peak. This is particularly the case with Option 2 where the simplification of the operation at Manchester Piccadilly and the freeing up of platforms at Manchester Piccadilly presents the opportunity for additional services from south and east Manchester.
- Recognising that many commuter flows are not into the city centre, the options in providing additional capacity across Manchester provide the potential for more commuter services linking destinations across the city centre.
- The ability to increase the frequency of commuter services presents the opportunity to adjust the stopping patterns of services to allow faster journeys, in addition to benefits from the linespeed improvements referenced under trans Pennine services.
- In Option 2 the ability exists to improve journeys to Manchester city centre by operating services that call at Manchester Victoria, Manchester Oxford Road and Manchester Piccadilly on the way to Manchester Airport. Indeed if platforms were provided on the Liverpool lines at Salford Central this station could be included.
- By providing a link from the Calder Valley corridor to Manchester Piccadilly the opportunity exists for all principal corridors to access all sub areas by only one interchange see 4.3.6.1.
- The capacity that has been created could be used for services to East Pennine Lancashire if the additional infrastructure at Darwen and/or Todmorden curve were funded.
- To the east of Huddersfield the opportunity exists to take advantage of the capacity created by the loop at Dewsbury.

Manchester Airport

- The options allow for the provision of more direct trains to Manchester Airport and potentially more destinations as referenced in the conditional outputs. Therefore the ability to create direct connections to destinations such as Bradford, Chester and Liverpool. In Option 2 the connection from the Calder Valley corridor is direct via the Ordsall Chord, while in Option 1 it involves a reversal at Salford Crescent.
- In Option 2 most of the services from Manchester Piccadilly to Manchester Airport will operate from platforms 13-16 making the journey easier for passengers.

- In Option 2 the simplification of the service pattern at Manchester Piccadilly indicates a performance improvement which, it is suggested, is particularly important to passengers travelling to an airport for onwards flights.

Freight

- The options provide the capability to double the number of paths from the West Coast Main Line to Trafford Park, which provides capacity to meet the rail industry 2030 freight forecasts.
- An hourly path is available on the Chat Moss route to serve the developments at Port Salford and Parkside.

5.12 Future opportunities remaining

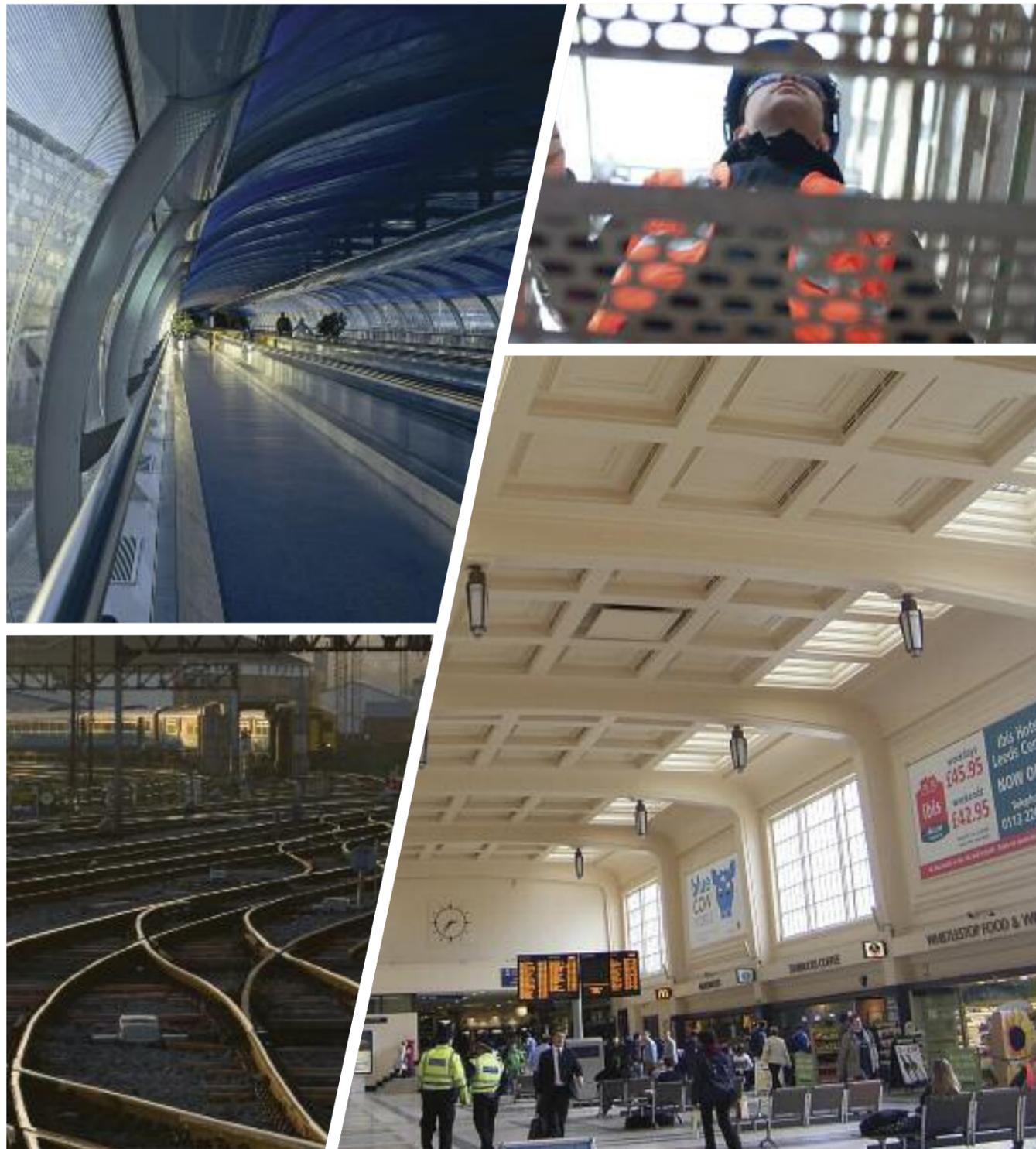
The options taken forward in the strategy do not exhaust the potential future capacity of the rail network in the Hub area even given the further development work recommended on the linespeed interventions and on the interface with electrification strategy. Indeed even the two strategic options should not be seen as mutually exclusive. Once one is selected to form the base of the strategy elements of the other, either service improvement and/or infrastructure, might be appropriate.

Looking forward as growth continues the further infrastructure interventions might have a case including the following:

- a western link for freight services from Trafford Park, allowing a greater number of passenger services on the Castlefield corridor.
- the Ardwick Eastern Flyover (5.11.2) and associated additional platforms at Manchester Piccadilly if necessary to provide for additional services from the south
- further interventions on the radial routes to facilitate improved frequencies or journey times
- create park and ride schemes and station car parks to facilitate the greater number of passengers being carried.

Chapter 6

Evaluation of strategic options



6.1 Strategy evaluation

An appraisal framework to assess the strategic options was developed and applied. This assessed the options for:

- value for money
- affordability
- performance against the conditional outputs
- train performance
- disruption during construction and after commissioning
- opportunities for timing of their implementation
- impact of New Lines/HS2

As such the evaluation of the two strategic options was broken down as follows:

1. qualitative assessment of strategic options
2. achievement against the conditional outputs
3. economic appraisal.

6.2 Qualitative assessment of strategic options

A number of elements of the options were assessed using qualitative criteria. These were:

- train performance
- disruption during construction and after commissioning
- affordability and opportunities for timing their implementation
- impact of New Lines/HS2

6.2.1 Train performance

Given the current Guide to Rail Investment Projects (GRIP) stage of the study it was inappropriate to carry out detailed timetable performance modelling using Railsys. This is appropriate to GRIP stage 3 and beyond. An approach involving a structured evaluation by experts facilitated by the Network Rail Performance and Capacity Allocation Team was undertaken. This approach compared the relative performance of the two options at key constraints both against each other and against the December 2008 timetable. The results for

each location were then weighted according to historical data on reactionary delay at the constraint.

