ECML Capacity Options Report
to support Access Application Process

Controlled Copy Number	

Report Control Sheet

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Issue Record

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1.0	Draft ORR issue for consultation	31/07/14
1.1	Draft ORR and industry issue for consultation	08/08/14
1.2	Updated draft to ORR for review	05/09/14
1.3	Report issued to industry in final copy	11/09/14

Contents

1. Executive Summary

Network Rail has produced this draft report to inform the ORR on the capacity options that will exist on the East Coast Main line (ECML) from 2020. The study was completed in line with the remit which can be found in Appendix A, and assumes a number of infrastructure and rolling stock changes that will affect capacity over this period of time.

In completing this report Network Rail has constructed multiple different service structures to understand the combination of services that can be accommodated on the route in 2020.

This analysis demonstrates that the theoretical maximum number of trains that can be accommodated on the ECML Fast lines is 20 per hour. Having consulted with the industry and agreed the need to accommodate two services in every hour calling at Welwyn North, the overall quantum of hourly paths drops to 18 (based on 3 minute planning headways).

Working against an agreed structure containing 18 trains per hour (TPH), this report identifies how different combinations of long distance high speed (LDHS), Thameslink Great Northern (TSGN), inter-regional, local and freight services could be planned to make full use of the available capacity.

The report has focused on capacity options based on 7, 8, or 9 LDHS paths, as the 3 most probable LDHS levels, and the quantum south of Peterborough determines which options become available as you travel north up the route.

The capacity options can be summarised as follows:

- 7 LDHS paths can be combined with 10 TSGN Fast line services. This option also allows for 1 Class 4 TPH in each direction and potential for a Class 6 in the down direction. This option has the benefit of unused capacity in the standard hour, with the potential of absorbing time lost in running from any paths.
- 8 LDHS allows for 10 TSGN paths but in the off-peak hour offers limited capacity for class 4 freight on restricted tonnages on the south end of the route.
- 9 LDHS paths maximises the available opportunities for LDHS paths. Capacity for freight is restricted to a limited tonnage class 4 path and the 10 TPH TSGN requirement cannot be fulfilled.

In essence, the key choices are around both service structure and quantum of service groups which comprise the overall service offering.

In addition to the choices required through Welwyn, significant capacity choices are identified in the following sections (from south to north):

- Huntingdon – Peterborough
- Doncaster – Colton Jn (main line route and route via Leeds)
- Northallerton – Newcastle
- Drem – Edinburgh

The remaining route sections present choices based on service patterns, including stopping patterns and service intervals. All of these choices are detailed in Section 3, though this report also recognises that the service outcome needs to be considered as a whole.

The report confirms that there is no combination of choices that accommodates all aspirations. A suite of capacity options has been identified that will deliver different outcomes in terms of capacity, performance, journey time and connectivity.

In addition, the report highlights the requirement to have robust service recovery plans aligned with any capacity options. This element cannot be overstated in future access rights considerations. More detail can be found in Section 3.3 (Performance) and the performance assessment in Section 8 (Appendix D).

2. Introduction

2.1. Background

Network Rail, working to the remit in Appendix A, has undertaken this study to assess whether the confirmed and aspired uses of the ECML can be accommodated in 2020.

2.2. Objectives

The objective of this study is to provide the industry with analysis confirming what capacity choices are available on the ECML from 2020 onwards. .

2.3. Assumptions

In completing this report Network Rail has made assumptions on what infrastructure will be available and what rolling stock will be used on the route. The detailed assumptions are included in Appendix E.

2.3.1. Geographical scope

The geographical scope for the analysis includes the ECML between London Kings Cross and Edinburgh, plus Doncaster – Leeds – Colton Junction. This has been split into the following sections:

- Kings Cross to Stevenage (to include Kings Cross platforms & Hertford Loop)
- Stevenage to Peterborough
- Peterborough to Doncaster
- Doncaster to Colton Jn
- Doncaster to Colton Jn (via Leeds)
- Colton Jn to Northallerton
- Northallerton to Newcastle
- Newcastle to Drem
- Drem to Edinburgh (to include Edinburgh platforms)

There is no analysis for the Moorgate Branch as part of this work as no competing demands for capacity have been identified on that part of the network. The service structure from the Moorgate Branch has been included and is based on the development timetable work completed for DTT2011.

2.3.2. Access rights

For train services, we have considered existing access rights, current access applications and known aspirations for the 2016 to 2020 timeframe. The main applications are detailed in an ORR communication to the industry dated 18 June 2014.

2.3.3. Rolling stock

A number of other rolling stock changes are planned between 2016 and 2020. This includes the introduction of Intercity Express Programme (IEP) Class 800/801s and Thameslink Class 700s from 2018. In addition, Cross-Pennine electrification will result in electric multiple units (EMU) operating to and from the ECML from December 2018. Alliance Rail services are planned to use Class 390s.

Except where rolling stock changes have been identified, existing rolling stock and sectional running times (SRT) have been assumed.

2.3.4. Timetable Planning Rules

The 2014 Timetable Planning Rules (version 4.1) have been used for both LNE & EM and Scotland Routes.

2.3.5. Approach

The report has been completed in stages, as per the remit in appendix A. Capacity analysis has been undertaken to understand the capacity allocation options for the ECML in 2020, having factored in the list of known infrastructure interventions and the characteristics of the new rolling stock planned for introduction.

Alongside this, an initial high-level assessment of the performance and operational impacts has been considered to understand the wider consequences for operation of the network.

2.4. Communication

Network Rail has maintained regular dialogue with the industry, and the remit for this work has been consulted with the ORR and industry stakeholders.

As part of the regular progress updates, stakeholders have been briefed on the initial findings from Output 1 and their comments have informed the development of this report.

Formal sessions were held on the 2nd and 24th July, with both well attended, and Network Rail is grateful for the support and input received at these sessions.

3. Key Findings

3.1. Overview of current timetable

Our analysis of the current timetable shows that there is already a trade-off between different types of service on the ECML. The detailed graphs are in Appendix A.

There are isolated instances where a greater number of LDHS trains run in the hour. In such cases, there are generally fewer trains of other types, or some LDHS trains have extended journey times.

The choices on capacity for 2020 will result in either one standard hour structured timetable or a series of different timetable structures through the day. There will inevitably be a split between peak and off-peak patterns but the capacity options in this report provide an opportunity to explore where on the ECML the timetable structure could be standardised.

A standard repeating pattern is attractive to customers and is operationally advantageous, allowing core contingency plans at times of perturbation for a quicker recovery of service.

3.2. Capacity Options

Based on the assumed infrastructure at the end of CP5, the aspirations and currently confirmed rights for 2020 cannot all be met.

There are a number of constraints which restrict delivering the full aspiration across the route, from infrastructure constraints (where the number of trains is using the maximum network capacity on minimum margins) to speed differential of services (where the speed mix of services constrains how the network capacity can be utilised).

The diagram on the next page summarises the key constraints and where choices are required over the quantum, interval or journey time of services.

As described in the diagram the key choices are around both service structure and quantum of service groups which comprise the overall service offering. It is important to consider the service outcome as a whole, as it is generally the interaction between different types of services which limits the achievement of all aspirations.

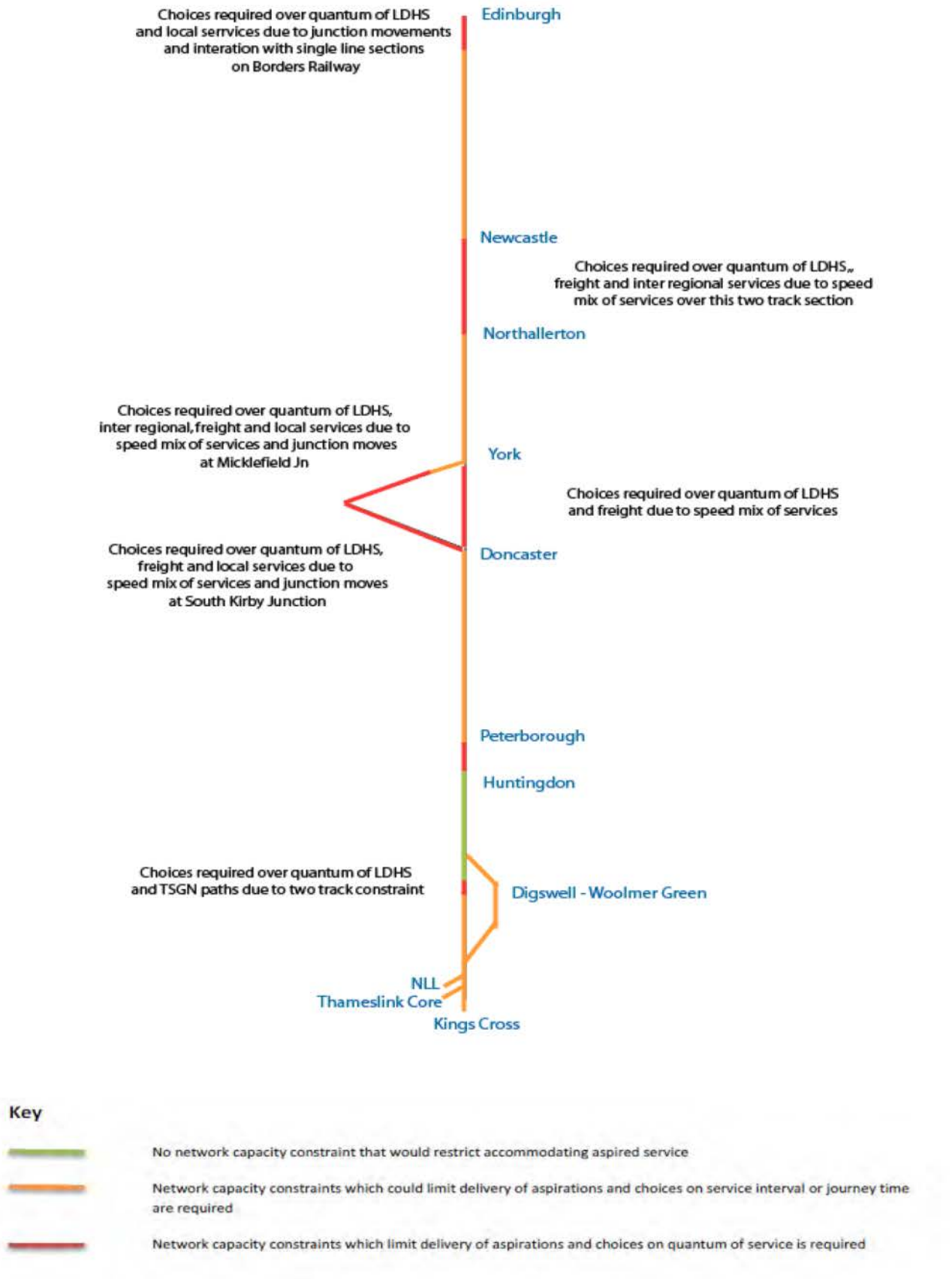


Figure 1 Summary of capacity findings

3.2.1. Service choices

This section provides a high-level summary of the choices that are available for use of the route in 2020. For a more detailed description of the findings see Appendix C.

The fundamental conclusion for all sections of the ECML is that the route provides capacity for a number of different markets and service groups and it is the interaction between these different types of service which drive the number and type of services that can be accommodated. At network bottlenecks such as Welwyn Viaduct specific numbers of services can be determined which can clearly indicate choices available. On other parts of the route, such as long two track sections, determining a number of trains that can operate is much more challenging as the capacity of that section is driven by not only the infrastructure capability but the types of services which need to use it.

To accommodate the maximum number of aspired services within the available network capacity, the service structure needs to be standardised.

This means that the calling patterns across all train services (independent of operator) need to be considered together to achieve the best possible outcome for journey times, service frequencies and connectivity. This supports achieving maximum benefit for all types of services by structuring the service offering around the network capacity constraints.

If calling patterns are viewed in isolation the risk is that either large amounts of pathing time will be required or the quantum of trains will need to be reduced to allow for an inconsistent timetable structure.

There is a clear trade-off between the uniformity of the timetable structure and the number of services that can be operated.

3.2.1.1. Rolling stock

Different rolling stock types have been included in the analysis for LDHS paths; IEP, Class 180 and Class 390. Although all provide different sectional running times (SRTs), the capacity conclusions are similar for all three traction types.

The key differences are for Class 180 south of Doncaster, where the SRTs are slightly slower than IEP and Class 390. This means that if a standard Class 180 path is paired on the opposite half hour with an IEP or Class 390 service, pathing time needs to be added. Alternatively, an additional call could be made on the IEP or Class 390 service to achieve the standard path over Welwyn Viaduct.

The key difference at the north end of the route is between Class 390 and IEP trains; Class 390 have faster SRTs (due to assumed EPS and tilting capability) and fewer calling points therefore a shorter journey time. This leads to different flighting structures between York and Edinburgh but does not change the quantum choices available.

3.2.1.2. South of Peterborough

The full TSGN inner service can be achieved if there is full segregation between the Slow line and Fast line service, other than between Woolmer Green and Digswell (no weaving of services between the Fast and Slow line between Finsbury Park and Welwyn Garden City). Current plans for the Cambridge - Tattenham Corner services is for this service to use the FL line between Woolmer Green and Digswell and then again between Marshmoor and Finsbury Park. There is potential capacity on the Fast line due to Stevenage call in an LDHS services, but the use of weaving services will cause a performance risk.

The key choices on this section of route are around the Fast line paths and over the two track sections between Woolmer Green and Digswell and between Peterborough and Huntingdon. There are choices for both service structure and the quantum of services.

Summary of capacity constraints

- Speed differential between fast line services (LDHS and TSGN) between Finsbury Park and Digswell
- Two-track constraint between Digswell and Woolmer Green and number of services on minimum headway
- Portions of two track between Peterborough and Huntingdon along with the speed mix of services
- Interaction with other routes connected to the Thameslink Core and therefore service spacing

Service structure

LDHS service pattern	Standard pathways (including number of calls) required south of Doncaster on a half hourly pattern
	Choices over interaction with TSGN pattern and whether LDHS services need to be overtaken between Peterborough and Doncaster
	Stevenage stop in LDHS uses more network capacity and is only possible for certain paths in the flight
TSGN semi-fast service interval	Exact 15 minute interval or a 12/18 minute interval
Peterborough – Kings Cross Peak Additional	Develop the peak timetable around a standard off-peak structure or accept pathing time will be required to achieve the additional Peterborough Peak service

Figure 2 Service structure choices south of Peterborough

Service quantum

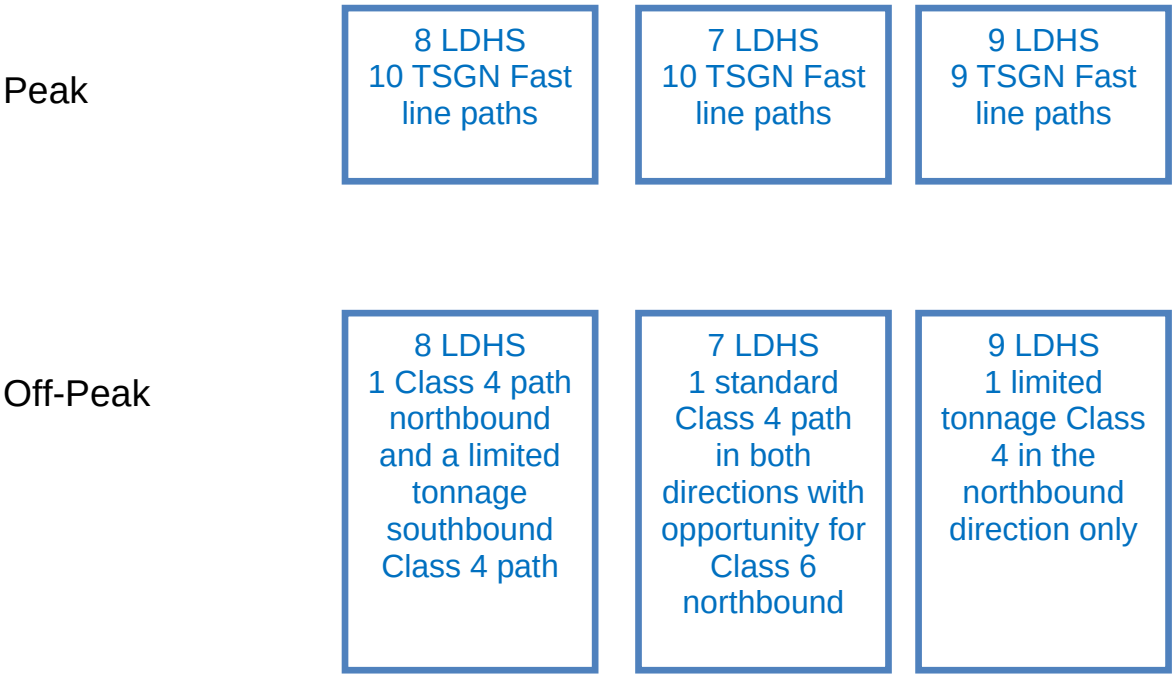


Figure 3 Service quantum choices south of Peterborough

3.2.1.3. Peterborough – Doncaster

With the upgrade to GN/GE and grade separation of Werrington Junction, freight services can be routed via this route. This results in no challenges to accommodate the quantum of LDHS paths over this section. The section is constrained by the flat crossing move required at Newark and the flighting of the LDHS pattern impacts on the available capacity for the services which need to use Newark Flat Crossing. The key choices on this section are around service interval and calling patterns which will impact on overall journey times achievable for LDHS services. Electric freight will have to be routed on the mainline between Peterborough and Doncaster, the capacity available for this routing will be driven by the calling pattern of LDHS chosen.