Option 1 was identified as likely to be similar or slightly worse than the current timetable despite the additional infrastructure due to the increase of services around Manchester Piccadilly. While provision of a flyover removes the crossing moves on the approaches conflicts remain at the platform ends and for traffic to/from Manchester Airport.

The analysis suggests that Option 2 is likely to perform better than both Option 1 and the current timetable. This reflects the significant simplification of the operation at Manchester Piccadilly with the removal of crossing moves on the approach and the operation of the station with platforms allocated to pairs of lines as follows;

- platforms 1-4 to East Lines
- platforms 5-12 to Fast Lines
- platforms 13-16 to Slow Lines

However because Option 2 presents a radical change to the pattern of service delivery, the impact at Manchester Victoria and on the Chat Moss route should be explored in detail in later GRIP stages.

6.2.2 Construction disruption

The two strategic options share substantially the same interventions on the radial routes. Hence for purpose of appraising the strategies the analysis of the disruption to both adjacent land users and rail services, during the construction has focussed on the core area.

The impacts of the interventions in the core area associated with the two strategies have been assessed in terms of the disruption during construction and post commissioning of the final scheme. This analysis is summarised in Figure 6.1.

The table clearly articulates that the greatest disruption to adjacent land users is through the construction of the Ardwick Flyover and platforms 15 & 16 at Manchester Piccadilly. Both variants of the Piccadilly platforms scheme have been developed in discussion with the local authority and developer to establish synergy with the proposed redevelopment of the land to the south.

The comparison between the alternative strategies therefore focuses on the difference between the Ardwick

Figure 6.1 Analysis of disruption to adjacent land use from the proposed interventions in central Manchester

	Disruption to property/businesses	Disruption to non-rail traffic
	During construction	After commissioning
Ardwick Flyover	Affects adjacent office site. Access to arches and adjacent business property obstructed. Potential disturbance to local residents	Adjacent office building may be preserved (estimated 3 metre clearance from new viaduct), but the site will be compromised. Access to arches and adjacent business property obstructed
	Likely to close adjacent streets and major roads	Partial/total closure of the street adjacent to the railway.
Manchester Piccadilly Platforms 15&16 (both variants)	Car park & electricity substation affected	Car park & electricity substation affected. Design is consistent with the proposed Mayfield development.
	Impact on local road network for access and materials supply	Alterations to adjacent road network.
Manchester Oxford Road	Railway arches affected	Releases platform 5 area for development
	Adjacent streets affected for access with materials over limited period	None
Ordsall Chord	Interface with local land owners including the Museum of Science and Industry	Interface with local land owners including the Museum of Science and Industry
	Disruption while building over the Manchester Inner Relief Road.	None, levels of Manchester Inner Relief Road were designed for this eventuality.
Manchester Victoria headways and new bay platforms	Railway arches affected	Railway arches
	Minor access to site issues	None
Marple Line Speed Improvements	None	None
	Minor access to site issues	None
Ashburys – Guide Bridge four track	None reinstates a former formation	None
	Minor access to site issue	None

Flyover and Ordsall Chord. The impact of the Ordsall Chord on the Inner Relief Road will need to be reviewed at a later GRIP stage. Passive provision in the road level was made when the Inner Relief Road was constructed; and the remainder of the scheme impacts on what is broadly brown field land. The Ardwick Flyover on the other hand causes significant disruption to residential, office and light industrial land use between Ardwick and Mayfield.

An important aspect of evaluating the two strategic options is the level of disruption caused to rail services during the construction phase. Figures 6.2 and 6.3 identify the major disruption associated with the interventions in each option.

In Option 1 the significant works at Manchester Piccadilly are estimated to require a number of significant blockades preventing or severely limiting access to Manchester Piccadilly and the Castlefield corridor. Without the funding of additional infrastructure there is limited opportunity for diversion and the costs associated with such infrastructure have not been included in the appraisal.

Option 2 is considerably less disruptive with the only major blockades associated with the works to platforms 15 & 16 at Manchester Piccadilly and the signalling commissioning associated with the Ordsall Chord at Castlefield. Indeed the enhancements can be programmed to provide the improved capability on the routes to Manchester Victoria first, for diversion of services while the works between Manchester Piccadilly and Castlefield Jn are carried out.

Hence the disruption to passengers and freight users is markedly lower in Option 2 than Option 1.

6.2.3 Affordability and timing

When considering the differences between Option 1 and Option 2 it is worth noting the importance of the inter relationship between the interventions at Manchester Piccadilly in Option 1 and their potential to trigger the need for resignalling. Therefore, it is likely that for Option 1 over £500 million of the capital cost would be required to be funded in one control period.

Option 2 presents the possibility of phasing the interventions in an incremental manner. While the greatest benefits will accrue to the economy only on early delivery of the full strategy, the investments could be spread across control periods.

6.2.4 Impact of new lines/high speed

The Department for Transport (DfT) guidance for the Manchester Hub study indicated that the preferred solution should not close off options for a future high speed line in Manchester. During the study period the Network Rail New Lines Study was published and HS2 was in its development phase preparing their report for the Secretary of State. While no specific details are available to this study from HS2 it is possible to create hypotheses for routing options for a high speed line to reach central Manchester.

An approach from the south is most likely either on the existing alignment having connected south of Stockport, or to either the east or west of the existing alignment. In the first case this might include an incremental phase of trains leaving a new line to the West Midlands before an extension to Manchester is built. It is also considered possible that a new line would require platforms that face to the south and to the north.

It is therefore highly unlikely that a high speed line would approach Manchester Victoria given its location, the constraints of the station and nature of the approaches. As such Option 2 does not close off any options for a new line arriving in Manchester after implementation of the Hub solution.

If arriving on the existing railway from Stockport, Option 2 could be combined with the Eastern Flyover (see Chapter 5) to provide additional platforms at Manchester Piccadilly. The impact of an Ardwick Flyover is more problematic in this instance although not insoluble provided provision is made at the design phase. Similarly an eastern approach would benefit from designing into Option 1 as the four tracking from Guide Bridge would require provision for GC gauge vehicles and make use of elements of the Eastern Flyover scheme.

A western approach to the city centre is unlikely to involve Manchester Piccadilly due to the congested nature of the land use and the slow approach over the Castlefield corridor. If an approach from the north as well as the south is required an underground station is most likely. As such neither strategic option closes off options for a new line.

In the light of the hypotheses, Option 2 does not close off any options and could complement a line arriving from Stockport with the Eastern Flyover. Option 1 need not close off options if details of any proposed route are known before detailed design and provision, either active or passive, is made.

6.3 Performance against the conditional outputs

In the light of the value for money appraisals outlined in Chapter 5 the table below details the level of performance of each of the strategic options against the conditional outputs.

Figure 6.2 Major disruption to rail services required by Option 1

During construction Option 1	
Ardwick Flyover	<p>Significant stage works to preserve parallel moves across the throat during construction. A series of major blockades will be required for slewing the slow lines, construction of the flyover and connections at Manchester Piccadilly. Expected to trigger premature resignalling of the Manchester Piccadilly area with the associated disruption.</p> <p>Limited opportunities for diversion routes</p>
Manchester Piccadilly Platforms 15&16 and 9 to 12 enhanced access	<p>Two stage construction, blockades required to connect 15 & 16 and to reconnect the reconstructed 13 & 14. Blockade required to remodel Piccadilly East Jn.</p> <p>Divert traffic over 15 &16 while 13 &14 are reconstructed</p>
Ashburys – Guide Bridge four track	<p>A series of planned possessions to remodel track layout</p> <p>Limited opportunities for diversion routes</p>
Oxford Road	<p>Planned disruptive possessions to remodel track layout</p> <p>Limited opportunities for diversion routes</p>

Figure 6.3 Major disruption to rail services required by Option 2

During construction Option 2	
Manchester Piccadilly Platforms 15 & 16	<p>Blockades required to connect 15&16 Blockade required to remodel Piccadilly East Jn.</p> <p>Some diversions via Victoria will be possible if the Ordsall Chord is constructed first. Divert traffic over 15 &16 while 13 &14 are reconstructed</p>
Manchester Oxford Road	<p>36hr possessions to remodel track layout</p> <p>Some diversions via Victoria will be possible if the Ordsall Chord is constructed.</p>
Ordsall Chord	<p>Blockades required to connect affecting routes through Ordsall Lane Jn and Castlefield Jn</p> <p>Limited opportunities for diversion routes</p>
Manchester Victoria headways and new bay platforms	<p>New platform works to require planned possessions of Down and Up Salford lines for connections</p> <p>Diversion via Down and Up Chat Moss lines available</p>
Marple Linespeed Improvements	<p>Planned possessions.</p> <p>Various diversions available.</p>

Figure 6.4 Achievement compared to conditional outputs

Objective	Requirement			
	Sub objective	Generic to both options	Option 1 specific	Option 2 specific
1. Capacity and flexibility	Adequate capacity needs to be provided to accommodate Trend growth to 2019/20 in longer distance, commuting and other local rail journeys, with average crowding being no greater than implied by the capacity metrics for 2013/14 for Manchester in the Department for Transport’s 2007 High Level Output Specification for the rail industry	Delivered As identified in Chapter 5 the additional vehicles are likely to complement the additional frequencies and capacity exists for additional peak services.		Simplification of service pattern and reduced pressure on platforms at Manchester Piccadilly presents a greater opportunity for additional peak services than Option 1.
	For the Trend scenario after 2019/20 and in relation to the Trend Plus scenario, the identified Manchester Hub proposal should be ‘future-proofed’ to accommodate these higher growth rates without a requirement for further major infrastructure works beyond the identified proposals but through measures such as train lengthening	Delivered The strategy involves running more rather than longer trains, thereby retaining a future option to lengthen trains.	Ardwick Flyover, Manchester Piccadilly platforms, loops, Manchester Airport platforms, planned to be built to adequate length.	Ordsall Chord, loops, Manchester Airport and Manchester Victoria platforms, planned to be built to adequate length.
2. Carbon reduction	The net effect of the Manchester Hub proposals on the overall carbon trajectory for the transport sector which in due course will be adopted by Government should be demonstrated.	See separate carbon assessment, Section 6.4.4	-	-
	If possible, the effect of Manchester Hub in terms of in-service operation should be to contribute to the trajectory of reduced carbon emissions as set in national level overall targets for the transport sector.		-	-
3. Performance	Network performance should be such that delay minutes on franchised services in the Manchester area will not be worsened by meeting the Manchester Hub Conditional Outputs and that the performance of franchised rail services in the Manchester area is kept consistent with the High Level Output Specification and in line with targets set nationally		See 6.2.2 performance assessment consistent or slightly worse than December 2008 timetable.	See 6.2.2 performance assessment improvement on December 2008 timetable.
	In respect of Airport services, as the available evidence is that good reliability and performance is of particular significance to encourage rail use by airline passengers, the conditional requirement is to improve performance further as a priority	Additional platform(s) at Manchester Airport mitigate performance risk due to increase in the number of services	Airport services from the east have crossing moves in the Manchester Piccadilly area reduced.	Airport services from the east have crossing moves in the Manchester Piccadilly area removed, but crossing moves remain at Ordsall Jn and Castlefield Jn.

Requirement				
Objective	Sub objective	Generic to both options	Option 1 specific	Option 2 specific
4. Journey times	These are target journey times for the key corridors, from a Manchester City Centre station (either Manchester Victoria or Manchester Piccadilly) to the principal adjoining city regions:			
	Leeds 40 minutes	The maturity of the scheme for delivery in Control Period 4 (CP4) prevented detailed analysis at this stage.		Diverting to Victoria provides a benefit of five minutes compared to current timetable.
	Bradford 50 minutes, recognising route characteristics	Journey time analysis and high level cost assessment did not identify value for money interventions to deliver the target journey time in Control period 5 (CP5).	Incremental journey time improvement opportunities to be developed at a later stage.	Incremental journey time improvement opportunities to be developed at a later stage. Incremental journey time improvements to be developed
	Sheffield 40 minutes	Journey time analysis and high level cost assessment did not identify value for money interventions to deliver the target journey time in CP5.	Incremental journey time improvement opportunities to be developed at a later stage.	Incremental journey time improvement opportunities to be developed at a later stage.
	Chester 40 minutes	Journey time analysis and high level cost assessment did not identify value for money interventions to deliver the target journey time in CP5.	Incremental journey time improvement opportunities to be developed at a later stage.	Incremental journey time improvement opportunities to be developed at a later stage.
	Liverpool Lime Street 30 minutes	-	Assumes 90mph running between Huyton and Astley allowing a 32 minute journey time from Oxford Road	Assumes 90mph running between Huyton and Astley allowing a 33 minute journey time from Manchester Victoria or 30 minutes to Salford Central if Salford Central Liverpool line platforms are provided.
	Preston 30 minutes.	Journey time analysis and high level cost assessment did not identify value for money interventions to deliver the target journey time in CP5.	Incremental journey time improvement opportunities to be developed at a later stage.	Incremental journey time improvement opportunities to be developed at a later stage.

Requirement				
Objective	Sub objective	Generic to both options	Option 1 specific	Option 2 specific
5. Growth centres in Greater Manchester	From each principal rail corridor to each sub-area within the Regional Centre there should be either: a direct rail service; or a service that requires no more than a single interchange for onward travel by rail, Metrolink or Metroshuttle.	-	Compliant	Compliant
	From each principal rail corridor to each of the key town centres, there should be either, a direct rail service, or a service that requires no more than a single interchange, by rail or Metrolink.	-	Compliant based on a Calder Valley Corridor service reversing at Salford Crescent.	Compliant
	From each principal rail corridor to Salford Quays there should be a service that requires no more than a single interchange by bus or Metrolink	-	Compliant based on a Calder Valley Corridor service reversing at Salford Crescent.	Compliant
6. Connectivity to deliver economic benefits	All principal corridors to be connected if possible to the same station in Manchester city centre for easy passenger transfer (or through cross-Manchester operation), as well as other central area stations appropriate to the travel market.	-	Compliant based on a Calder Valley Corridor service reversing at Salford Crescent.	Compliant
	The improved connectivity should therefore be used:(a) where possible, to promote direct cross-city movements (for which train service provision and hence franchising costs will also generally experience cost efficiencies), or (b) where this cannot be done, to facilitate convenient passenger interchange. This is best done at a single Manchester city centre station to avoid circuitous, time consuming/counter-intuitive routeing.	Both options seek to maximise cross city movements.	-	-
7. Manchester Airport	The requirement is for direct services of at least hourly interval service frequency in each of the principal corridors (30 minutes in the case of the Yorkshire and the Humber and North East via Leeds corridor)...	Compliant	-	-
	... on a 7 day/week basis ...	Compliant	-	-
	... with service start and finish time giving 95 % of air passengers the option of using rail for their inbound and outbound legs	Infrastructure is available to support services in 2009. The services level is not currently specified in the franchises.	-	-