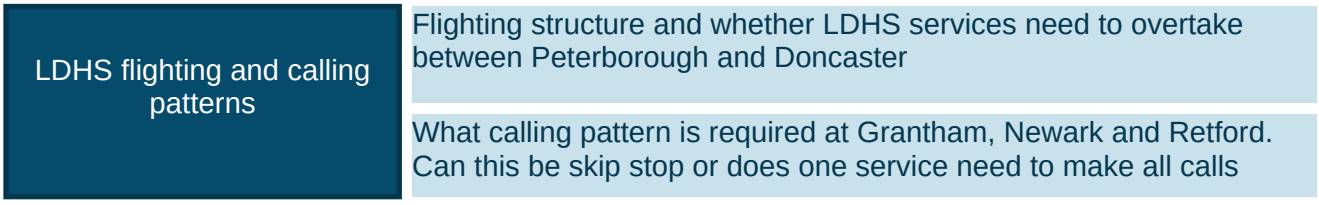


Figure 4 Service interval and calling pattern choices Peterborough – Doncaster

3.2.1.4. Doncaster – Colton Junction

The Doncaster Station area is constrained due to the number of conflicting movements of different service groups. Which option is taken forward in terms of LDHS service will dictate routeing of LDHS in the Doncaster area (for example how many are Leeds or Cleethorpes or Bradford services).

The section between Doncaster and Colton Jn is two-track and therefore the speed mix of services which use this section will drive choices regarding the quantum.

Summary of capacity constraints

- Number and complexity of conflicting moves at either end of Doncaster Station on flat junctions
- The speed differential of services on the two track section between Doncaster and Colton Junction

4 LDHS 1 non-London LDHS 1 Class 4 path over whole section 1 Class 6 path between Doncaster and Hambleton South Jn 1 Class 6 path between Doncaster and Shaftholme Jn	5 LDHS 1 non-London LDHS 1 Class 4 path between Doncaster and Hambleton Jn 1 Class 6 path between Doncaster and Hambleton South Jn 1 Class 6 path between Doncaster and Shaftholme Jn

Figure 5 Service quantum choices Doncaster – Colton Jn

3.2.1.5. Doncaster - Colton Junction (via Leeds)

The speed differentials of services over the two-track sections both via Wakefield Westgate and Micklefield are the primary constraints to achieving the service level, therefore choices are required over the quantum of services.

Summary of capacity constraints

- Speed differential between stopping and non-stopping passenger services between Leeds and Micklefield
- Junction margin and required conflicting movements at Micklefield Junction
- Speed differential between non-stop passenger, freight and stopping passenger between South Kirby Junction and Leeds
- Required conflicting movements at South Kirby Junction

Doncaster – Leeds section:

2 LDHS 2 non-London LDHS 1 Class 4 path 1 Class 6 path 4 local	3 LDHS 1 non-London LDHS 1 Class 4 path 1 Class 6 path 4 local	3 LDHS 2 non-London LDHS 1 Class 4 path 1 Class 6 path 3 local

Leeds – Colton Junction section:

1 LDHS 1 non-London LDHS 2 local 5 inter-regional	0 LDHS 1 non-London LDHS 3 local 4 inter-regional	0 LDHS 1 non-London LDHS 4 local 4 inter-regional (requiring some skip stopping)

Figure 6 Service quantum choices Doncaster – Colton Jn via Leeds

3.2.1.6. Colton Junction – Northallerton

This is a predominantly four track section and although there are constraints due to service structures, platform capacity at York and the choice over freight routeing, no specific choices on quantum of services are driven over this section.

3.2.1.7. Northallerton – Newcastle

The speed differential of services over this two-track section leads to a number of choices both over quantum and service interval.

If the service interval is structured to optimise capacity over this section, there are implications for the quantum that is possible on the south end of the ECML. Flighting passenger services together to optimise capacity over this section would affect the passenger service interval on intermediate calls between York and Edinburgh.

The aspired level of service over this section is much greater than the service delivered today and the full set of aspirations cannot be achieved. CP5 Connectivity infrastructure is assumed which provides more passing opportunities on this section, and this infrastructure has been used to support delivery of subsets of aspirations on this section. Choices will have to be made over the number of LDHS, non-London LDHS, freight and inter-regional services which can be accommodated on this section.

Summary of capacity constraints

- The speed differential of services on the two track section between Northallerton and Newcastle

Service structure

LDHS flighting and calling patterns	Flighting of LDHS services over this section needs to be supported by calling patterns elsewhere on the route based on the conclusions from south of Peterborough on standard structure
	Calling patterns at Northallerton, Darlington and Durham for all service groups

Figure 7 Service structure choices Northallerton - Newcastle

Service quantum

3 LDHS 2 non-London LDHS 1 inter-regional service 1 Class 4 path 1 Class 6 path	4 LDHS 1 non-London LDHS 2 inter-regional services 1 Class 4 path	2 LDHS 2 non-London LDHS 2 inter-regional services 1 Class 4 path 1 Class 6 path

Figure 8 Service quantum choices Northallerton – Newcastle

3.2.1.8. Newcastle – Drem

This is a long two track section which has a low quantum of services but is constrained by the large difference in journey time of different service types over the section. The slowest services on the route need to be overtaken by faster services, constraining how the service can be structured and therefore the quantum of service which can be accommodated.

Summary of capacity constraints

- Service speed differentials on the two-track section between Newcastle and Drem

Service structure

LDHS (London and non-London) flighting and calling patterns	Flighting of LDHS services over this section will be driven by choice of rolling stock on the London – Edinburgh service (IEP or Class 390)
	Calling patterns at Alnmouth, Morpeth, Dunbar, Berwick-upon-Tweed for all service groups

Figure 9 Service structure choices Newcastle - Drem

Service quantum

3 LDHS 1 non-London LDHS 1 Class 4 or Class 6 path 1 Dunbar – Edinburgh 1 Morpeth - Newcastle	2 LDHS 1 non-London LDHS 1 Class 4 path 1 Class 6 path 1 Dunbar – Edinburgh 1 Morpeth - Newcastle	2 LDHS 1 non-London LDHS 1 inter-regional service 1 Class 4 or Class 6 path 1 Dunbar - Edinburgh 1 Morpeth - Newcastle

Figure 10 Service quantum choices Newcastle – Drem

3.2.1.9. Drem – Edinburgh

The interaction between the local Edinburgh and longer distance services between Portobello Junction and Edinburgh results in service quantum choices.

It is important to note that the service structure determined for the long two-track section between Newcastle and Drem will impact on the service structure that can be achieved between Portobello Junction and Edinburgh.

The single line sections on Borders Railway and the service spacing between Newcastle and Portobello Junction constrain how the short section between Portobello Junction and Edinburgh Waverley can be used.

Summary of capacity constraints

- Interaction with single line sections of Borders Railway
- Crossing move at Portobello Junction
- Service structure defined by long two track section between Newcastle and Drem

Service quantum

2 LDHS 1 non-London LDHS 1 North Berwick 2 Tweedbank 1 Dunbar	3 LDHS 1 non-London LDHS 1 North Berwick 1 Tweedbank 1 Dunbar	3 LDHS 1 non-London LDHS 1 North Berwick 2 Tweedbank

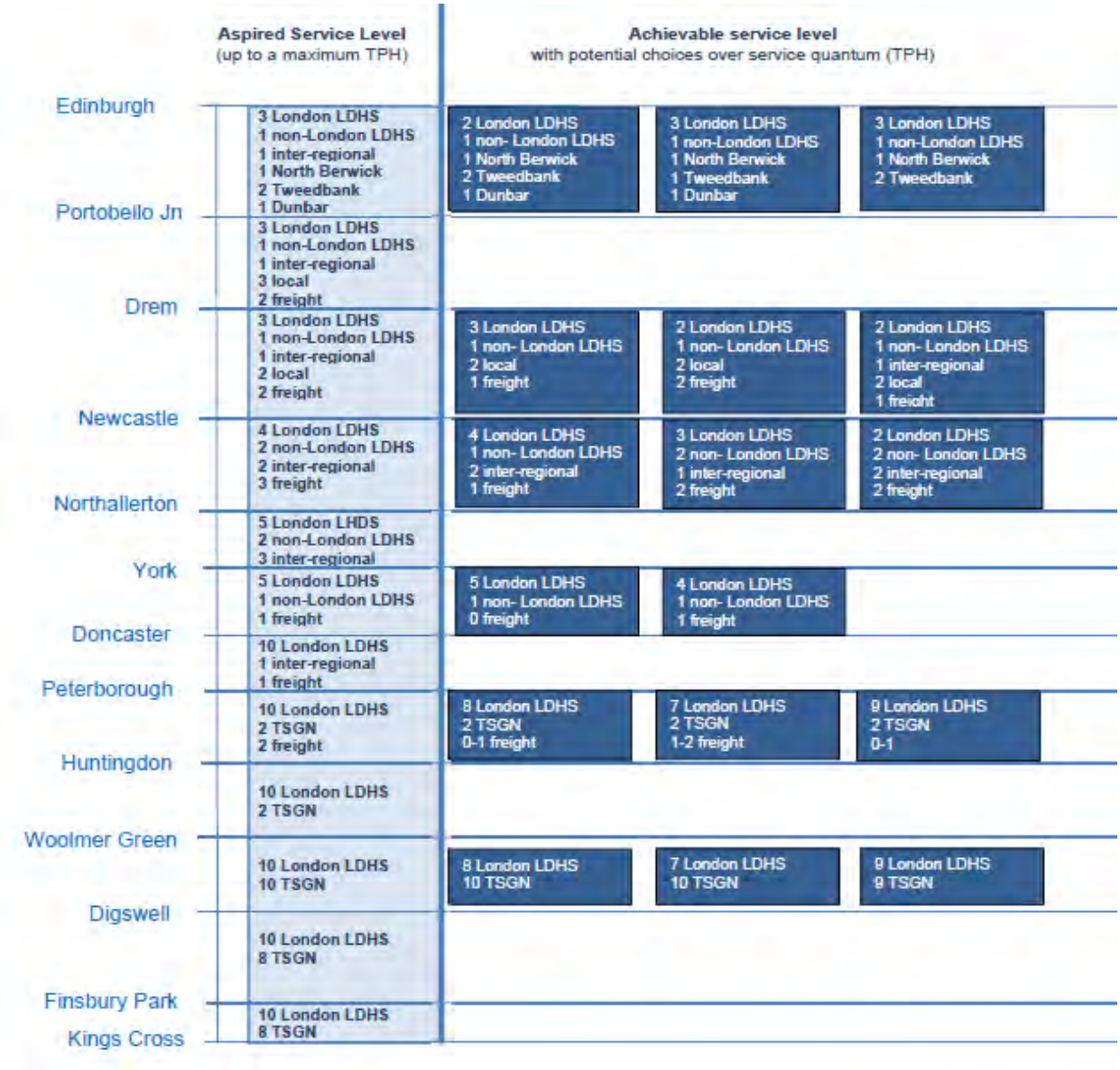
Note: Freight numbers as Newcastle – Drem section to Monktonhall Jn

Figure 11 Service quantum choices Portobello Junction – Edinburgh

3.2.2. Summary of Service choices

The choices and trade-offs in terms of service level are interdependent between different parts of the route and the chosen service structure and calling patterns.

The following diagram summarises the key points where the aspired service level cannot be delivered on the network capacity and the potential choices available in terms of different service levels.



Via Leeds Section

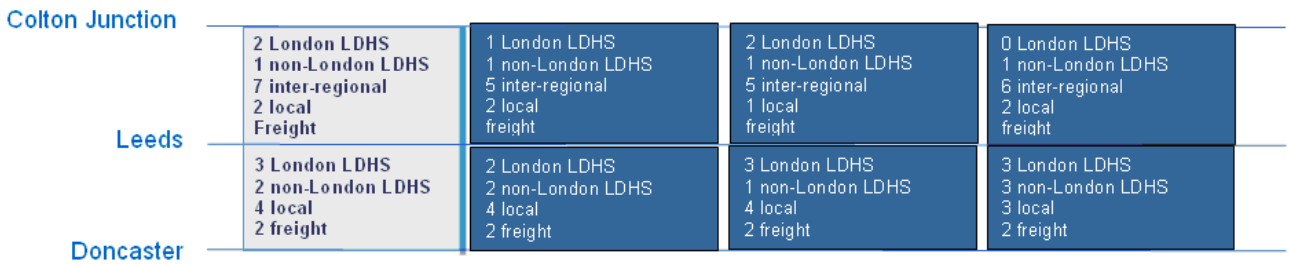


Figure 12 Summary of ECML service choices

3.3. Performance

To understand the potential impact on network performance as a result of the quantum options identified for LDHS, Network Rail has examined three historic examples of timetable changes which delivered an increase in the hourly quantum. The full detail of this assessment is included in Appendix D.

The timetable changes that have been assessed are:

- Introduction of the Virgin West Coast VHF timetable in December 2008
- Introduction of East Coast's "Eureka" timetable in May 2011
- Introduction of TPE's 5th Transpennine path in May 2014

For each of these timetable changes, Network Rail has looked at the key measures seen on weekdays either side of the change.

For all three timetable changes there has been a reduction in the Public Performance Measure (PPM) and an increase in the ratio of primary to reactionary delay minutes. In two of the three cases, there has also been an increase in the average lateness at termination and a reduction in right time performance.

The only timetable change which did not result in a worsenment in these figures was the East Coast "Eureka" timetable. This timetable change was mitigated by allowances and advertised differentials on arrival times.

Based upon these results Network Rail believe that increasing the quantum of LDHS services will result in a worsenment of the performance figures on the route.

For PPM, the potential impact is in the order of 1.8 to 2 percentage points, depending on any mitigation that could be put into place. Note this is based on high level analysis and without any modelling of the actual timetable or diagrams to be implemented.

As any options in this report are developed into timetables, Network Rail would like to assess these against structural themes which might aid resilient performance of the timetable. Performance modelling of the timetable options will be required as appropriate.

For any option taken forward into full timetable development, Network Rail will require detailed discussion and industry agreement on the service recovery principles that will need to apply.

3.4. Operation and maintenance of network

Network Rail has carried out an initial high-level assessment of what the impact on the ECML assets and our ability to operate and maintain them would be if the options as outlined in 3.2 were to form a timetable. In all cases, further detailed work will be required in the further development of any specific option.

3.4.1. General maintenance principles

The impact of capacity allocation on first and last trains has not been assessed therefore Network Rail would want to analyse this in detail before any decisions are made regarding the sale of any access rights.

The same applies to our current patrolling arrangements but for the purpose of this report the current assumption is that there would not be any impact on this.

3.4.2. Power supply

Work is underway within Network Rail to confirm the maximum power draw available on the ECML. For the purpose of this report, we are currently assuming that there will be sufficient power to supply any service combination.

However, the increase in train service requirements will require modelling to confirm adequacy of power supply capacity and overhead line equipment (OLE) current carrying capability before making any decisions regarding capacity allocation and the sale of access rights.

3.4.2.1. Specific power supply issues currently identified

Network Rail would like to highlight the following specific issues that may affect capacity:

- The mainline between Wood Green to Bawtry is being upgraded to deliver the capability requirements of the DfT 2016 ITSS. This is due to be delivered by 2018.
- Network Rail is currently investigating the feasibility of interim capability increases prior to 2018.
- The remainder of the route (including the Hertford Loop) will not be upgraded, and capacity limitations exist. Between Kings Cross and Wood Green work is underway to enable increased capacity by 2018. On the remainder of the route, Network Rail is working to develop a cost-effective and progressive upgrade strategy that matches future timetable requirements.
- There will need to be appropriate alignment between any increase in train services and the power supply strategy. The current priorities are addressing voltage issues on the Hertford Loop, where Network Rail has remitted work to align with European Traffic Control System (ETCS) implementation, and enabling increased capacity at Doncaster.
- This is essential both to address the next most significant capacity constraint on the route but also to demonstrate the inverter technology which will reduce the cost of increasing capability further north on the ECML.

3.4.2.2. Other considerations regarding power supply

The following are general issues that will need to be considered:

- The flighting of successive electric trains can increase power supply requirements beyond total power capacity. When several trains accelerate simultaneously in the

same location, the actual OLE capability and voltage needs to considered and modelled in advance.

- The operation of trains from High Speed 2 (HS2) would be a step change in power supply beyond our present assumptions.
- Major increases in line speed or a wholesale move to electric haulage of freight would also create a step change in capability required.
- An increase in traction usage will further increase the maintenance and renewal regime for the OLE.
- Network Rail will consider the impact of all these issues prior to any sale of access rights.

3.4.3. Level crossings

It is to be noted that increasing the number of TPH on the ECML, including LDHS, will affect the All Level Crossing Risk Model (ALCRM) score for level crossings on the Route. A key condition is therefore that any detailed timetabling work includes an assessment of level crossing risk as well as available and affordable mitigations.

3.5. Other issues to consider

In making decisions on the allocation and sale of access rights, Network Rail will also consider the various network services that operate; such as test trains, ballast trains and rail head treatment trains. Although the latter only run during the autumn, provision still needs to be made for them in the year-round working timetable (WTT).

As regards the daytime standard hour timetable on weekdays, particular account will need to be taken of the need to path the New Measurement Train (NMT), which has regular WTT paths on the ECML. The continued operation of these network services is vital to the safe and efficient running of the railway.

In addition, future decisions will need to be informed by the occasional requirement to divert the Anglo-Scottish sleeper service via the ECML, at times of planned engineering work or perturbation on the West Coast Main Line (WCML). This has its greatest impact on ECML capacity on Monday mornings when the Up sleeper from Inverness uses the southern end of the ECML near the start of the morning peak.

4. Next Steps

As confirmed in section 3, Network Rail has identified a number of capacity options which will form the basis of a timetable solution in 2020, however demand for capacity is such, that not all aspirations and access applicants can be accommodated into one overall option. On that basis compromises will have to be made in quantum, interval and journey times to achieve 7, 8 or 9 hourly LDHS services on the route.

Network Rail will continue to work with all industry stakeholders in the consideration of the access applications listed in the appendices of the report remit in appendix A.

As part of any access rights considerations, Network Rail and ORR, in consultation with the industry, will agree which of the sub set capacity choices needs further work. This work will include timetable development, detailed network performance analysis and further assessment of the infrastructure impact of increasing the quantum of services.

The findings of this report will be used as the basis for current considerations on the allocation of capacity on the ECML and Network Rail looks forward to continuing to work with industry stakeholders form our view as to what the most appropriate use of the capacity is.