Requirement				
Objective	Sub objective	Generic to both options	Option 1 specific	Option 2 specific
8. Trans Pennine	Leeds – Manchester a 15 minute interval service (or better)	-	Compliant	Compliant
	Sheffield – Manchester a 20 minute service interval	The opportunity is identified for up to four trains per hour running in half hourly pairs from South Yorkshire and the East Midlands.	-	-
9. North south links and high speed rail	To meet forecasts and requirements for a doubling of West Coast Main Line demand by 2026	Study assumed future West Coast timetable being developed as part of the Stafford project for 2016 at Manchester.	-	-
	with such provision as indicated as being appropriate by the National Networks Strategy Group, to accommodate High Speed 2 (HS2) options to and beyond central Manchester, together with a possible parkway station	-	See 6.2.4 requires passive provision. Compliant	See 6.2.4 compliant
10. Freight	Provision for a doubling of freight tonnage from existing and new origins and destinations to/from the multi-modal terminals at Trafford Park and elsewhere in the North West by 2030.	The additional freight paths provided to and from Trafford Park are adequate to meet the forecast of 2030 freight traffic	Compliant	Compliant

Figure 6.4 demonstrates that both strategic options provide have a broadly consistent level of performance against the conditional outputs.

6.4 Economic evaluation

Detailed economic appraisal has been completed for both strategic options and in this section the review will focus on the differences in;

- Capital costs
- Operating costs
- Benefits

In addition the analysis will demonstrate the economic justification for both options against the DfT appraisal framework.

6.4.1 Capital costs

The respective capital costs of the strategic options at 2009 cash prices and exclusive of property costs are in the region of;

Option 1	£790m
Option 2	£530m

6.4.2 Operating costs

The service specification developed to prove the concept of the strategic options provides similar service opportunities with two significant differences that impact on the operating costs and associated need for revenue support.

In Option 1 Fast services from Manchester to Liverpool alternate between use of the Chat Moss and CLC routes. In Option 2 the absence of a link between Victoria and the CLC route, and route the inability to identify a likely scheme, results in all four fast services running via the Chat Moss route and additional services are provided on the CLC route in their place.

As a result the operating cost of Option 1 is less than Option 2 by £4 million per year at 2009 prices. The annual operating cost for Option 1 is £38.8 million compared to £42.8 million for Option 2.

The service specification on which the appraisal was based has scope for further refinement, to increase benefits and revenue and reduce operating costs. This can be done at later development stages of the Manchester Hub project.

6.4.3 Differences in the benefits

Although the two options deliver broadly the same net volume of benefits the corridors in which these benefits are generated varies between the two options. Option 1 sees flows to and from corridors currently well connected to Manchester Piccadilly benefiting, as this option delivers improved journey opportunities via Manchester Piccadilly. Option 2 provides improved integration between the corridors connecting to Manchester Victoria, largely to the north of Manchester, with the

wider inter-regional and inter city rail network. The following bullet points summarise where there is a key difference in the benefits generated and the reasons for this difference.

- Travel from central Manchester is more attractive in Option 2 because journey opportunities away from the city centre are available from the three central Manchester stations to all corridors. Further journeys from Manchester to Liverpool and Leeds are quicker from Manchester Victoria in Option 2.
- Commuter corridors from north east Manchester generate greater benefit in Option 2 because this option offers direct connection to Liverpool and a quicker direct connection to the south side of Manchester. This reflects the greater growth on commuter services on northern corridors referenced in 4.2.3.
- Journeys from the Sheffield corridor to Manchester are quicker in Option 1. This is because the journey times from Manchester Piccadilly to Sheffield are two minutes quicker than from Manchester Victoria and in Option 1 all Sheffield trains operate from Manchester Piccadilly. It has therefore been concluded that Sheffield to Manchester and Manchester Airport journeys must be via Manchester Piccadilly; in Option 2 this sees the Manchester and Manchester Airport train running at 30 minute intervals to Manchester Piccadilly with the journeys beyond Manchester running via Manchester Victoria on the alternate pair of services also at 30 minute intervals.
- Journey opportunities from the West Coast Main Line (WCML)/Welsh Borders/south Manchester to Huddersfield, Leeds and beyond are better in Option 1. These flows from the WCML and Wales to the Leeds corridor require a connection at Manchester Piccadilly. There are four trains per hour from Manchester Piccadilly to the Leeds corridor in Option 1, whereas there are only two in Option 2, with longer journey times via Manchester Victoria.

6.4.4 Carbon appraisal

In response to conditional output 2 a carbon assessment of the strategies was carried out. This was consistent with WEBTAG appraisal criteria for reduction in road vehicle mileage as a result of modal shift to rail and Department for Environment, Food and Rural Affairs (DEFRA) guidance on the carbon impact of vehicles. The resultant appraisal identified a reduction of 1.98 million tonnes of carbon over 60 years from implementation of the Manchester Hub based on current traction type and performance.

6.4.5 Net present value appraisal of costs and benefits

Figure 6.5 shows the net present value of the annual benefits and costs associated with Options 1 and 2 over a 60 year appraisal period. For appraisal purposes, following DfT guidelines figures have been discounted to 2002 values using historic inflation rates. Benefits have been uplifted by assumed passenger growth in future years and indices consistent with WEBTAG

guidance and previous Route Utilisation Strategy (RUS) analysis have been used to estimate how operational costs, capital costs and non user benefits might change over the appraisal period.

Current WEBTAG guidelines do not include wider economic benefits in calculating the Benefits Cost Ratio (BCR), although from April 2010 they are included. As a result in appraising the Manchester Hub wider economic benefits have been included in the BCR.

Including the revenue benefits the two strategic options deliver significant benefit; £4.01 billion present value in Option 1 and £4.23 billion present value in Option 2. As can be seen both options represent high value for money with the difference in the benefits cost ratio being driven by difference in capital cost for the two schemes and the increased benefits in Option 2 described in 6.4.3.

Figure 6.5 Appraisal table

60 year appraisal	Option 1 PV £m	Option 2 PV £m
Costs (Present value)		
Investment cost	859.7	578.2
Operating cost	768.9	849.9
Revenue	-474.5	-491.5
Total costs	1,154.1	936.7
Benefits (Present value)		
Rail users benefits	1,581.2	1,601.5
Non users benefits	454.1	473.8
Crowding benefits	909.7	1,018.5
Other government impacts	-121.6	-126.0
Wider economic benefits	713.4	766.2
Total quantified benefits	3,536.8	3,733.9
NPV	2,382.7	2,797.3
Quantified BCR	3.1	4.0

Note: All figures are presented in 2002 market prices

Chapter 7 Conclusions



The assessment work has identified that both Option 1 and Option 2 represent credible packages for enhancing rail services across the North. In 2009 prices, Option 1 has a capital cost in the region of £790 million and Option 2 £530 million, excluding property costs.

Both Option 1 and 2 deliver substantial economic benefits. Over a 60 year appraisal period Option 2 delivers greater benefit than Option 1.

Both strategic options have a value for money case. Following Department for Transport (DfT) criteria both Option 1 and Option 2 have a high value for money case.

As well as being cheaper to implement, the economic appraisal indicates that Option 2 also has a better value for money case.

Greater risk is associated with the cost of Option 1. In particular, it has greater land purchase and greater compensation payments due to disruption to train operations during construction. In terms of train performance, Option 2, with its increased use of Manchester Victoria, is an improvement over the current position. Option 2 also provides opportunities to phase the interventions either to minimise disruption during the construction works or to reflect affordability. The assessment of risk and disruption during construction reinforces the case for Option 2 over Option 1.