4.1. Responses to Draft Report

The draft report was consulted and responses were received from:

- ORR
- Alliance Rail
- DB Shenker
- East Coast
- FCC
- FTPE
- GBRf

Network Rail thanks all those who responded as comments are invaluable in helping to understand future capacity on the ECML and how it should be used. The report has been updated to reflect points of detail. Many of the comments received addressed the next steps and how decisions will be made on a suitable service level to take forward for further development or ideas for further capacity tests. It is recommended that these good ideas are taken forward in the next phase of planning work:

- Examination of what a repeating two or three hourly pattern on the route could achieve
- Examination of the peak, shoulder and off peak periods in detail to understand the level of service that can be achieved in the transition between peak and off peak
- Update all infrastructure and rolling stock assumptions based on latest available information before next phase of work
- Update TPR assumptions for detailed timetable development based on latest information from the ongoing TPR workstream

4.2. Milestones

Network Rail is aware of the following key milestones to early 2015:

Milestone	Due Date	Lead Organisation
Draft report published for industry review	8th August - 22nd August 2014	Network Rail
Report published in final copy	Friday 11th September	Network Rail
Network Rail and ORR to agree which capacity options require detailed timetable work with performance assessment	Friday 19th September	ORR / Network Rail
Network Rail complete detailed timetable and performance Study	Friday 7th November	Network Rail
ORR complete economic evaluation of the capacity options	December 2014	ORR
ORR to decide which applications to approve and issue directions	Early 2015	ORR

Table 1: ECML Capacity Decisions and Milestones

As suggested by the ORR letter published on June 18th, Network Rail's capacity study, does not give the full detail on ECML capacity as DfT does not expect to announce the winning bidder for the East Coast franchise until November.

Given the complexity of the ECML position and the likely requirement for detailed economic analysis, Network Rail expects to work with the industry towards a formal access rights decision in early 2015.

REPORT ENDS

5. Appendix A – Report Remit

5.1. Project Content

5.1.1. Background

ORR is currently considering an application from Alliance Rail for new access rights on the East Coast Mainline (ECML).

Alliance Rail is seeking to run an hourly service, in each direction, between London Kings Cross and Edinburgh via the ECML with the services being introduced in the December 2016 New Working Timetable. These services will call at Newcastle only in each direction.

Alliance Rail has an aspiration for the journey time for London to Edinburgh to be 3 hours 45 minutes, with the journey from London to Newcastle taking on average 2 hours 29 minutes.

The application has been made to the ORR under the Section 17 process.

In addition to this application, Alliance Rail has applied for rights to run return services from London Kings Cross to West Yorkshire & Cleethorpes from December 2017. (5.4. Remit Appendix A)

For the Intercity East Coast (ICEC) Franchise, a section 17 application has been submitted for the franchise train services and this is referred to in 5.5. Remit Appendix B.

The aspired TSGN service specification for the ECML has been received from Govia as the winning bidder. This identifies the TSGN specification the ECML is assumed to accommodate from December 2018 for this franchise and this specification (5.6. Remit Appendix C).

In the context of these confirmed and emerging aspirations for a finite level of capacity, Network Rail is required to confirm what capacity is available on the ECML.

5.1.2. Objective

The objective of this analysis is to provide the industry with Network Rail's position on available capacity on the ECML from 2020.

This work will be delivered in stages, in the form of the following outputs:

Output 1: - A piece of analysis which delivers a set of capacity allocation options for the ECML in 2020, having factored in the list of known infrastructure interventions as captured in 5.7. Remit Appendix D and the characteristics of the new rolling stock.

A decision tree has been provided in 5.9. Remit Appendix F to confirm how the work will progress depending on the findings of output 1.

Output 1 will be delivered by Network Rail's strategic capacity team.

If Output 1 confirms capacity exists for all aspirations to be accommodated the work will be handed over to Capacity Planning to deliver:-

Output 2a:- A theoretical standard hour timetable built on the findings of output 1 which seeks to accommodate all known aspirations first, in December 2020, and then works back to understand what service could be operated in December 2019 and December 2018. If appropriate this work will also be carried out to understand what the December 2016 & 2017 timetables could deliver.

- An assessment of the performance outputs of each proposed timetable will be provided as part of this output.
- An assessment of the operability of each proposed timetable output will include maintainability and any safety impact assessment, including any impact on the operability of the level crossings on the route.

If this output is delivered this will conclude the work of this remit and a final report will be produced confirming what output 2 has concluded.

If Output 1 identifies that there is not capacity for all known aspirations:-

Output 2b:- A report confirming what issues Network Rail believe prohibits all known capacity aspirations from being fulfilled in December 2020.

The report will then provide the outputs of the sub set work and provide to the ORR a list of capacity options with different combinations of the known aspirations accommodated. This will include some peak and off-peak options.

These sub set outputs will cover the impact of capacity allocation on Network Rail's performance outputs of any capacity allocation and the connectivity achieved through different combinations of capacity allocations.

Note. Further work will be required to inform the economic impact of any sub set being implemented into the timetable and this work falls outside of the scope of this remit.

5.1.3. Timescales

Network Rail will submit a draft report to the ORR no later than July 31st 2014; however Network Rail will share the progress of this work with the ORR at 2-weekly intervals, and hold a stage gate review at the completion of each output to share findings with all identified stakeholders.

This report is one stage in the process towards allocating rights on the ECML from 2016. The outputs of this report will provide the industry with options to capacity allocation; further

work will be required amongst all stakeholders to determine how capacity allocation is underpinned by the sale of any access rights.

5.2. Assumptions

5.2.1. Infrastructure

For all outputs 5.5 Remit Appendix D outlines what infrastructure interventions have been assumed to be delivered by December 2020.

5.2.2. Known Aspirations

5.4 Remit Appendix A has a summary of the known aspirations for ECML operators from 2016-2020.

5.2.3. Rolling Stock

It is assumed that the new services being proposed by Alliance will be operated using a Class 390 Pendolino.

As no sectional running times (SRTs) currently exist for this stock on the ECML, Network Rail will use RailSys to propose SRTs for Class 390s. Any assumptions for SRTs will be agreed with Alliance Rail and the Operational Planning Manager before any timetable work commences. The SRTs will remain an assumption for testing capacity implications until infrastructure changes are confirmed and finalised SRTs can be developed and agreed through the normal industry process.

The intercity express programme (IEP) has mandated the ICEC franchisee to commit to the introduction of IEP rolling stock and this remit will assume a rolling introduction of the class 800/801 from December 2018 – this assumption will be applied to all outputs as appropriate.

The remit will assume that TSGN services will utilise Class 700 Thameslink trains from 2018.

The remit will assume New EMUs for TPE trains Leeds to Newcastle, and for Northern trains Leeds to York December 2018.

The remit will assume all Grand Central Sunderland services to be operated by Class 180s from Dec 2016.

The remit will assume the withdrawal of Pacers from 2020

Unless explicitly stated above it is assumed that all other traffic on the ECML in the period until December 2020 will continue to operate using its existing rolling stock and therefore existing SRTs will be used in any detailing timetabling work.

5.2.4. Geographical Scope

The geographical scope of the analysis will include:

- The East Coast Main Line between London Kings Cross and Edinburgh (split as identified in section 5.2.6).
- Doncaster – Leeds – Church Fenton -Colton Junction

Where it is necessary to retime trains away from the ECML, the implications will be considered on a case-by-case basis with the aim of confirming that each identified LDHS path can be planned to the destinations confirmed in the Remit Appendices

5.2.5. Planning parameters

This project will carry out the analysis using the 2014 Timetable Planning Rules ver 4.1 (TPR) for LNE & EM and Scotland Routes.

There is a separate work stream delivering a TPR review for LNE & EM. It should be noted that the outcome of that review could change the results of this study and will need to be assessed on completion of the TPR review.

This review is due for completion in time for the production of the December 2016 timetable. The emerging outputs of this reviewed will be shared with the project team delivering this remit and factored into its outputs as appropriate.

5.2.6. Methodology

The work undertaken as part of this remit will deliver strategic capacity analysis.

It is assumed that there will be no significant changes to the working timetable between May 2014 and December 2016.

The work will be completed making use of ITPS (Network Rail's train planning system, Railsys and Microsoft Office suit software)

The primary focus will be to identify capacity for LDHS paths on the ECML from December 2020 with the outputs rolled back to December 2019 & 2018.

To achieve this, the route will be split into the following sections:-

- King's Cross to Stevenage (to include King's Cross platforms & Hertford Loop)
- Stevenage to Peterborough
- Peterborough to Doncaster
- Doncaster to Colton Jn
- Colton Jn to Northallerton
- Northallerton to Newcastle
- Newcastle to Drem
- Drem to Edinburgh (to include Edinburgh platforms)

In any detailed timetabling work all capacity identified will comply with the Timetable Planning Rules and, where required, use of all available flex pertaining to existing rights will be considered in order to accommodate the required quantum of paths.

This will initially be done in a single peak hour and, if successful, will be rolled out across successive hours.

The scope will need to consider capacity for platforming LDHS paths arriving and departing London Kings Cross in a standard SX hour. In addition, capacity to accommodate an additional LDHS path at Edinburgh Waverly will be assessed.

When examining all options it will be assumed that no services will have journey time protection, unless it is known that operators have rights beyond 2016 with this protection stipulated.

Where required, freight paths may be flexed taking their current rights as a starting point, but with new timings or routing options suggested where it is advantageous in seeking new industry capacity. – E.g. route of services over the upgraded GN/GE Joint line. Existing quantum freight rights will be maintained as part of the analysis. Network Rail will update all identified stakeholders on progress of this work on a 2-weekly basis.

5.3. Roles & Responsibilities

5.3.1. Client

The Office of Rail Regulation is the leading Client for this work.

5.3.2. Sponsor

- The sponsor for this work is Matthew Rice, he will:
- Be the person to whom the Project Manager is accountable.
- Act as the key point of contact for all stakeholders.
- Have overall accountability for the outputs.

5.3.3. Project Manager and team

The Project Manager for Output 1 and Output 2b will be Clare Waller.

The Project Manager for Output 2a will be David Fletcher.

Throughout this work the project manager shall:-

- manage the resources identified required to deliver this study
- inform the Sponsor of any potential significant changes to timescales
- ensure the delivery of this project to the agreed timescales

- Ensure that the work undertaken focuses on the objectives and delivers in line with the expectations of the Sponsor and Stakeholders.
- Retain and catalogue all workings throughout the analysis to provide background to any conclusions.

The project managers will have Bob Casselden allocated to them for the duration of this work on a full time basis.

5.4. Remit Appendix A. Known Access Rights Post December 2016 (SX)

- Cross Country Trains (due to expire December 2017)
    - 1 TPH Birmingham via Leeds to Scotland
    - 1 TPH Birmingham via Doncaster to Newcastle
- DRS
    - 2 trains per day serving Torness power station.

5.5. Remit Appendix B. Known Applications

- Alliance Rail Section 17 Application to operate:-
    - 1 TPH in each direction Kings Cross to Edinburgh calling at Newcastle
- Alliance Rail Section 17 Application to operate:-
    - One train per two hour King's Cross to West Yorkshire / Cleethorpes (Alliance) King's Cross to Bradford Forster Square via Hambleton West Junction and Leeds approximately every two hours, with one train per day serving Ilkley instead of Bradford. King's Cross to Cleethorpes via Doncaster – up to four trains per day.
- First Hull Trains
    - 7 Trains per day in each direction KX to Hull
- Grand Central
    - 4 trains per day in each direction KX to Bradford Interchange
    - 5 trains per day in each direction KX to Sunderland
- East Coast Section 17 to operate :-
    - Up to 7 TPH (from 2020) from Kings Cross outlined as a minimum:-
        - 2x Fast services King's Cross to Edinburgh.
        - 2x Fast services King's Cross to Leeds (via Wakefield).
        - 1x Semi fast King's Cross to Newcastle / Northallerton
        - 1x stopping service King's Cross to Newark (extendable to a number of possible destinations, including Leeds via Micklefield).

A 3rd hourly service to Leeds will be considered at the 7th TPH for the basis of this study.

These services are not shown in any priority order.

5.6. Remit Appendix C. Known Aspirations

- Thameslink Key Output 2 specification as included in the TSGN ITT and further informed by Govia as the winning bidder.
    - 2 TPH all day Kings Lynn to London Kings Cross – operated by Class 377
    - 2 TPH all day Cambridge to Tattenham Corner – operated by Class 700
    - 2 TPH all day Peterborough to Horsham – operated by Class 700
    - **4 TPH high-peak** Peterborough to London Kings Cross – operated by Class 365
    - 2 TPH peak Welwyn Garden City to Caterham **(starting back at Letchworth for services arriving St Pancras 0700-0859)** – operated by Class 700
    - 2 TPH peak **(4 TPH in the high-peak hour)** Welwyn Garden City to London Kings Cross – operated by Class 365
    - 4 TPH all day Welwyn Garden City to Moorgate – operated by 313 replacement
    - 4 TPH all day Hertford North to Moorgate – operated by 313 replacement
    - 4 TPH peak Gordon Hill to Moorgate – operated by 313 replacement
    - 2 TPH high peak Hertford North to Moorgate – operated by 313 replacement
    - 2 TPH all day Cambridge to Brighton – operated by Class 700

- Regional Urban
    - North of England ITSS

- Freight
    - QJ strategic paths will be factored in to all analysis
    - Growth as identified in the Freight market study.
    - Freight capacity as per the East Coast ITSS 2020

- Transport Scotland aspirations

- Cross Country aspirations for an additional Birmingham – Leeds via Wakefield.

- Cross Country aspirations to improve the journey times on services using the ECML.

5.7. Remit Appendix D. Assumed infrastructure interventions

The remit will assume that the following infrastructure will have been delivered during CP5.

- Thameslink Key Output 2 including Automatic Train Operation (ATO) through the Thameslink core, new EMU depot at Eastfield, the Belle Isle Connect
- IEP works including East Coast Power Supply Upgrade, with capacity to supply the required power to each output.
- Works necessary to provide Enhanced Permissible Speed (EPS) between Northallerton and Edinburgh as defined by a separate piece of work between Network Rail and Alliance.

Further this remit will only consider infrastructure that has funding for delivery confirmed.

A supporting list of infrastructure schemes is being used to support this work and it is circulated with this remit.

East Coast Connectivity Fund works as proposed for draw down by the East Coast Programme Board, as follows:-

<u>Peterborough Station Area</u>

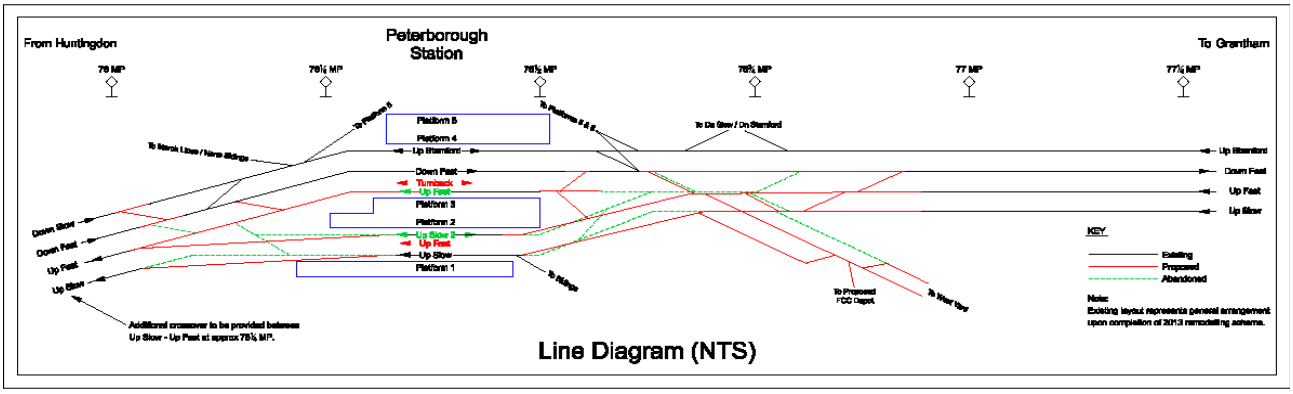


Figure 13 Peterborough Station Area project

Scope:

(1) 100mph fast line alignment through a new Platform 2 face

(2) Increase Speed over the Down Slow from 50mph to 100mph (then 75mph over Nene River Bridge) between Fletton and Peterborough.

(3) Remodel north end of station to improve speeds over Spital ladder.

<u>GN/GE Southern Access</u>

Grade separation, exploring options for flyover or dive under.