In terms of wider economic benefits to the North of England and meeting the conditional outputs Option 2 outperforms Option 1. The issues of network performance and connectivity for the Calder Valley corridor are particular distinguishing differences.

Given the common nature of interventions on the radial routes at this stage in the development of the Manchester Hub the critical strategic decision is the strategy through the core central area.

In the light of the analysis it is therefore concluded that strategic Option 2 be taken forward for further development through the Guide to Railway Investment Projects (GRIP) stages to inform Network Rail's Initial Strategic Business Plan in 2011 and the High Level Output Specification to be issued in 2012 for delivery in Control Period 5 (CP5). This further development work will include opportunities for aspects of Option 1 to be combined with Option 2 to provide additional benefits.

Through Option 2 the Manchester Hub offers the potential for significant improvements to rail services, which are detailed in **Chapter 8**.

To realise the benefits identified in the study Network Rail intends to work with DfT and stakeholders through the feasibility stage of the Manchester Hub project to develop the opportunities to:

- Improve the journey time on the North trans Pennine route to the North East and Yorkshire and the Humber.
- Develop the plans for key commuter corridors further in the light of the ongoing work with DfT, Northern and Greater Manchester Passenger Transport Executive (GMPTX) on Greater Manchester passenger forecasts.
- Develop the plans in conjunction with the Developing a Sustainable Transport System, (DaSTS) studies which include; Trans Pennine, Access to Manchester, Access to Leeds and North West Connectivity.
- Review the further opportunity for the services from south Manchester to West Yorkshire and beyond.
- Refine the proposed direct connections both between cities in the North and the commuter network to maximise benefits across the North.
- Review the strategy in the light of emerging proposals on electrification from the Network Route Utilisation Strategy (RUS) Electrification strategy.
- Refine the proposal in the light of proposed rolling stock strategy developed through the Network RUS Depots and Rolling Stock strategy to be published for consultation in November 2010.
- To develop the opportunities for freight in line with the ongoing work developing the plans for the Strategic Freight Network beyond 2014.
- Through the Northern RUS to review the opportunities outside of the study area
- To identify opportunities for incremental journey time improvements, through linespeed improvements associated with maintenance and renewal activity.

Network Rail will now take the development of the Manchester Hub forward through Network Rail's project development process linking to the following timescales as part of the development of plans for delivery in CP5:

Summer 2010	Industry view of initial CP5 options
September 2010	Draft Northern RUS
Summer 2011	Initial Strategic Business Plan
June 2012	High Level Output Specification CP5.

Chapter 8

Opportunities for service improvements from the preferred option



8.0 Opportunities

The provision of the infrastructure in Option 2 provides significant opportunity for train service improvements, which are detailed below. These improved services and links could be implemented at any time once the infrastructure is in place. This would depend on future growth in demand, the business case for each incremental service enhancement and affordability should additional subsidy be required.

8.1 London, Birmingham and the south

- additional capacity to Manchester to meet the plans for the West Coast Main Line. This could be an additional stopping service between Manchester and Birmingham and reduced journey time for an existing service
- does not close off options for trains from a high speed line in the future to arrive in Manchester.

8.2 Inter-regional and trans Pennine service

- Leeds, York and Hull:
 - six trains per hour from Leeds and beyond. Opportunity for four fast trains with only one or two stops thereby improving journey times
 - faster journey time to and through central Manchester
 - increased frequency provides opportunity for new direct services to Liverpool, Chester, Preston or Manchester Airport.
- The North East (Newcastle and Middlesbrough):
 - opportunity for new direct services beyond Manchester
 - improved journey times through use of the four fast trains on North trans Pennine
 - improved performance of services to Manchester Airport
 - improved connections for onwards journeys at Leeds, Huddersfield and Manchester Victoria.
- South Yorkshire (Sheffield and Doncaster):
 - faster journey time to Manchester Piccadilly by around five minutes
- increased frequency for up to four trains per hour running as two pairs, one in each pair to Manchester Piccadilly and Manchester Victoria respectively
- increased direct services beyond Manchester to Liverpool, Chester or Preston via Victoria with journey time improvements via the Chat Moss route.
- East Midlands (Derby, Leicester and Nottingham):
 - two trains per hour to Manchester
 - faster journey time to Manchester Piccadilly by around five minutes
 - improved connections beyond Manchester (via Victoria) making use of the improved journey time to Liverpool via the Chat Moss route
 - potential for one train per hour to run direct to Manchester (avoiding Sheffield) with resultant journey time improvement without worsening current East Midlands to Sheffield connectivity.
- Bradford and Halifax:
 - two trains per hour crossing Manchester to Manchester Airport and Liverpool or Chester
 - improved connection through Manchester Victoria and Manchester Piccadilly.
- Liverpool:
 - improved journey time of 33 minutes to Manchester Victoria
 - four fast trains per hour between Manchester Victoria and Liverpool Lime Street
 - improved connections for inter-regional destinations at Manchester Victoria
 - access to Manchester Airport via Warrington Central.
- Chester:
 - doubled frequency to two trains per hour
 - direct service across Manchester to destinations such as Manchester Airport, Bradford, Sheffield and Leeds
 - incremental journey time improvements as a result of works on the Chat Moss route.

- The North West (Preston and beyond):
 - additional services from Manchester to Preston and destinations to the north
 - capacity for electrified services to operate via Chat Moss route and West Coast Main Line (WCML) with the ability to provide a fast service between Wigan and Manchester.

- opportunity, if infrastructure is funded, for more frequent service to Eccles by way of loop or turnback.

- CLC Route:
 - potential for additional services
 - potential to review stopping pattern which may improve frequency at some stations – but trades off journey time
 - potential to consider stations at White City/Cornbrook.

- Northwich:
 - more off-peak services closer to Greater Manchester
 - faster journey time to key locations
 - potential for Greenbank - Altrincham to be linked to Ashton/Guide Bridge.

- Crewe:
 - potential for extra peak capacity when needed
 - more frequent service to Manchester Airport
 - Heaton Chapel/Levenshulme could see return to 15 minute all day pattern.

- Stoke-on-Trent
 - new direct service to Manchester Airport
 - potential for faster services serving Manchester from Congleton/Kidsgrove depending on stopping pattern of the all day Birmingham slow service.

- Buxton/Hazel Grove:
 - potential for additional services all day or peak only
 - More off peak services beyond Hazel Grove (could be to Buxton or to Chinley)
 - modest improvement in journey times – dependent on stopping patterns
 - potential for long distance services to call at Hazel Grove and or Chinley all day or peak only
 - potential for a new station at Chapel-en-le-Frith on the Great Rocks line
 - better faster connections to Sheffield and the East Midlands from Manchester and potentially from Hazel Grove and Chinley dependent on stopping patterns.

- Marple:
 - potential for more peak services to Marple, Rose Hill and New Mills Central
 - potential to improve services to Ardwick if viable
 - more all day services to Chinley – with connections there to Sheffield and the East Midlands

- potential for (additional) services to go to Manchester Victoria, and for new station at Eastlands.

- Glossop/Hadfield:
 - more all day services in Greater Manchester
 - significant increase in service frequency from Guide Bridge to Manchester
 - potential for some services to go to Manchester Victoria if electrified
 - ability to increase overall frequency if services alternate between Glossop and Hadfield.

- Huddersfield and Stalybridge:
 - potential for more peak or all day services to Stalybridge from Manchester Victoria and or Manchester Piccadilly
 - commuter services to Huddersfield from Manchester Piccadilly in lieu of Manchester Victoria
 - a link created between Stalybridge and Guide Bridge
 - more frequent trans Pennine trains call at Stalybridge
 - inclusion of Ashton-under-Lyne in the trans Pennine network
 - potential for new station and turnback facility at Diggle facilitating additional services
 - potential for electrification to Stalybridge allowing electric through working from beyond Manchester Victoria
 - increased frequency east of Huddersfield.

- Manchester Loop;
 - 15 minute pattern Manchester Victoria – Oxford Road – Manchester Piccadilly – Manchester Airport
 - potential to include Salford Central if Liverpool line platforms provided
 - potential for a station at Eastlands with services working through Manchester Victoria.

8.4 Manchester Airport

- provide opportunity for new direct connections such as to Bradford, Halifax, Chester, Stoke-on-Trent and Warrington
- improved cross Manchester capacity and platform provides additional capacity for services
- improved city centre dispersal through Manchester Piccadilly, Oxford Road and Manchester Victoria
- improvement in performance through the simplification of the operation at Manchester Piccadilly.

8.5 Freight

- doubling the number of paths from the West Coast Main Line to Trafford Park meeting the 2030 freight forecast
- provision of an hourly path on the Chat Moss route to serve developments at Port Salford and Parkside.

8.3 Key commuter corridors

- Rochdale/Calder Valley:
 - additional all day services to Rochdale from Manchester and Leeds
 - direct services to destinations beyond Manchester Victoria such as Manchester Airport and Wigan
 - increased frequency of services between Halifax and Leeds
 - capacity for services from Burnley via Todmorden if investment at Todmorden is funded.
- Bolton Corridor:
 - potential to alleviate peak crowding through services via WCML for Preston and north
 - potential for more services to work through to destinations beyond Manchester Victoria, such as the East Midlands
 - faster journey times to Wigan from additional services via WCML
 - opportunity for more all day services to Blackburn if investment at Darwen is funded.
- Atherton Line:
 - potential for additional services in the peak
 - faster journey times to Atherton and potentially other significant stations
 - potential to alleviate peak crowding as Wigan passengers travel via WCML
 - potential for through working to destinations beyond Manchester Victoria to destinations such as Bradford.
- Chat Moss Route:
 - significantly faster more frequent direct links between Liverpool and Manchester
 - more frequent fast services between Wigan and Liverpool
 - faster local journeys due to electrification with scale dependent on stopping pattern
 - more frequent service between stations to Chester and central Manchester

Glossary



Absolute block	A form of railway signalling
Hope Valley	The route from Dore to Edgeley Jn Stockport
North Trans Pennine	The route from Manchester to Leeds, York, Hull and the North East via Huddersfield
CLC	The route from Manchester to Liverpool via Warrington Central
Chat Moss	The route from Manchester to Liverpool via Newton-le-Willows
Calder Valley	The route from Manchester to Bradford via Rochdale and Halifax
GRIP	Guide to Railway Investment Projects, Network Rail's project development framework.
WEBTAG	DfT's Transport Analysis Guidelines defining the appraisal criteria for transport projects

Appendices



Appendix A

Details of formal stakeholder meetings and invitees

The Steering Group membership was as follows:

Name	Title	Organisation
Peter Strachan (until January 2009)	Route Director London North Western	Network Rail (Chair)
Jo Kaye (from January 2009)	Route Director London North Western	Network Rail (Chair)
Vernon Barker	Managing Director	First TransPennine Express
Heidi Mottram	Managing Director	Northern Rail
Rob Warnes	Performance and Planning Director	Northern Rail
Nick Gibbons	National Planning Manager	DB Schenker
Nicky Mailey	Head of Regional Transport	Government Office of the North West
David Leather	Chief Executive	Greater Manchester Passenger Transport Executive (GMPTEx)
Stephen Clark	Deputy Clerk	Greater Manchester Integrated Transport Authority (GMITA)
Brian Welch	Policy Manager Cities and Regions Rail	Department for Transport (DfT)
Stuart Baker	Divisional Manager (National) Rail Projects	Department for Transport (DfT)
John Jarvis	Transport Project Director	The Northern Way
Richard Eccles	Head of Network Planning	Network Rail
Tom Wadsworth	Communications Manager	Network Rail
Graham Botham	Principal Commercial Scheme Sponsor	Network Rail
Richard Donaldson	Commercial Scheme Sponsor	Network Rail
Emma Pemberton-Eccles	Public Affairs Manager	Network Rail

The Steering Group met on the following occasions:

- 8 September 2008
- 5 November 2009
- 13 January 2009
- 5 March 2009
- 8 May 2009
- 29 June 2009
- 7 August 2009
- 17 September 2009
- 15 October 2009
- 16 November 2009
- 10 December 2009

The Working Group drew on the following people for working level discussions;

Name	Organisation
Richard Donaldson	Network Rail (chair)
Peter Warhurst	Northern Rail
David Langton	First TransPennine Express
Jonathan Dunster	Virgin Trains
Stan Kitchin	DB Schenker
Nick Gibbons	DB Schenker
James Carter	CrossCountry
Peter Leppard	Arriva Trains Wales
Jon Ratcliffe	Arriva Trains Wales
Tom Jones	Freightliner
Simon Taylor	East Midlands Trains
Lanita Masi	East Midlands Trains
Julian Daley	Merseytravel
Chris Loader	GMPTe
Neil Chadwick	Northern Way
Graham Botham	Network Rail
Simon Hughes	Network Rail
Adrian Bocking	Network Rail
James Angus	Network Rail
Paul Prescott	Network Rail
Bob Casselden	Network Rail
Alastair Hutchinson	Network Rail
John Haith	Network Rail

In addition to ad-hoc discussions on specific issues throughout the study the group or subgroups met on the following occasions;

- 11 February 2009
- 24 February 2009
- 18 March 2009
- 26 June 2009
- 30 June 2009
- 1 July 2009
- 18 September 2009

Wider Stakeholder meetings were held on 15th May 2009 and 17th September 2009 involving the following attendees:

Name	Organisation
James Jarrett	4NW
Peter Leppard	Arriva Trains Wales
Mike Cliffe	Blackburn with Darwen Borough Council
Chris Farrow	Central Salford URC
Jim Wensley	Central Salford URC
Paul Griffiths	Cheshire East Council
Andrew Ross	Cheshire East Council
Christine Garner	Cheshire West and Chester Council
James Carter	CrossCountry
Nick Gibbons	DB Schenker
Kevin Williams	Derbyshire County Council
Brian Welch	DFT
Simon Taylor	East Midlands Trains
Barry Davies	East Midlands Regional Assembly
David Langton	First TransPennine Express
Chris MacRae	Freight Transport Association
Stephen Clark	GMITA
David Leather	GMPTe
Steve Eccles	Halton Borough Council
Chris Anslow	Lancashire County Council
Bob Longworth	Manchester Airport
Jon Bottomley	Manchester Airport
David Stopher	West Yorkshire Passenger Transport Executive (Metro)
David Marshall	North East Councils
Roger Jones	North West Rail Campaign
Emma Antrobus	North West Rail Campaign
Rob Warnes	Northern Rail
Ian Wray	North West Development Authority (NWDA)
Claire Jones	NWDA
Beverley Doward	NWDA
Simon Dove	ONE North East
Warren Marshall	Peel Airports
Neil Chadwick	Northern Way
Stephen Skeet	South Yorkshire Passenger Transport Executive
John Jarvis	The Northern Way
Jon Dunster	Virgin Trains
Steve Hunter	Warrington Borough Council
Mike Padgett	Yorkshire and Humber Assembly
Michael Padgett	Yorkshire Forward

Appendix B

Infrastructure interventions considered

This appendix summarises the engineering interventions that have been considered as part of the Manchester Hub Study Phase Two.

For each intervention, the outline scope, and functionality is shown. Interventions are arranged into three groups: those that form the Option 1 set, those that comprise the Option 2 set and those that have not been progressed for this study.