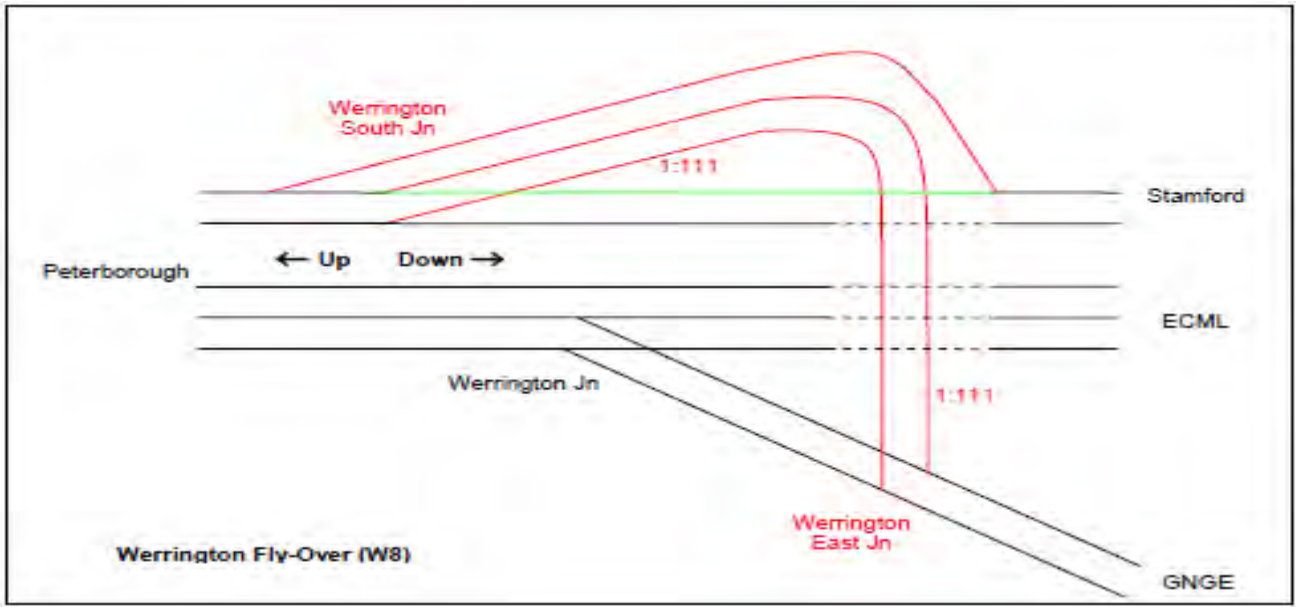


Figure 14 GN/GE Southern Access project

Doncaster Station Area

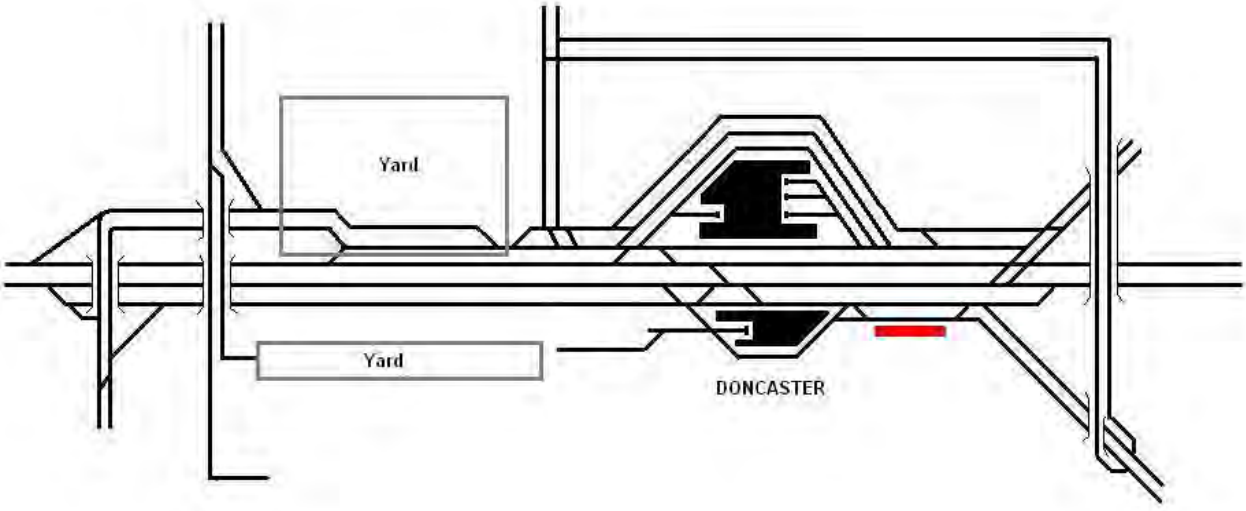


Figure 15 Doncaster Station Area project

Scope:

- Construction of 100m long bay Platform with half length canopy with a covered footbridge and two new lifts, adjacent to Frenchgate centre for trains to/from Hull/Scunthorpe
- Associated lighting, telecoms, CCTV.
- Additional canopy on Platform 1 & 4 to cover the area to the new footbridge.

- 2 new turnouts, 2 friction buffer stops. Modification to existing track, signalling and OLE equipment, although the Platform line will not be electrified.
- Bi-directional signalling to the Doncaster East Side (25mph) from Black Carr Junction to Balby bridge
- A new 25mph crossover on the Thorne lines
- Modification of the carriage sidings including electrifying the new route through the sidings
- A new crossover between the existing shunt neck and Low Ellers Curve
- A new driver walkway at St Catherine's Junction.

Shaftholme Jn speed increase

- Increase turnout speed from 20mph to 40mph and increase the down main line speed from 100mph to 125mph.

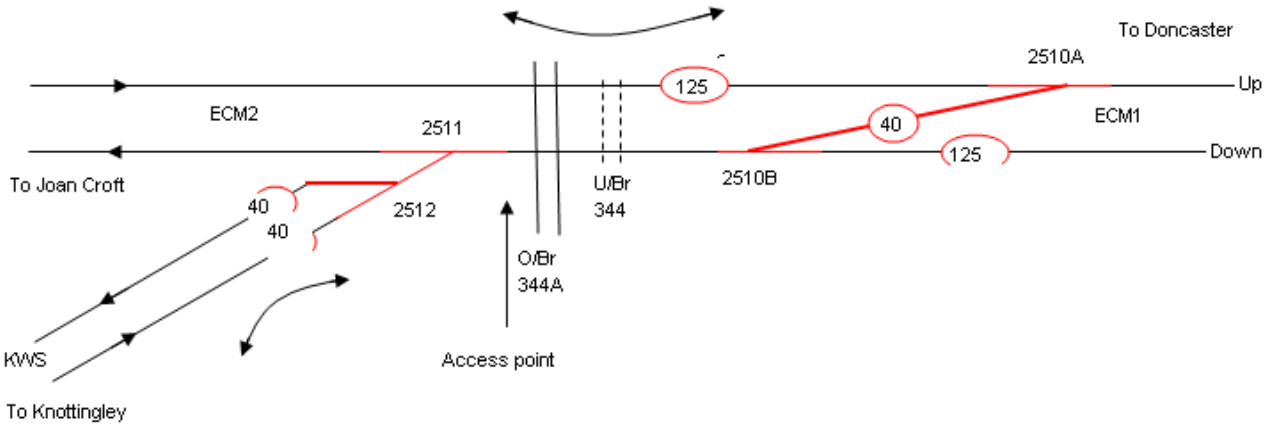


Figure 16 Shaftholme Jn speed increase project

York Station North Throat

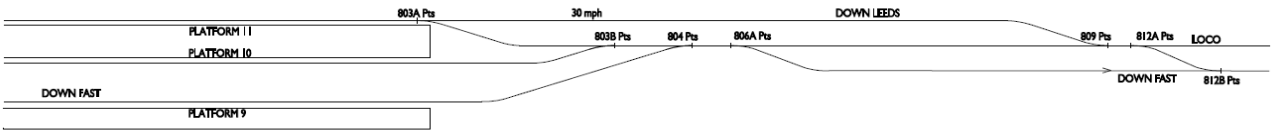


Figure 17 York Station North Throat project

- New line from Platform 11 to the loco line to allow parallel moves into/out of platforms 9/10 and platform 11.
- Construction of 300m of plain line
- Installation of 2 no. switches and crossings (S&C) units
- Modifications to the existing signalling infrastructure
- Installation of new OLE equipment.

Northalleron – Newcastle: Freight Loops

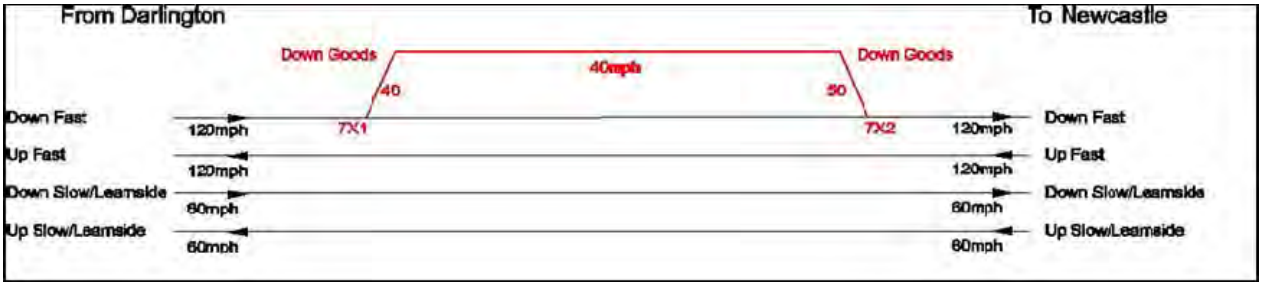


Figure 18 Northallerton to Newcastle Freight Loops project (Ferryhill)

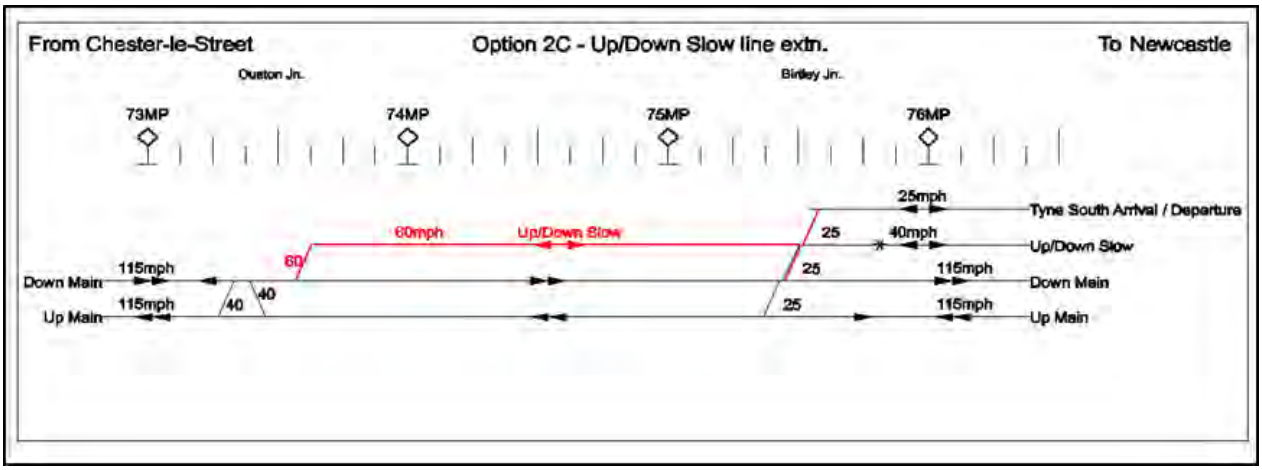


Figure 19 Northallerton to Newcastle Freight Loops project (Ouston – Birtley)

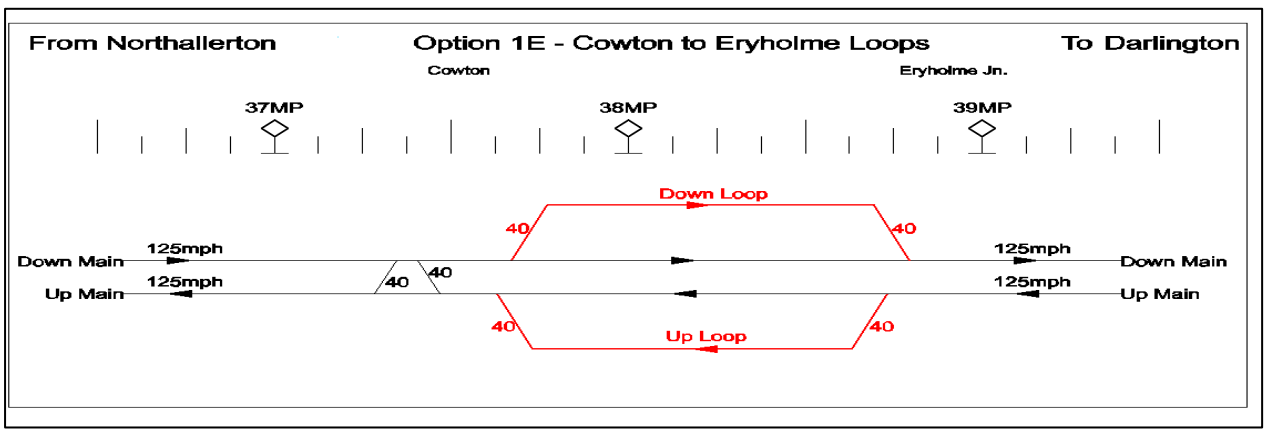


Figure 20 Northallerton to Newcastle Freight Loops project (Cowton – Eryholme)

5.8. Remit Appendix E. Contact Details

Sponsor
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Project Manager (Capacity Analysis)
David Fletcher
David.fletcher@networkrail.co.uk
07713 303000

5.9. Remit Appendix F. Decision tree

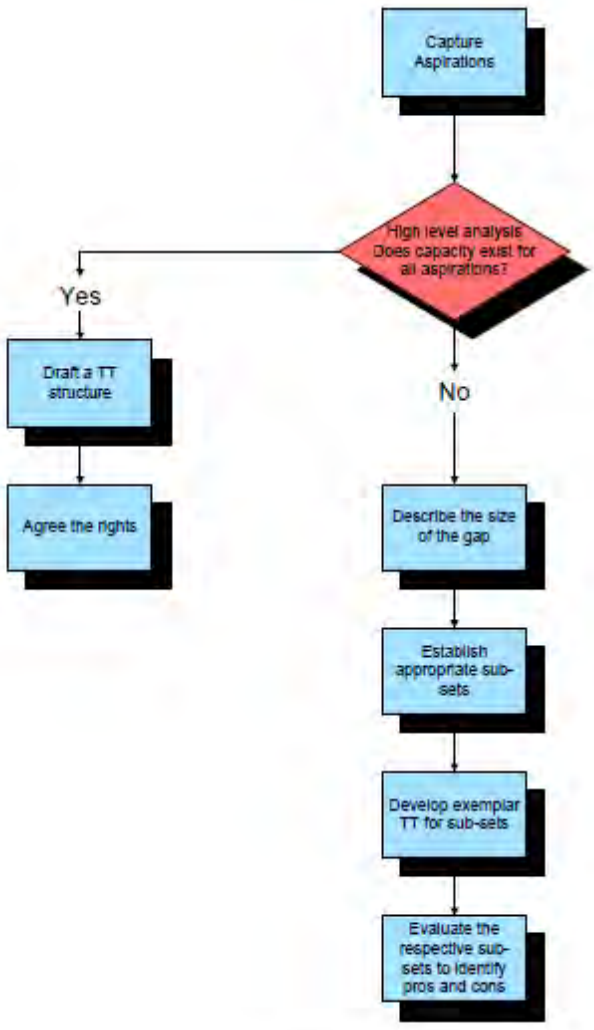

Figure 21 Decision Tree for Capacity Analysis Remit

6. Appendix B – Background on Current Timetable

6.1. Overview

The current ECML timetable is based on a repeating standard pattern; however there are many hour-by-hour variations to this standard pattern. To illustrate this, the graphs in 6.2 show the number of TPH in the May 2014 Working Timetable at a number of key locations on the route. For freight, this is based on SX WTT paths and does not include day specific or non-repeating trains. The locations chosen were:

- Woolmer Green Junction – to show the use of capacity over the two track section between Woolmer Green Junction and Digswell Junction
- Huntingdon – to show the use of capacity over the two track section between Huntington and Peterborough
- Stoke Junction – to show the use of capacity over the Peterborough - Grantham section
- Durham – to show the use of capacity over the two track section between Northallerton and Birtley Junction
- Heaton South Junction and Drem – to show the use of capacity at either end of the Newcastle – Edinburgh section

6.2. Analysis of current timetable at key locations

The graphs that follow demonstrate that there is currently a trade-off between different types of train on the ECML. There are hours in which a greater number of Long Distance High Speed (LDHS) trains run, but in these hours there are generally fewer trains of other types.

It should be noted that there is one hourly period, 0900 – 0959, where there are currently 9 LDHS trains passing through Woolmer Green in the Up direction. However, the total number of Up trains in this hour (16) is less than the 17 trains in the preceding hour.

Further analysis of the 0900 – 0959 hour shows that some of these LDHS trains include significant pathing time (a total of 5½ minutes between Stevenage and Kings Cross in one train and 7 minutes in another), meaning that, in terms of journey times, these services are more akin to TSGN services over this section.

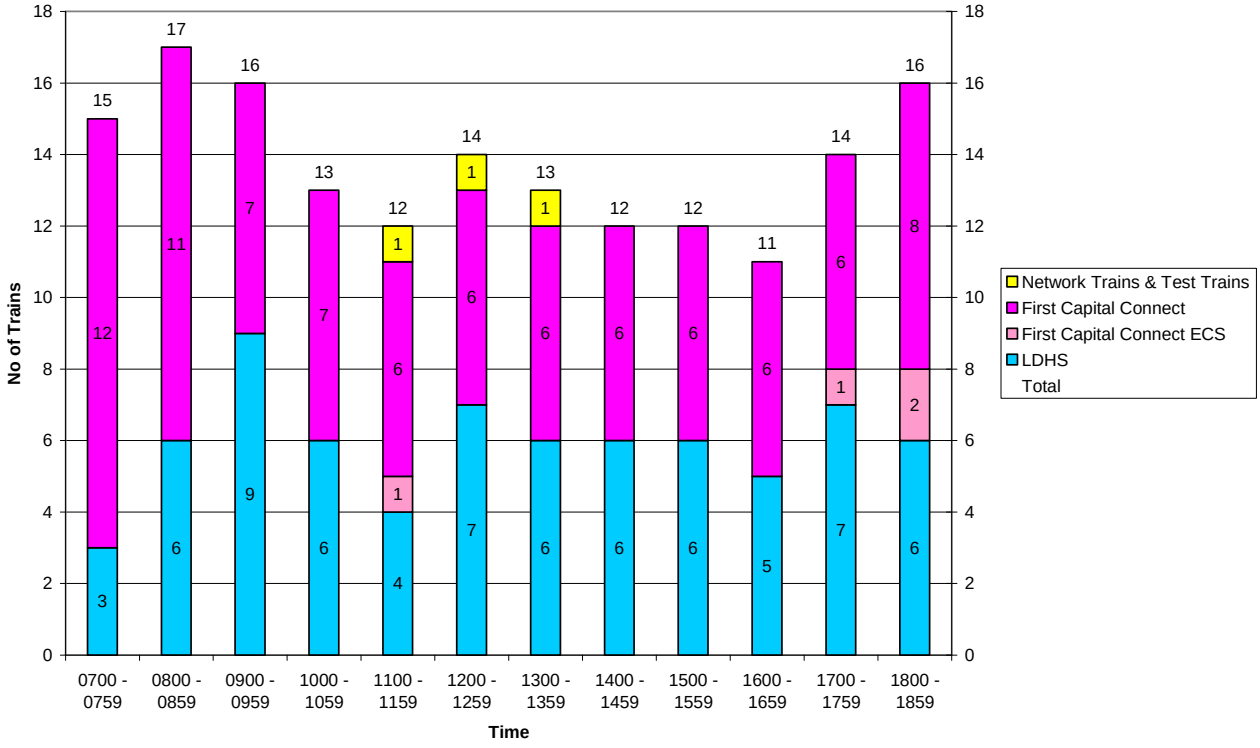

Figure 22 Woolmer Green Up Direction

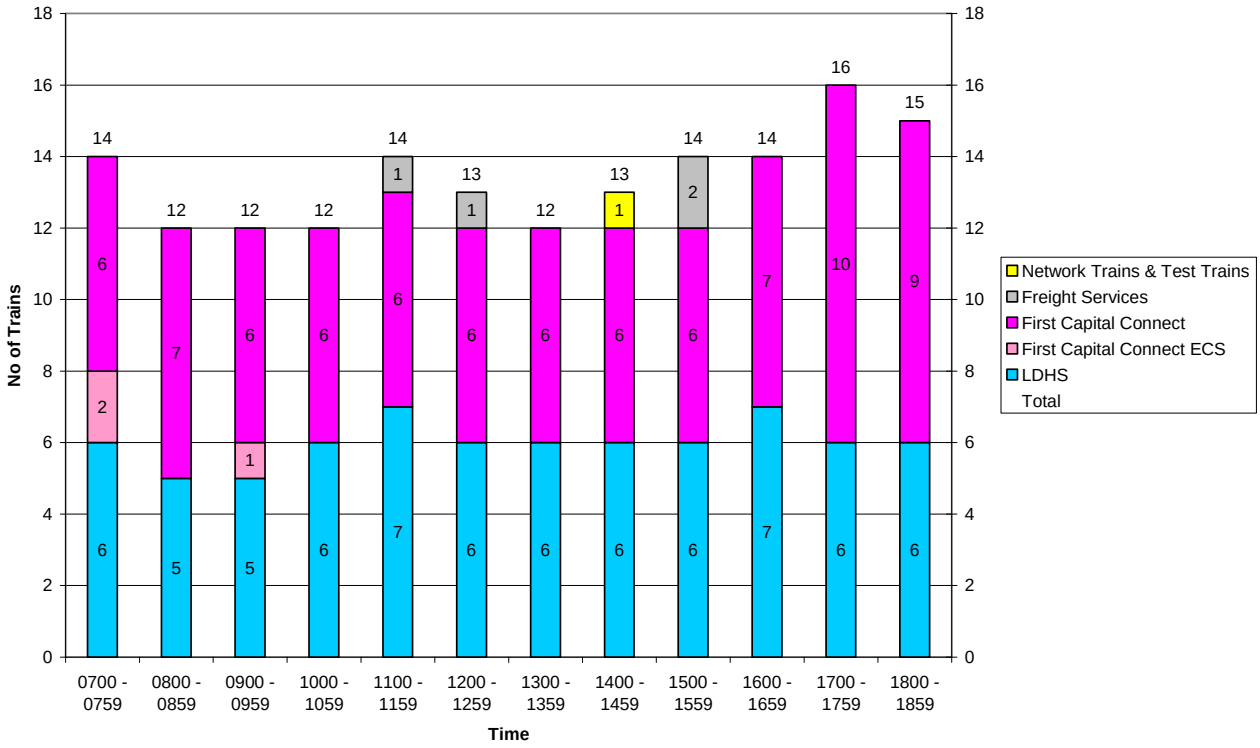

Figure 23 Woolmer Green Down Direction

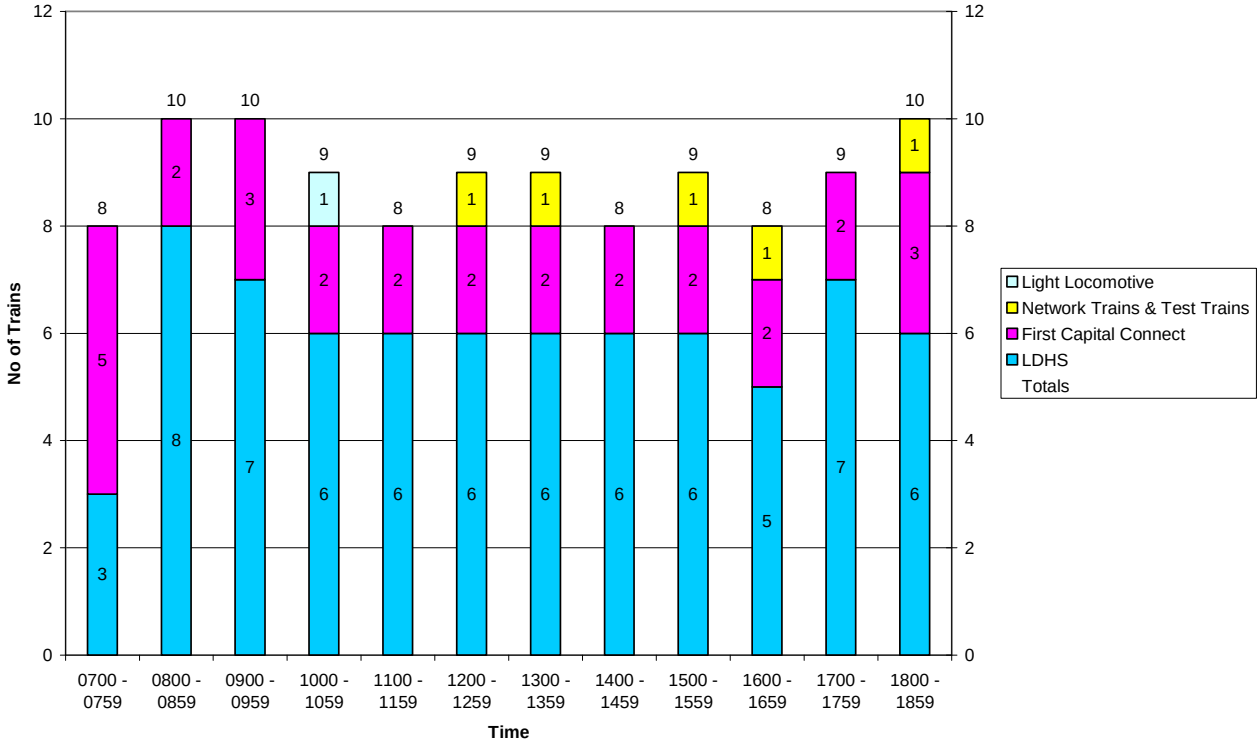

Figure 24 Huntingdon Up Direction

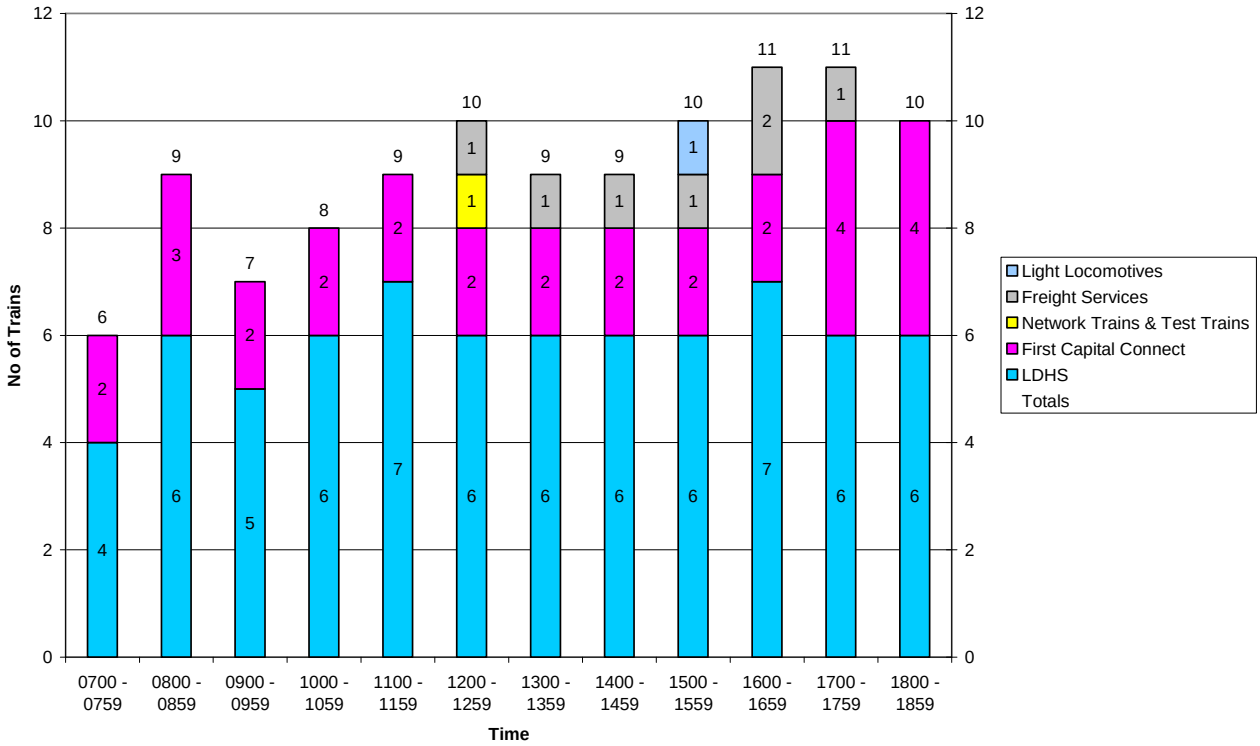

Figure 25 Huntingdon Down Direction

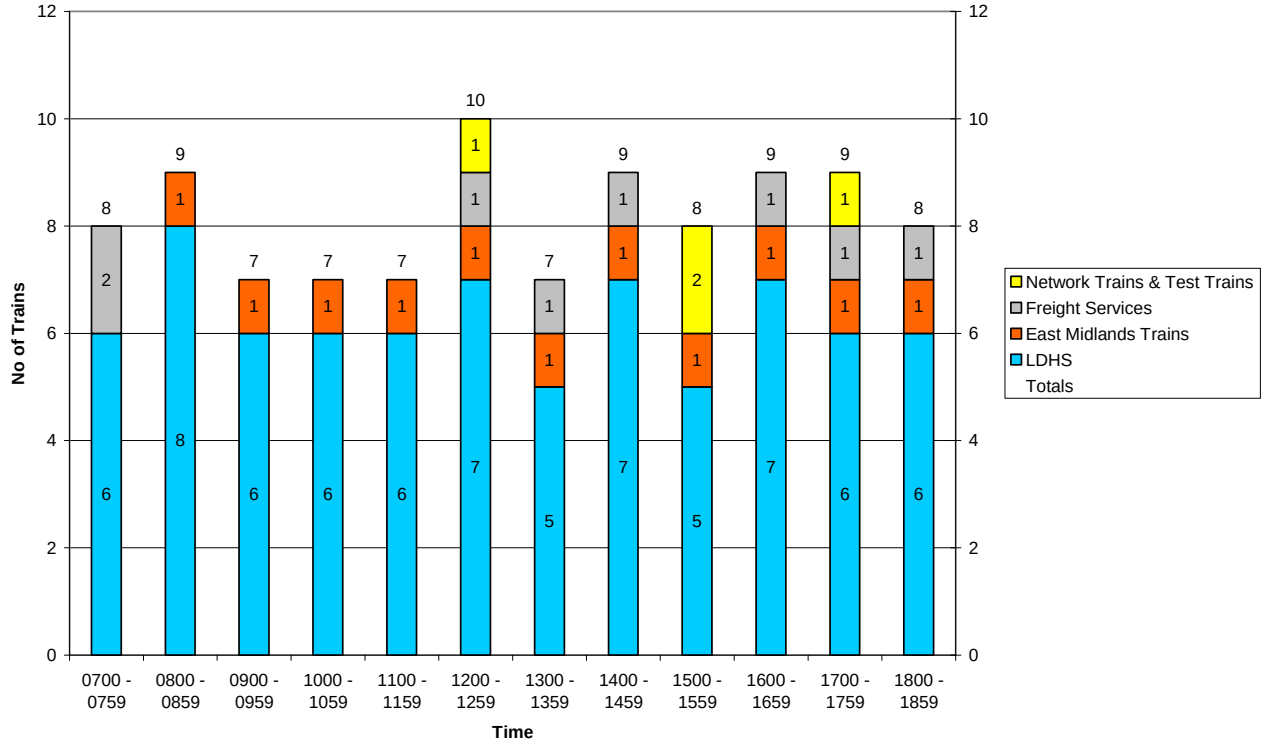

Figure 26 Stoke Up Direction

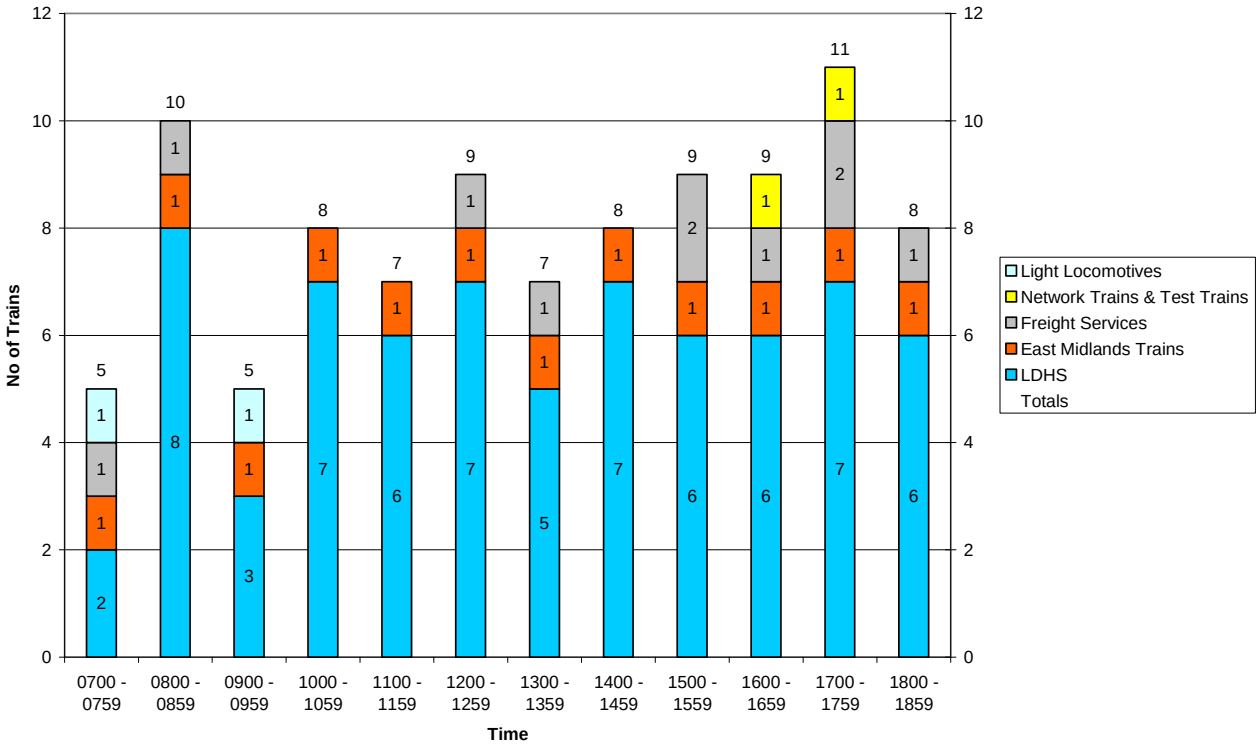

Figure 27 Stoke Down Direction

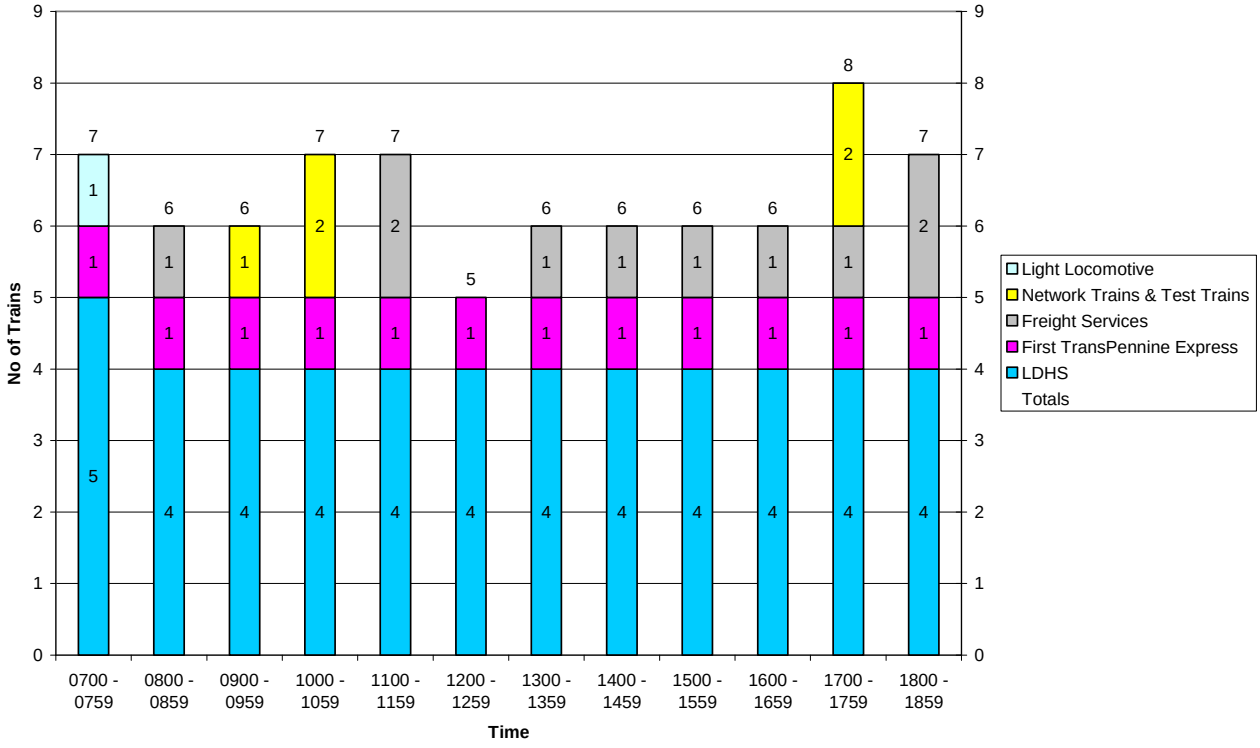

Figure 28 Durham Up Direction

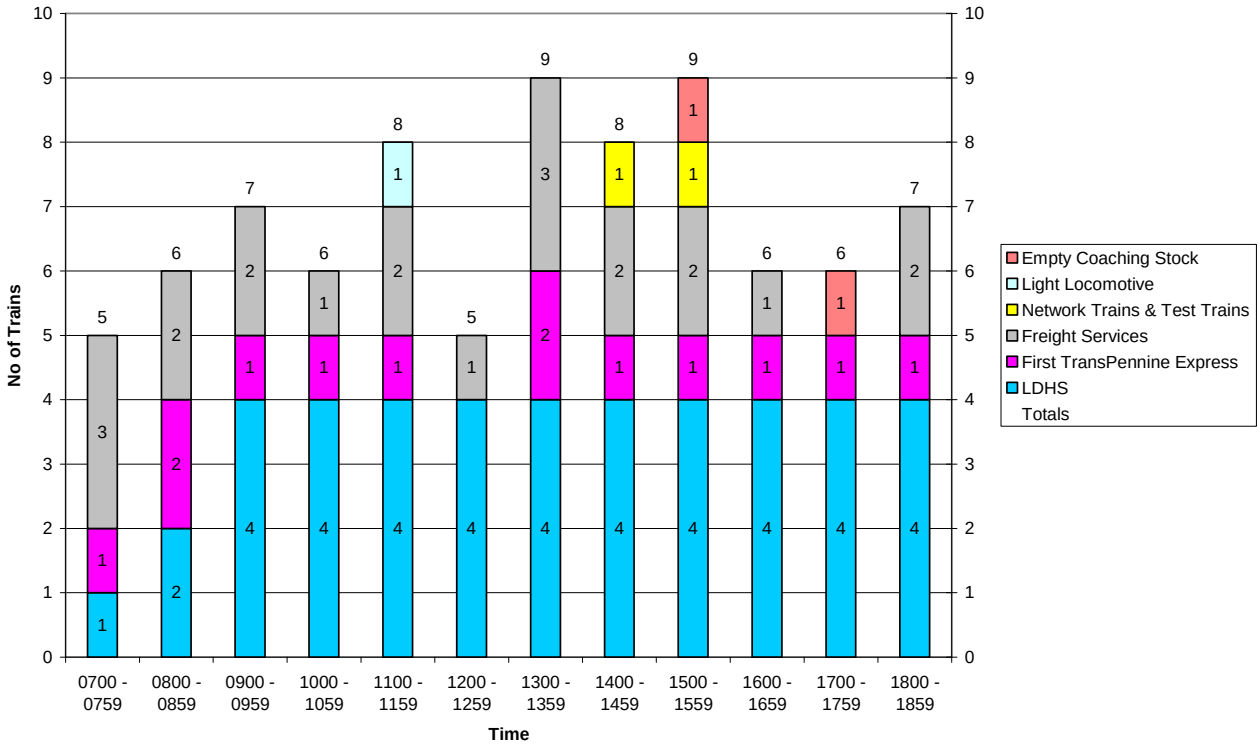

Figure 29 Durham Down Direction

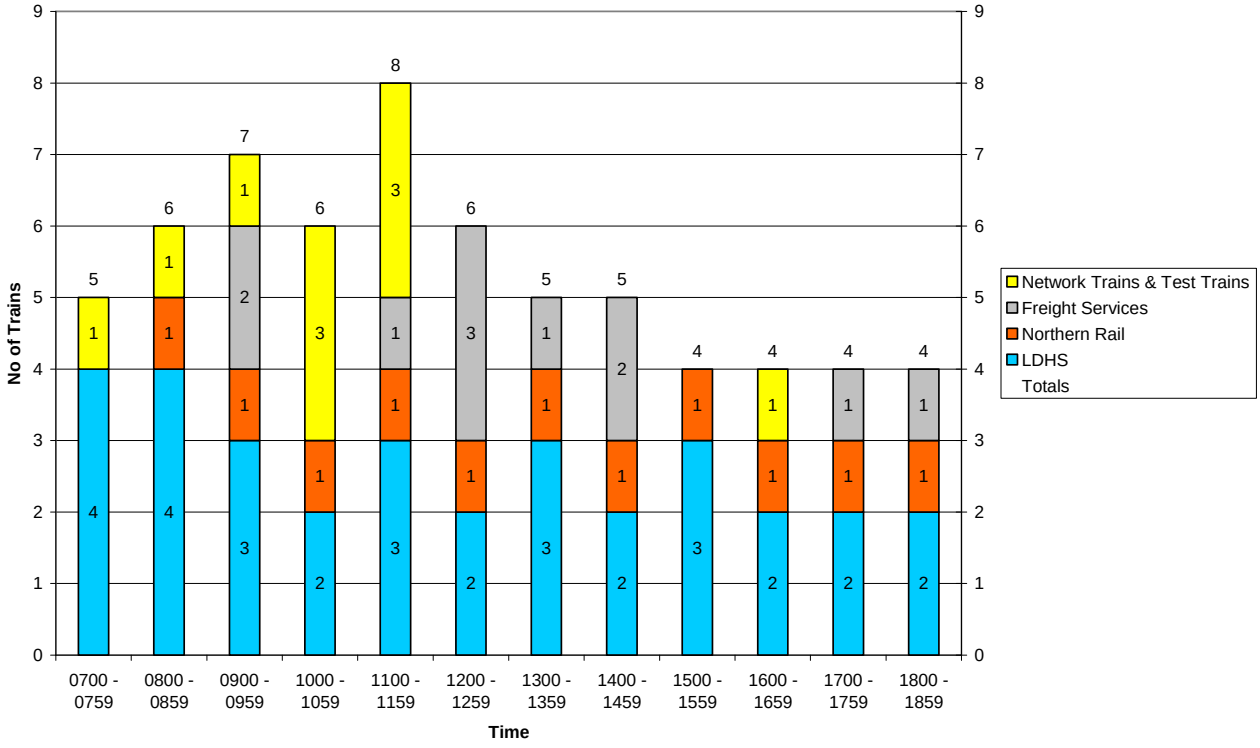

Figure 30 Heaton South Junction Up Direction (excl. movements to/from Heaton Depot)

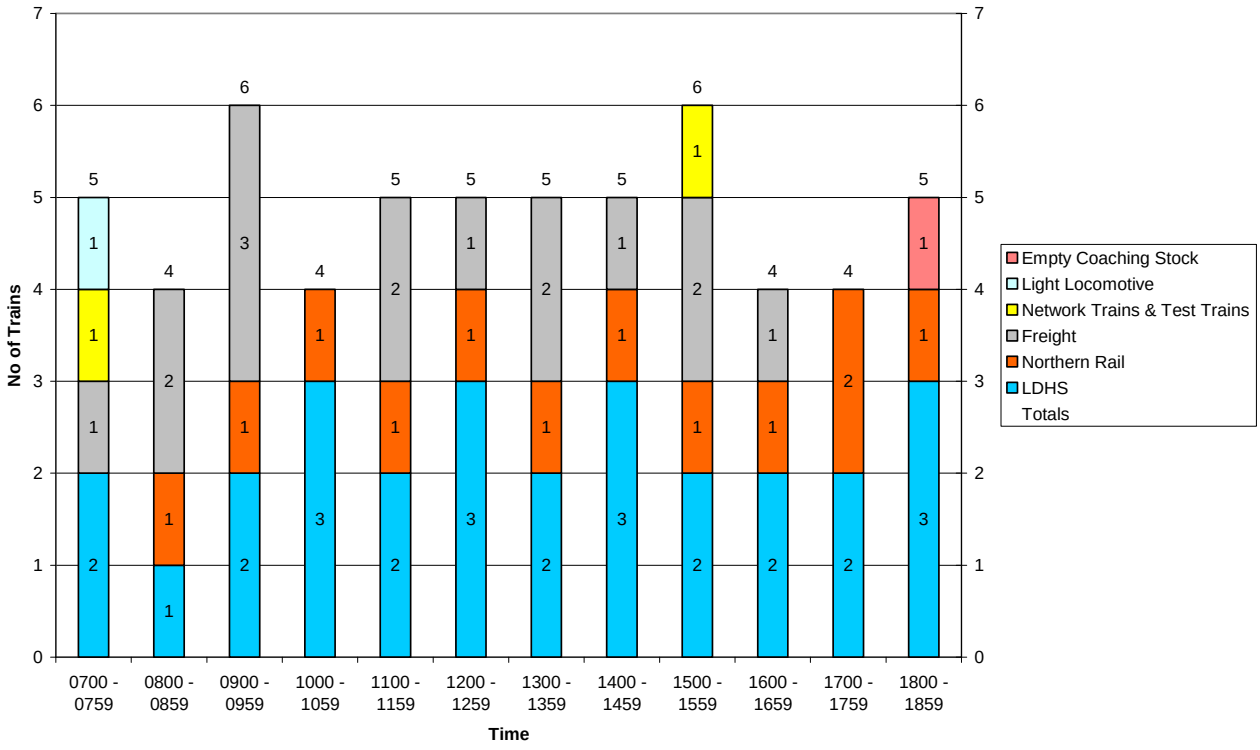

Figure 31 Heaton South Junction Down Direction (excl. movements to/from Heaton Depot)

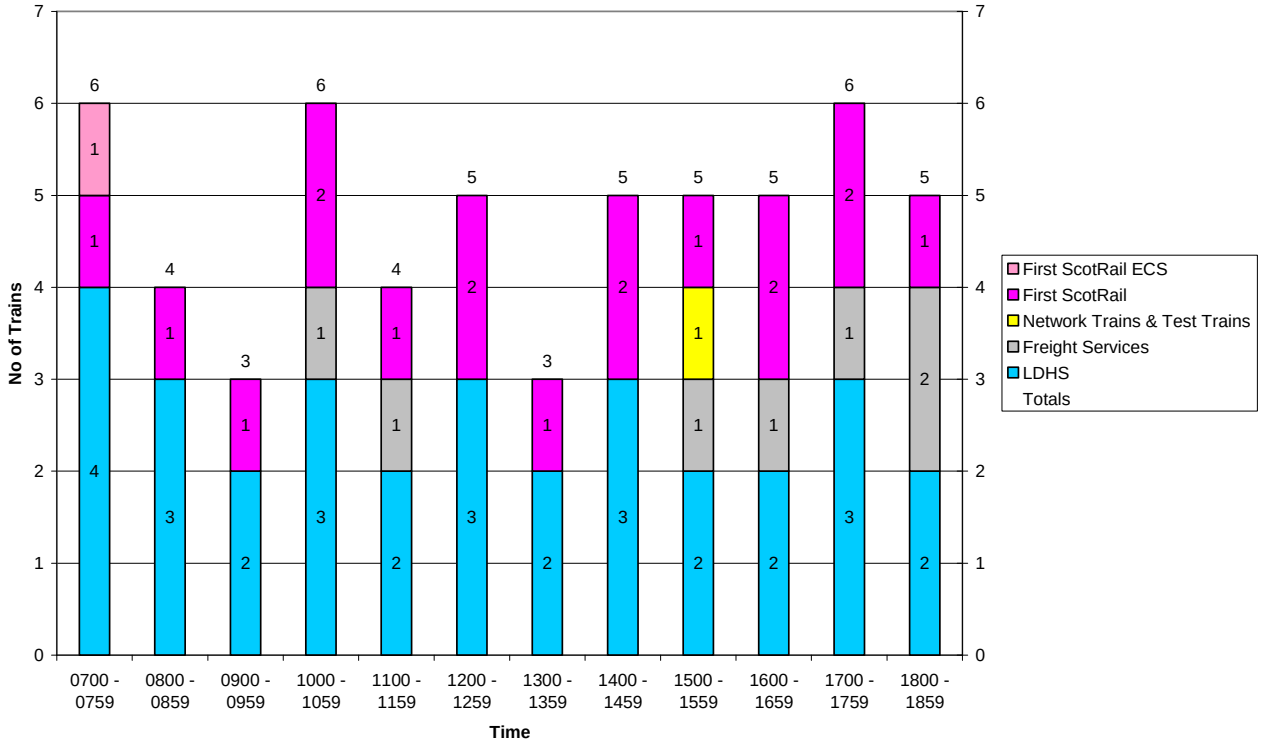

Figure 32 Drem Up Direction

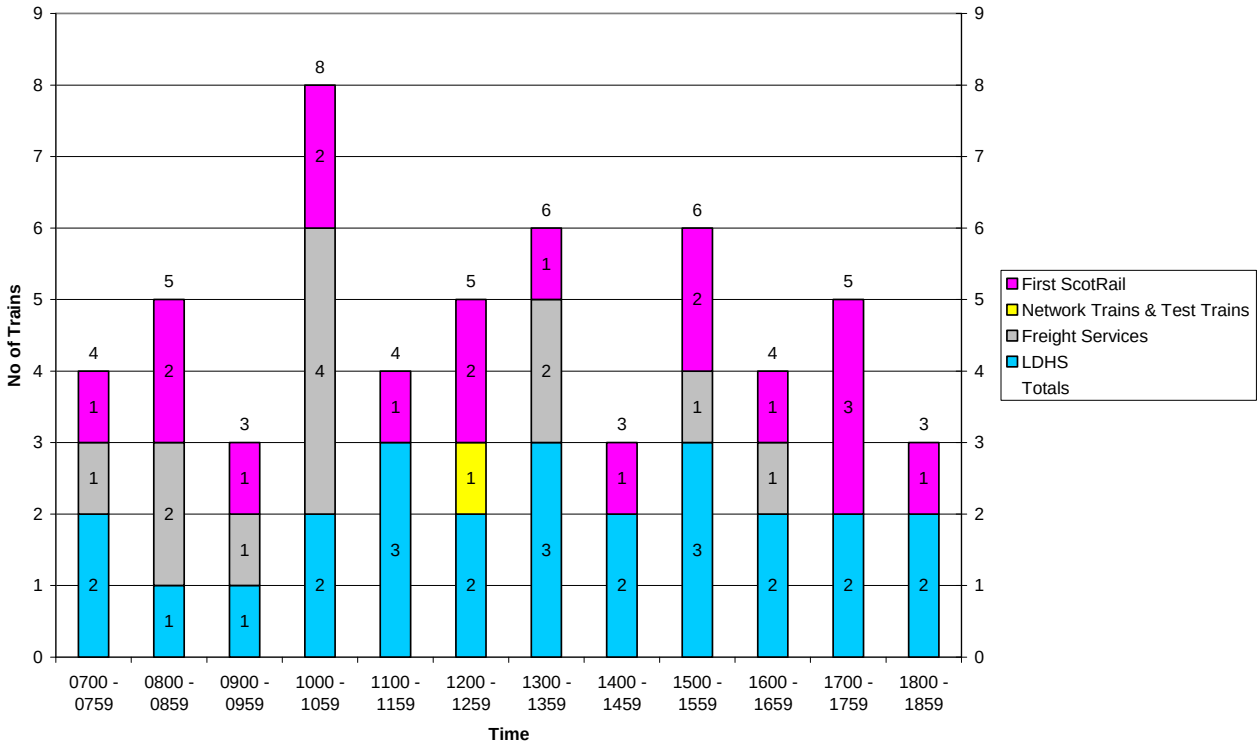

Figure 33 Drem Down Direction

7. Appendix C – Capacity Analysis

7.1. Introduction and approach

The capacity analysis has been completed in a number of stages as defined in the remit. The purpose of this work is not to define a detailed timetable but to test a number of different scenarios. Detailed timetables have not been developed in this process.

The approach has been to examine different service structures (including changes to quantum and intervals) to understand how network capacity is used and therefore the resulting service that could be delivered on the infrastructure assumed to be available in 2020 (see assumptions).

7.2. Output 1

The first stage of the analysis was to examine whether all the known access rights, access applications and aspirations for services on the ECML could be accommodated on the infrastructure in 2020.

To understand whether this could be achieved, service structures between Kings Cross and Peterborough were assessed. The TSGN Fast line paths and LDHS paths were examined and different timetable structures were formulated. There are a number of constraints to how this service quantum can be structured.

Speed of rolling stock
Class 700 and Class 365 trains have a maximum speed of 100mph whereas Class 800/801, Class 390 and Class 180 trains have a maximum speed of 125mph. This means that more network capacity is used when there is a mix of rolling stock using the same line.

Thameslink
There is a requirement to link TSGN services and integrate these with the 24 TPH Thameslink core service, as well as origins and destinations south of London

Woolmer Green – Digswell
The two-track section over Welwyn Viaduct is a bottleneck. This constraint is compounded by the requirement for some services to call at Welwyn North station.

Cambridge branch
The number of services and different calling patterns for TSGN services (non-stop Cambridge/Kings Lynn, semi-fast Cambridge and all stations Cambridge) on this two-track section is a constraint. It limits the choices for how services can be flighted over this section to achieve good journey times for the fast services. This in part dictates the structure for TSGN services between Hitchin and Finsbury Park.