Schedule of Engineering Interventions

Phase 2 Report ref	Scheme	Scope	Railway System Capability Benefit	Option set
5.1	Adswold Road – Cheadle Hulme four tracking	Provide two extra tracks over one mile including a viaduct.	Removes or reduces junction conflict to release capacity	none
5.2a	Edgeley Grade Separation (Cheadle Curve)	Diverts services from Buxton & Hope Valley via Up & Down Cheadle line through a new link to the west side of Edgeley Jns	Removes or reduces junction conflict to release capacity	none
5.2b	Edgeley Grade Separation (Flyover)	Creates a flyover at Edgeley No 1 Jn for services from the Hazel Grove direction	Removes or reduces junction conflict to release capacity	none
5.3	Rehanding the running lines Adswold Road Jn to Slade Lane Jn	Remodel from Slade Lane to Cheadle Hulme to pair tracks by destination.	Removes or reduces junction conflict to release capacity. Benefit not proven – issues with stopping services	none
5.4	Slade Lane Six Track	Add two extra tracks between Slade Lane Jn and Manchester Piccadilly	Removes or reduces junction conflict to release capacity	none
5.5	Slade Lane – Ardwick improved Headways	Speed changes and signal respacing to deliver two to two and a half minute headways	Capacity	none
5.6	Ardwick Grade Separation	Takes traffic from Ashburys over the main line using a new flyover to join near Mayfield Good Loop	Reduced conflict from crossing moves.	none
5.7a	Ardwick Flyover – reduced conflict version	As 5.6, but with a forked ramp at the Mayfield end to straddle the slow lines.	Further reduced conflict from crossing moves	1
5.7b	Ardwick Eastern Flyover	The fast lines diverge near Longsight North Jn onto new viaduct up and over the Ashburys Line. Terminates in new platforms on the East side of Manchester Piccadilly station.	Capacity relief for Ardwick Jn, removal of some conflicting moves and new station facilities.	none
5.8	Midland Curve	Provides a connection between Manchester Victoria and Manchester Piccadilly via Phillips Park using the Midland Curve viaduct. Scope assessed includes two additional lines into two additional platforms at Manchester Piccadilly.	Improved connectivity, reduced conflict at Ardwick Jn.	none

Phase 2 Report ref	Scheme	Scope	Railway System Capability Benefit	Option set
5.9	Manchester Piccadilly Platforms A, B etc	Additional terminal platforms to the east of the current station and included in 5.8 and 5.7b	Additional platform capacity at Manchester Piccadilly	None
5.10	Manchester Piccadilly platforms 15 & 16 only	Provides two additional 200 metre through platforms parallel to existing platforms 13 and 14.	Increased capacity (+25%) on the Castlefield corridor by easing the ruling constraint – which is P13 & 14 reoccupation times.	2
5.11	Manchester Piccadilly platforms 15 & 16 and remodel access to platforms 9-14	As 5.10, but remodels platforms 13 and 14 too to permit a doubling of the connection into the terminal platforms 9 to 12.	As 5.10, but also provides more terminal platform capacity through ability to better access platforms 9 to 12.	1
5.12	Manchester Oxford Road platform capacity	Switch & Crossing (S&C) remodelling, associated signalling and overhead line works and platform lengthening.	Increases through capacity at Manchester Oxford Road to match that provided by 5.10 or 5.11.	1 and 2
5.13	Castlefield four-tracking	Parallel viaduct to the south of the existing alignment.	Increases through capacity (provided 5.10 or 5.11 and 5.12 are also delivered) but is not the ruling constraint.	none
5.14	Western entrance to Trafford Park terminal	Additional electrified loops and S&C to permit access to the west. Requires either 5.15 or 5.16 too.	Potential for relief of capacity on the Castlefield corridor. Supports diversion of freight to the West Coast Main Line (WCML) at Warrington or Winwick Jn.	none
5.15	New link between Padgate and the WCML	Reinstatement of twin track railway, electrified, on extant corridor at Warrington and new junctions at Padgate and on the WCML	As 5.14.	none
5.16	New link from Glazebrook to Kenyon	Reinstatement of twin track railway, electrified, on substantially extant corridor and new junctions at Kenyon on the Chat Moss line.	As 5.14.	none
5.17	Manchester Airport additional platform	Provision of a fourth platform and associated infrastructure.	Additional platform capacity for airport services.	1 and 2
5.18	Ordsall Curve	A two track chord line between Up and Down Chat Moss lines and the Up and Down Bolton line.	Provides a direct rail connection between Manchester Victoria and Manchester Piccadilly stations. Improved connectivity and access from the North and East to Manchester Airport. Reduced crossing conflicts at Ardwick Jn	2
5.19	Ordsall Grade Separation	Flyover for the Up and Down Chat Moss over the up and Down Bolton lines at Ordsall.	Improved capacity from reduced crossing moves conflict at Ordsall Lane Jn.	none
5.20	Salford additional platforms	Two additional six-car platforms at Salford Central station on the existing Liverpool lines alignment with access and egress arrangements.	Facility for additional stop in the central Manchester/Salford conurbation	none
5.21	Manchester Victoria – Stalybridge electrification	Extend planned electrification from Manchester Victoria to Stalybridge	Enables Chat Moss electric services to pass through Manchester Victoria to release capacity.	none

Phase 2 Report ref	Scheme	Scope	Railway System Capability Benefit	Option set
5.22	Astley headways	Elimination of headway constraint arising from user worked level crossing at Astley Signal Box through provision of an overbridge.	Remove headway constraint to improve capacity	2
5.23	Manchester Victoria Headways	Speed change and associated signalling alterations to implement a 25/35mph differential maximum speed.	Remove headway constraint to improve capacity	2
5.24	Manchester Victoria Bay platforms	Provide two new six-car platforms at Manchester Victoria connected to the Up Salford near Victoria West Jn	Terminal platforms for services to/from the North West. Releases capacity on the through platforms.	2
5.25	Chat Moss linespeed increases (LSI)	All disciplines scope from LSI to 90mph between Huyton and Astley.	Improved journey times	1 & 2
5.26	Broad Green – Huyton four-tracking	Two additional electrified tracks over two miles, including Roby and Huyton stations, with associated resignalling	Improved capacity allowing freight and stopping services to recess.	2
5.27	St Helens Central electrification	Extend electrification.	Allows electric services to operate between Huyton and Wigan	none
5.28	Golborne Jn speed increase	Increase the speed of turnouts and crossovers in the Golborne area	Increases junction capacity and improves journey time.	none
5.29	Manchester - Chester LSI	All disciplines LSI scope	Journey time saving between Manchester and Chester	See 5.11.6
5.30	Manchester - Preston LSI	All disciplines LSI scope	Journey time saving between Manchester and Preston via Bolton	See 5.11.6
5.31	Bolton Loops	Loops on the Bolton Line by creating Platform 1 and Platform 5 as loop platforms	Improved service frequency possible to Bolton and beyond	none
5.32	Salford Crescent	Control Period 4 (CP4) works	Extra capacity at Salford Crescent assumed in CP4	none
5.33	Castleton Jns to Bury	Remodel Junction at Castleton South, and other works	Allows trains to operate between East Lancs and Victoria.	none
5.34	Rochdale bay platform	Remodel Rochdale to allow a bay platform in which to reverse towards Manchester	Increases capacity on Calder Valley line	1 and 2
5.35	Manchester - Bradford LSI	All disciplines LSI scope	Journey time saving between Manchester and Bradford	See 5.11.6
5.36	Headway improvement Calder Valley	Improve headways on Calder Valley,	Increases capacity on Calder Valley	none