Two track sections between Peterborough and Huntingdon
All services need to be routed over the two-track sections between Peterborough and

Huntingdon. The differences in speed, along with the other constraints, makes it difficult to find suitable paths

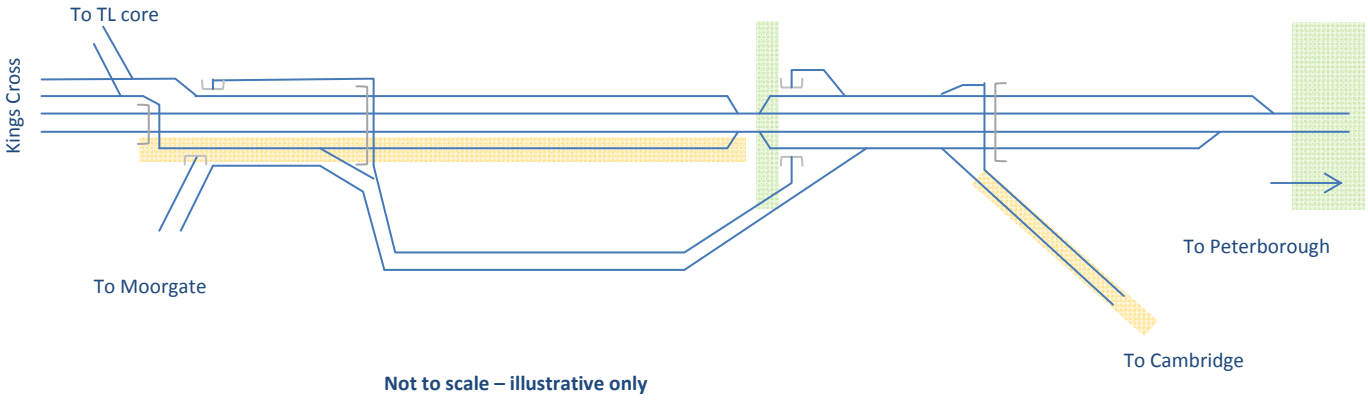

Figure 34 Constraints between Peterborough and Kings Cross

The peak aspirations were examined and it was concluded that all of the above constraints, but in particular Woolmer Green – Digswell, limit the number of services that can run between Kings Cross and Peterborough on the Fast lines. A standard hour timetable structure was developed to demonstrate this.

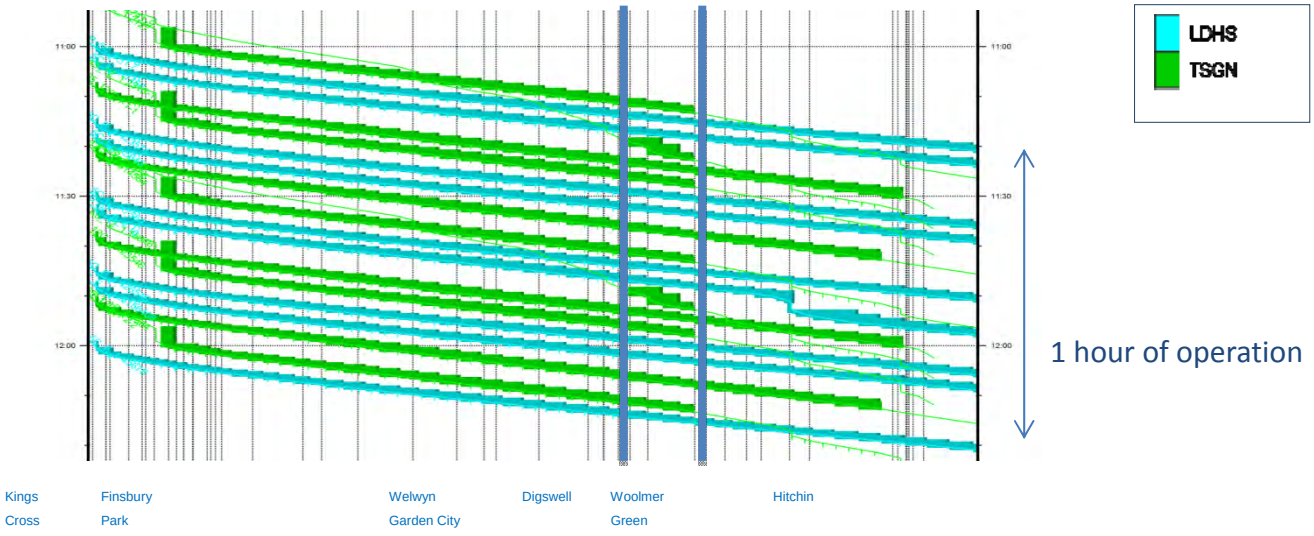

Figure 35 Train graph Output 1 – Kings Cross to Peterborough

The maximum number of trains that can be accommodated is 18 per hour, taking into account the need to call at least 2 TPH at Welwyn North and ensuring that journey time penalties are not incurred for faster services.

If the Welwyn North call is removed this would potentially allow for 20 TPH, though the speed differential between LDHS and TSGN then becomes a key constraint as the train calling at Welwyn North is always after an LDHS and before the next TSGN service. This would erode some of the spare network capacity made available by removing the Welwyn North call.

The number of services over the two track section can be increased about 18TPH if the LDHS and Outer Suburban services are slowed down. This requires pathing time to be added to the timetable.

7.3. Output 1 Conclusions

All aspirations cannot be achieved on the assumed infrastructure available in 2020, as more than 18 trains are included in the aspirations. In line with the remit for this report, this means that Output 2a has not been undertaken and the analysis moves on to Output 2b.

7.4. Output 2

Output 2 started by defining a number of subsets for the aspirations, for further testing of the timetable structures and choices. These subset definitions were based on the findings from Output 1, infrastructure capability and logically grouped aspirations (assuming that there is no removal of a service to any location). The subsets were shared with the industry for feedback.

7.5. Subsets south of Peterborough

Based on the conclusions of Output 1, the constraints south of Peterborough limit the number of trains over the two-track section between Woolmer Green and Digswell to 18 TPH, with two services per hour calling at Welwyn North, or 20 TPH, with no services calling at Welwyn North.

Assuming that removing or reducing the service to Welwyn North is not acceptable all subsets tested south of Peterborough are based on a maximum 18 TPH service over Welwyn Viaduct. The subsets have been defined based on the logic of having a standard pattern service south of Peterborough (both peak and off-peak) to optimise the capacity available. It is acknowledged that the pattern north of Peterborough is more likely to be a repeating two or three hourly pattern depending on the aspired service level to various destinations.

7.5.1. Subset A

Peak service:

- 8 LDHS
- 2 Kings Cross - Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 Kings Cross – Royston (calling at Welwyn North)
- 2 Kings Cross - Peterborough

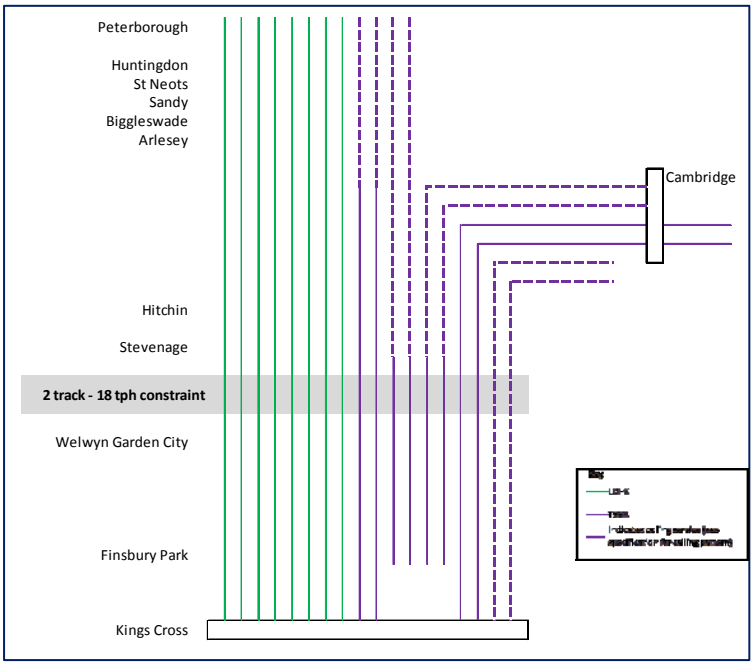

Figure 36 Subset A Peak

Off-peak service:

- 8 LDHS
- 2 Kings Cross – Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 TL - Royston (calling at Welwyn North)
- 1 freight path (Class 4)

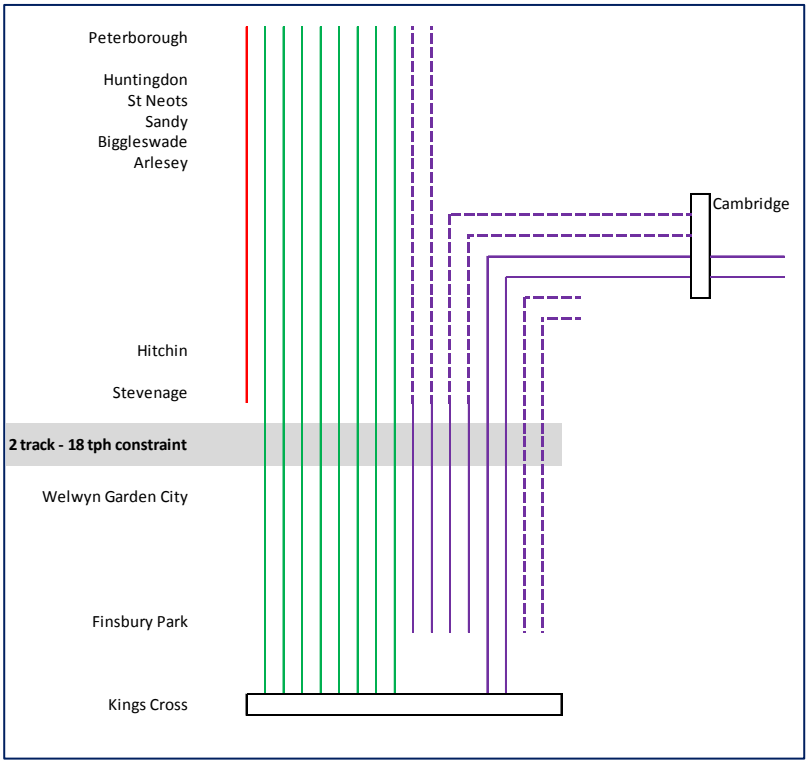

Figure 37 Subset A Off-peak

7.5.2. Subset B

Peak service:

- 9 LDHS
- 2 Kings Cross – Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 Kings Cross – Royston (calling at Welwyn North)
- 1 Kings Cross - Peterborough

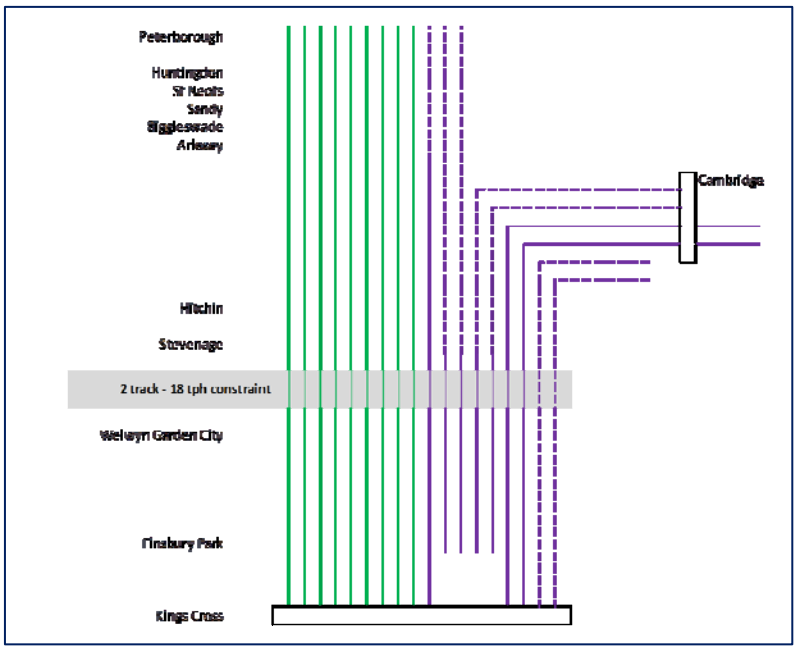

Figure 38 Subset B Peak

Off-peak service:

- 9 LDHS
- 2 Kings Cross – Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 Kings Cross – Royston (calling at Welwyn North)

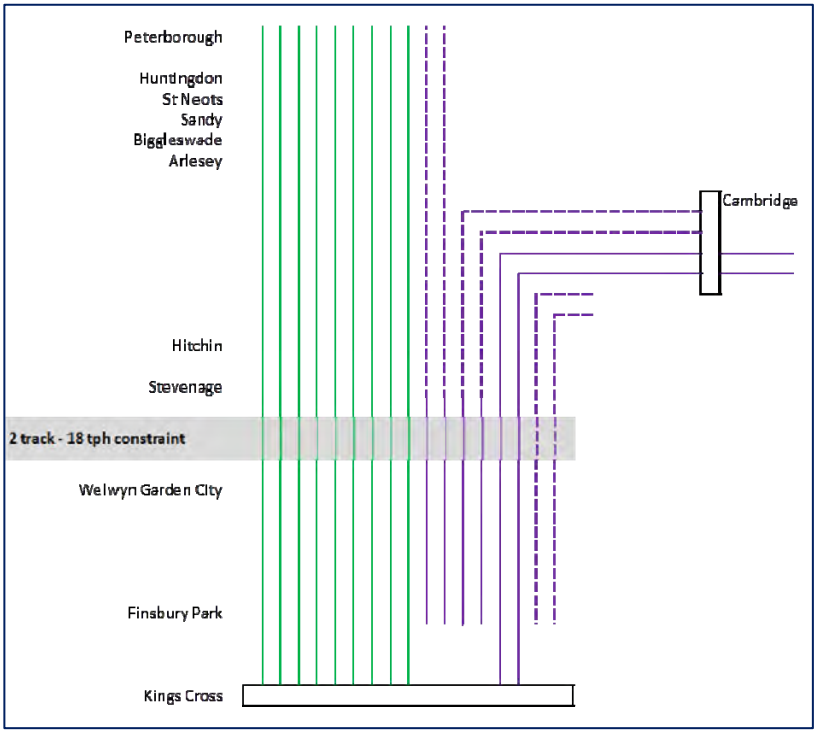

Figure 39 Subset B Off-peak

7.5.3. Subset C

Peak service:

- 7 LDHS
- 2 Kings Cross – Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 Kings Cross – Royston (calling at Welwyn North)
- 2 Kings Cross - Peterborough

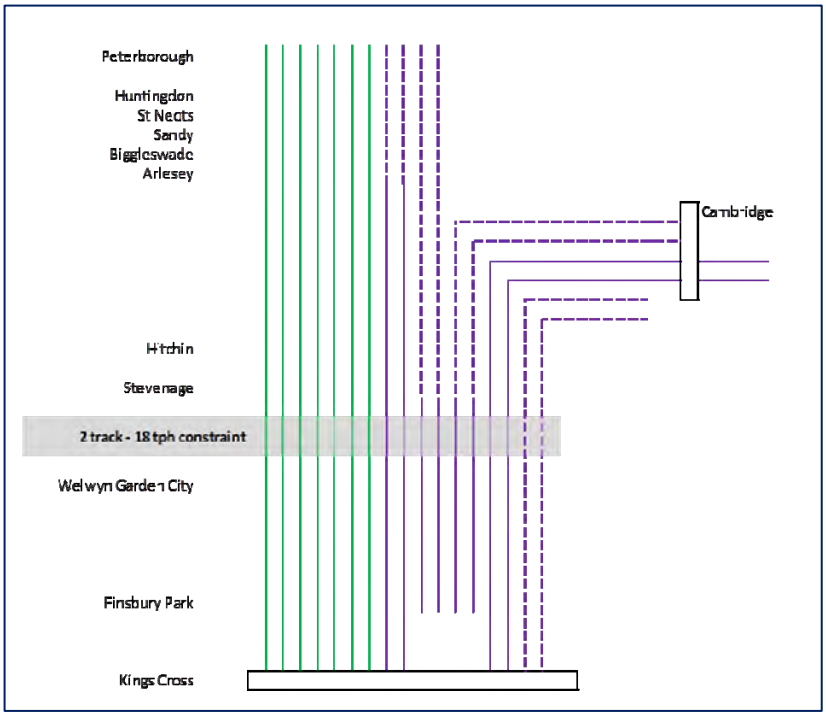

Figure 40 Subset C Peak

Off-peak service:

- 7 LDHS
- 2 Kings Cross – Cambridge/Ely/Kings Lynn
- 2 TL – Cambridge
- 2 TL – Peterborough
- 2 Kings Cross – Royston (calling at Welwyn North)
- 2 freight paths (Class 4 and Class 6)

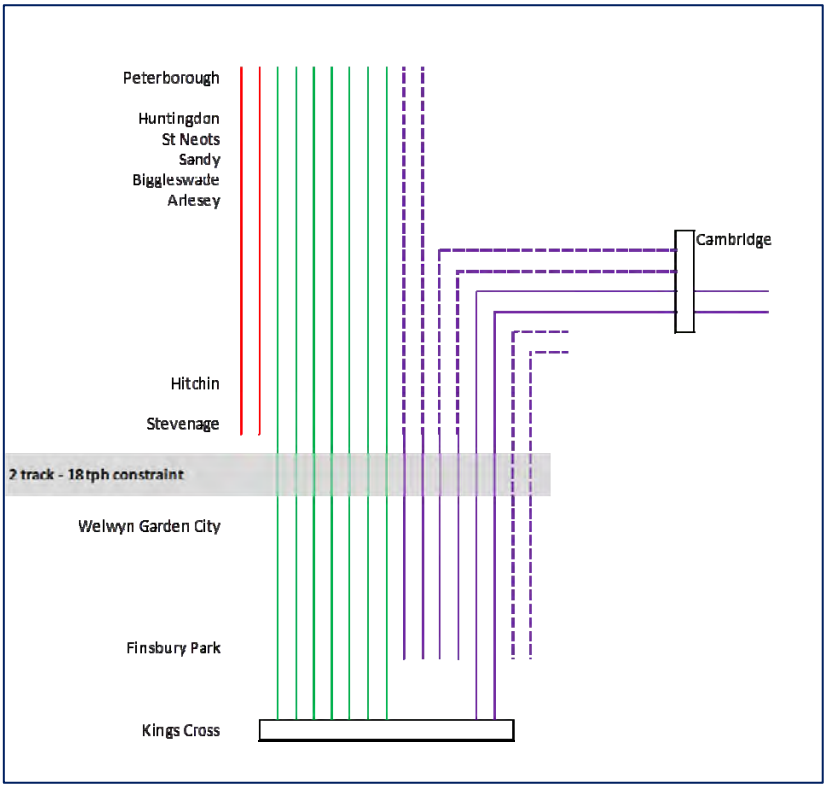

Figure 41 Subset C Off-peak

7.6. Subsets north of Peterborough

Once the choices for the core main line services were defined south of Peterborough, these were then extended over the whole route examining the interaction with other services (freight, inter-regional and local) to define subsets to test over the whole route. These subsets have been chosen to examine different service choices – for example quantum of freight and passenger.