Phase 2 Report ref	Scheme	Scope	Railway System Capability Benefit	Option set
5.37	Stalybridge - Leeds LSI	Dependent on output from the CP4 scheme	Journey time saving between Manchester and Leeds	none
5.38	Victoria – Stalybridge LSI	All disciplines LSI scope	Journey time saving between Manchester Victoria and Stalybridge	none
5.39	Dewsbury Up loop	Reinstate Up loop through Dewsbury station	trans Pennine capacity benefits	1 and 2
5.40	Marsden to Diggle four-tracking	Reinstate track between Diggle and Marsden in the disused bores of Standedge tunnel	trans Pennine capacity benefits	1 and 2
5.41	New Mills Central – Manchester Victoria LSI	S&C renewal and remodelling and signals respacing.	tmproved speeds for trans Pennine and commuter services	2
5.42	LSI Ashton Moss – Heaton Norris Jns	All disciplines LSI scope	Journey time saving	none
5.43	Chinley loops	Station works and addition of two passing loops	trans Pennine capacity benefits	1 and 2
5.44	New Station at Chapel-en-le-Frith	Provide new station in Chapel-en-le-Frith	Capacity benefit from allowing slow trains to get off the main line	none
5.45b	Dore Jn doubling	Track, civils & signals to double the chord between Dore Station Jn and Dore West Jn, including Dore & Totley station.	Improved speed and capacity on Hope Valley services	1 and 2
5.45a	Grindleford loops	Station works and addition of two passing loops	Improved capacity for Hope Valley services	1 and 2
5.46	Manchester - Sheffield LSI	All disciplines LSI scope	Journey time saving between Manchester and Sheffield	See 5.11.6
5.47	Roby conversion three to four-aspect signalling	Signalling scope. Included in 5.26 in Option 2	Capacity benefit on Chat Moss line.	1
5.48	Ashburys to Guide Bridge four-tracking	Remodelling work and four-tracking over 3.5 miles	Capacity	1

Appendix C

The modelled timetable

A summary of the off-peak pattern of the service that was modelled is provided below. With the exception of the Chat Moss route, the level of service provision on the corridors remained the same in both the options considered, the big difference being how the services were handled in the centre.

Long distance

- London service - 20 minute frequency fast – two trains per hour (tph) via Stoke-on-Trent and one tph via Crewe
- Birmingham service - 30 minute frequency fast – one tph via Stoke-on-Trent and one tph via Crewe
- Trafford Park freight - two tph from the WCML
- Bootle Branch – Earlestown – WCML freight two tph
- Ordsall Lane Jn – WCML freight two tph: with one from beyond Victoria.

Inter-Regional and trans Pennine

The pattern of inter-regional services from Manchester that was modelled is as below, noting that many of the services work through Manchester to create through links:

- Leeds and further north east via Huddersfield – four tph fast and two tph semi-fast
- Hope Valley – 4 tph fast: two via Stockport, and one via Dore South Curve
- Leeds via Bradford / Halifax and Calder Valley half hourly fast, one tph semi-fast
- Leeds via Brighouse and Calder Valley – one tph semi-fast
- Preston – four tph fast - two via Wigan and WCML, two via Bolton: one service originating from Scotland alternating between Edinburgh and Glasgow
- Liverpool –
 - Option 1 (see 5.11) two tph fast via Chat Moss, two tph semi-fast via CLC
 - Option 2 (see 5.11) becomes four tph fast via Chat Moss, two tph semi-fast via CLC
- Liverpool - Preston – half hourly fast via St Helens Central
- Chester and further west – half hourly
- Cardiff – one tph
- Birmingham via Stoke-on-Trent and Macclesfield one tph.

The impact of these additional inter-regional services on the existing timetable is summarised by Figure C.1

Figure C.1 Inter-regional services

	Option	Services to Manchester	Destinations in modelled option				
			MA*	Other direct destinations			
Sheffield	Base	2	1	Liverpool 1			
	1	4	1	Liverpool 2	Preston 1		
	2	4	1	Liverpool 2	Preston 1		
Leeds	Base	4	2	Liverpool 1			
	1	6	2	Liverpool 2	Chester 1	Southport 1	
	2	6	2	Liverpool 2	Chester 1	Southport 1	
Bradford (from Leeds)	Base	2	-	-			
	1	4	1	Preston 1			
	2	4	1	Liverpool 1	Preston 1	Wigan	
Liverpool	Base	3	1	Norwich 1	Scarborough 1		
	1	4	-	Norwich 1	Scarborough 1	Doncaster 1	Hull 1
	2	6	1	Norwich 1	Scarborough 1	Doncaster 1	Hull 1
Chester	Base	1	-	-			
	1	2	1	Leeds 1			
	2	2	1	Leeds 1			
Preston	Base	2	2	-			
	1	4	2	Leeds via Bradford 1	East Midlands 1		
	2	4	2	Leeds via Bradford 1	East Midlands 1		
Cardiff	Base	1	-	-			
	1	1	-	-			
	2	1	-	-			
Birmingham	Base	-	-	-			
	1	1	-	-			
	2	1	-	-			

* Manchester Airport

Manchester Airport

Ten tph from Manchester and beyond, two tph from Crewe and beyond:

- half hourly from Leeds via Huddersfield: one from Newcastle and one from Middlesbrough
- half hourly from Preston: one from Scotland and one from Blackpool
- half hourly stopping service from Liverpool
- half hourly from Crewe with one starting from Stoke-on-Trent
- hourly from Cleethorpes via Sheffield
- hourly from Southport via Salford Crescent
- hourly from Chester via Manchester
- hourly from Bradford and Halifax

Key Commuter Corridors

- Manchester Airport 10 tph
 - eight tph fast inter-regional services
 - half hourly all stops
- Stockport Corridor – 16 tph
 - nine tph fast long distance or inter-regional services providing for commuters at Chinley, Hazel Grove, Macclesfield, Wilmslow, Stoke-on-Trent and Crewe
 - Alderley Edge half hourly, one from Crewe
 - Macclesfield hourly
 - Buxton two tph
 - Northwich line, two tph
- Marple Corridor – six tph
 - two tph fast inter-regional services
 - Marple one tph
 - Rose Hill one tph
 - Chinley half hourly, one from Sheffield on alternate hours
- Hadfield line four tph
 - Hadfield half hourly
 - Glossop half hourly

- Diggle route eight tph
 - six tph fast or semi-fast inter-regional services providing for commuters at Ashton-under-Lyne, Stalybridge, Huddersfield and Dewsbury
 - Stalybridge half hourly, one from Huddersfield (destination Manchester Victoria in Option 1 and destination Manchester Piccadilly in Option 2)
 - Huddersfield – Leeds half hourly
 - one tph Calder Valley via Brighouse fast to Leeds
- Manchester – Leeds via Calder Valley and Bradford six tph
 - four tph fast or semi-fast inter-regional
 - Manchester - Rochdale half hourly
- Bolton Corridor seven tph
 - two tph fast inter-regional providing services at key commuter stations and with on train capacity eased by two more via WCML
 - Preston half hourly
 - Blackburn one tph
 - Wigan via Bolton half hourly both from Southport
- Atherton Line three tph
 - on train capacity eased from two fast inter-regional via WCML
 - Wigan via Atherton half hourly slow, one from Kirkby
 - Wigan one tph semi-fast
- Lime Street – Wigan via St Helens Central four tph
 - half hourly fast inter-regional
 - half hourly Wigan
- Chat Moss four tph Option 1, six tph Option 2
 - half hourly or quarter hourly fast inter-regional providing services at key commuter stations
 - Manchester to Liverpool Lime Street half hourly
- CLC four tph
 - half hourly semi-fast inter-regional providing services at key commuter stations
 - Manchester Piccadilly and Manchester Airport to Liverpool Lime Street half hourly.