Subset	London - Leeds (via Wakefield)	London - Leeds (via Micklefield)	London - Edinburgh	London - Newcastle	London - York	London - Cleethorpes	London - Sunderland	London - Ilkley/Bradford	London - Hull	Plymouth - Edinburgh	Reading - Newcastle	Liverpool - Newcastle	York - Middlesbrough	Liverpool - Norwich	Liverpool - Edinburgh	Plymouth - Leeds
Subset A1	2		2	1	1	0.5	0.5	0.5	0.5	1	1	1	1	1		
Subset A2	2		2	1	1	0.5	0.5	0.5	0.5		1			1	1	1
Subest A3	3		2	1		0.5	0.5	0.5	0.5	1	1	1	1	1		
Subset A4	2	1	3	1			0.5		0.5	1	1	1	1	1		
Subset B1	2		2	1	1	0.5	0.5	0.5	0.5	1	1	1	1	1		
Subset B2	2		3	1	1	0.5	0.5	0.5	0.5	1	1	1	1	1		
Subset C1	2		2	1		0.5	0.5	0.5	0.5		1		1	1	1	1
Subset C2	2	1	2	1			0.5		0.5							

Figure 42 Summary Table of subsets and number of services per hour on key passenger flows

7.7. Stage 2 Capacity Findings

Following the definition of subsets, service structures have been constructed to understand how the capacity is used and whether these can be accommodated within the available network capacity.

The findings that follow are split by geographical sections but the analysis has looked route-wide and therefore looks at how these sections interact.

7.7.1. Kings Cross to Peterborough (including Hertford Loop)

All work has assumed that the Fast line services and Slow line services can be segregated, except on the two-track sections between Woolmer Green and Digswell, and between

Peterborough and Huntingdon. This analysis is therefore split between the Slow lines (including Hertford Loop) and the Fast line. Note that if there is any requirement for TSGN inner services to use the Fast lines, the capacity available for LDHS and TSGN outer services will be reduced.

7.7.1.1. Slow Lines (including Hertford Loop)

The key constraints in developing the Slow Line service structure are the quantum of services joining the ECML at Belle Isle Junction (from the Thameslink Core), the mix of service types, speed differences (for freight and passenger) and calling patterns in the passenger service. The line to/from the North London line joins at Copenhagen Junction which is a single lead junction. Up freight services accessing the North London Line westbound must cross down TSGN services at Copenhagen Jn. An 8.5 minute gap in down TSGN services is required due to the slow speed of the connection onto the North London incline.

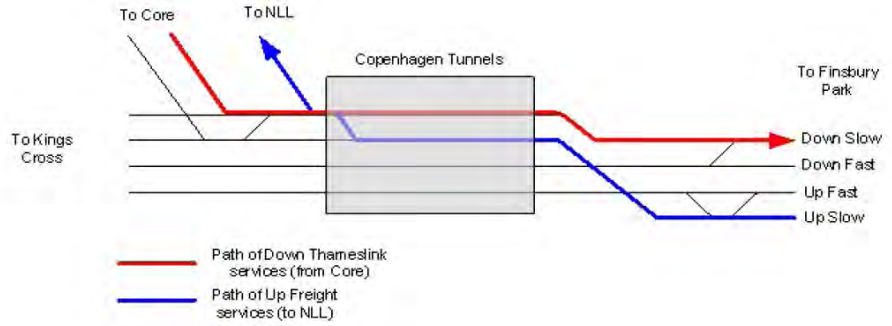

Figure 43 Freight routing to NLL

Stopping services at Haringey and Hornsey are limited to slow line running as there is only one platform face at each of these stations. This does not allow for full segregation of the Hertford Loop passenger service on Slow line 2.

The Hertford Loop is two-tracked throughout with bay platforms at Gordon Hill and Hertford North for terminating services. The Hertford Loop route reconnects with the East Coast Main Line at Langley Junction, just south of Stevenage. The pattern of the GN inner services is constrained by the mix of speeds around the Hertford Loop, the constraints on paths for freight services around the loop and the required calling patterns at Haringey and Hornsey.

The Slow lines north of Stevenage provide no specific capacity constraint but become very difficult to structure when examined alongside the two track sections over Welwyn Viaduct and between Peterborough and Huntingdon. This is discussed in further detail under section 7.7.1.2.

Although there are constraints influencing how the timetable can be constructed over the Slow lines, capacity can be provided for both the TSGN service level and two standard freight paths via the Hertford Loop.

7.7.1.2. Fast Lines (including two track sections)

As discussed in section 7.2, construction of a Fast line service structure is primarily constrained by a combination of speed differentials and the two track sections (Woolmer Green – Digswell and Peterborough – Huntingdon).

Service structures have been built for all subsets to demonstrate the choices which will need to be made in how to use the network capacity.

7.7.1.2.1. TSGN service interval and LDHS flighting

The first subset is constructed around a 15 minute interval TSGN outer service.

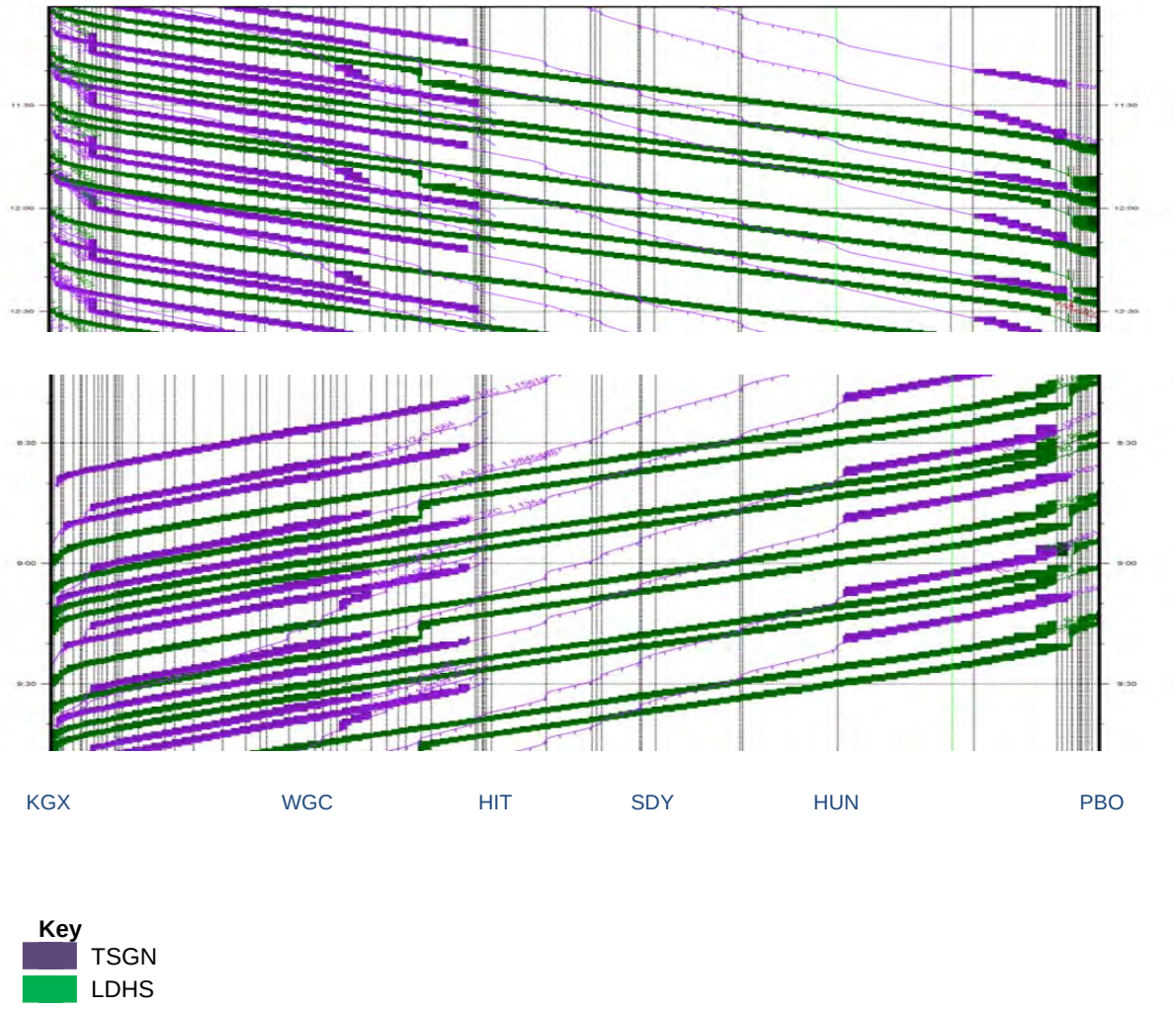

Figure 44 Peak TT graph Kings Cross – Peterborough – 15 minute interval TSGN semi-fast service

8 LDHS per hour and the TSGN level of peak service is possible if the timetable is structured to achieve 18 TPH service over Welwyn Viaduct. The Cambridge branch is a constraint in terms of the different calling patterns between the non-stop Cambridge/Kings

Lynn service and the semi-fast and stopping service. To achieve good journey times on the fast service (and avoid the need for pathing time) the services need to be flighted.

Achieving a Stevenage call in the LDHS pattern is challenging due to the need to flight the LDHS services. The Stevenage call can only be added to two paths at the end of the flight, otherwise a train path will need to be removed.

The LDHS services have been constructed on a half hourly repeating pattern south of Doncaster which results in pairs of services every 30 minutes needing to have matched paths. This is driven by the 15 minute TSGN pattern and the core LDHS structure of 2tph to Leeds and 2tph to Edinburgh. This means LDHS paths need to have the same calling pattern between Peterborough and Kings Cross and the same number of calls between Peterborough and Doncaster. It is very likely that the standard structure to south of the route would lead to a 2 or 3 hourly repeating pattern to the north of Doncaster to serve the various aspired destinations and calling patterns. A 30 minute pattern for LDHS is not essential and input from operators on commercial need would be important in determining the right interval and calling pattern for LDHS services. The conclusions on pairing services would be required for whatever pattern is decided appropriate to achieve the capacity over the route, but for example could be through a repeating 15 minute flight rather than 30 minutes.

To achieve 18 TPH in the Up direction over Welwyn Viaduct, the trains need to be flighted such that they are on minimum planning headways at this point (with suitable gaps to accommodate the stopping services). This means that calling patterns need to be symmetrical to achieve the pattern over this section.

For example, two trains from Leeds departing 30 minutes apart with a different number of calling points could not be accommodated as they would not be at Welwyn Viaduct 30 minutes apart. To make an unsymmetrical calling structure work there would either need to be a reduction in service quantum or an increase in journey times through the use of pathing time.

The timetable structure has been developed around an 18 TPH peak service over the Viaduct. This allows the peak additional passenger services to be removed in the off-peak, whilst retaining the rest of standard pattern timetable all day.

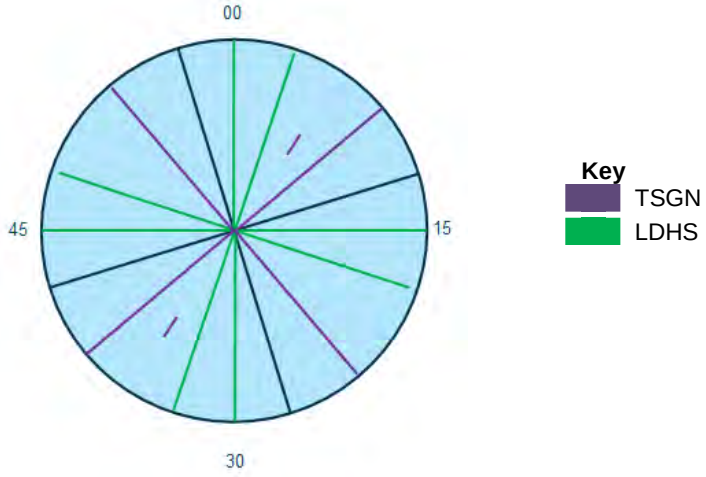

Figure 45 Illustrative service structure with 15 minute TSGN service interval

This LDHS flighting structure results in flights of two trains every fifteen minutes. This has implications on the calling patterns and flighting between Peterborough and Doncaster which is discussed in section 7.7.3.

In the off-peak, the removal of the Kings Cross – Peterborough TSGN service increases the network capacity available for freight between Peterborough and Huntingdon. Having flights of two LDHS paths every fifteen minutes limits the capacity available for freight in the off-peak.

Only one freight path can be achieved in both directions:

- One Class 4 1600 tonne northbound path (75C66S16)
- In the southbound direction, due to the longer portion of two track, one Class 4 freight path can be achieved but is limited to 1100 tonnes and requires looping at Connington for approximately 30 minutes

This does not meet the freight requirements from the Freight Market Study or 2020 ITSS.

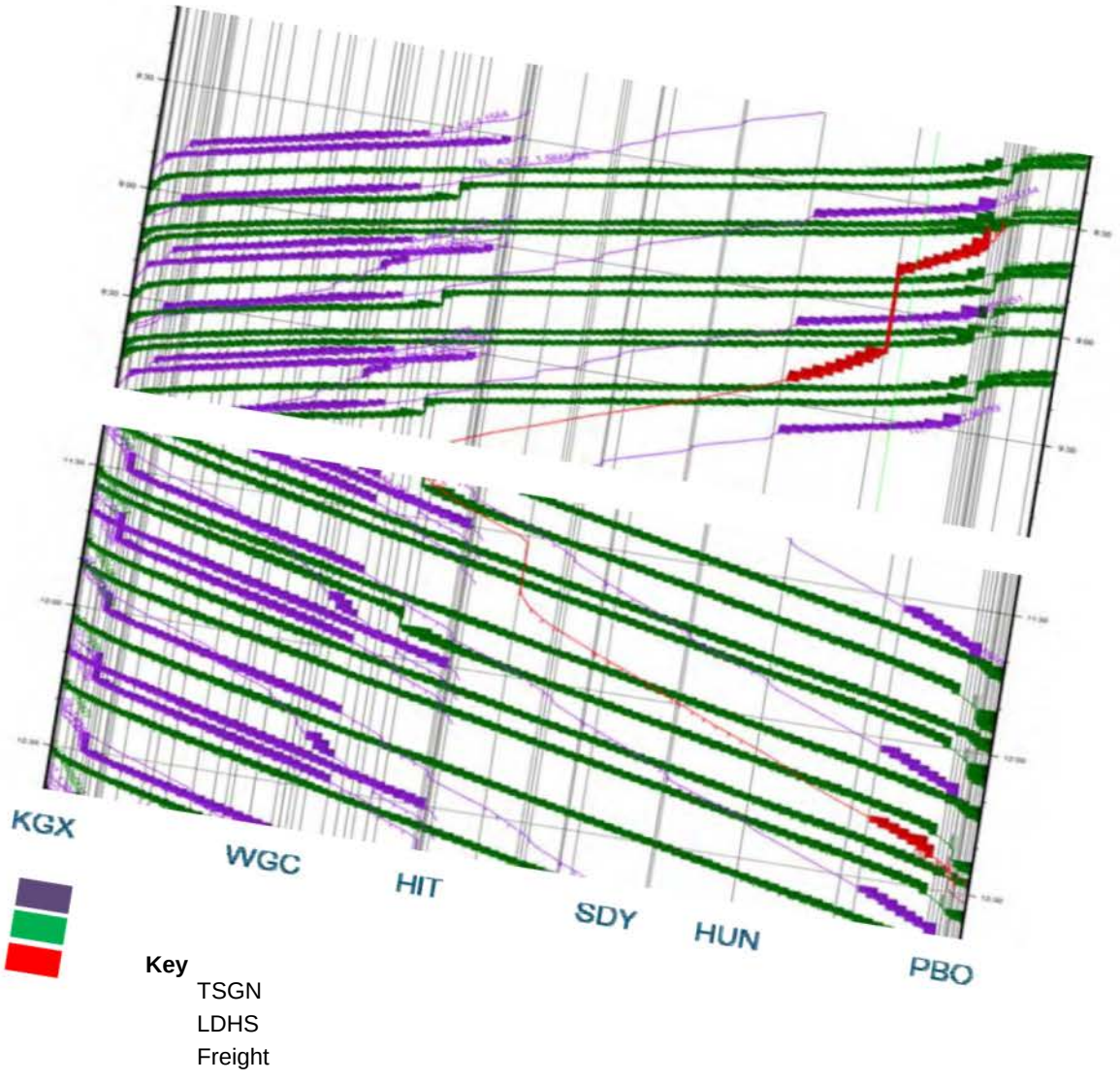

Figure 46 8 LDHS Off-peak service structure

7.7.1.2.2. 12/18 minute TSGN semi-fast service interval

To understand what impact a different structure of TSGN semi-fast services could deliver, a subset was tested with a different flighting of LDHS and TSGN semi-fast services. The TSGN semi-fast service is on a 12/18 minute interval which allowed for wider spacing of LDHS services. This had the advantage of removing some of the constraints on calling pattern between Peterborough and Doncaster and allowing more capacity in the off-peak for freight services. The structure of the LDHS pattern south of Peterborough impacts on the achievable pattern north of Peterborough.

The key challenge with this option was pathing the peak additional TSGN services between Peterborough and Kings Cross. To achieve these paths in the peak, journey time extension was required either in the form of pathing time, or extended dwell at Huntingdon to achieve a path between Peterborough and Huntingdon.

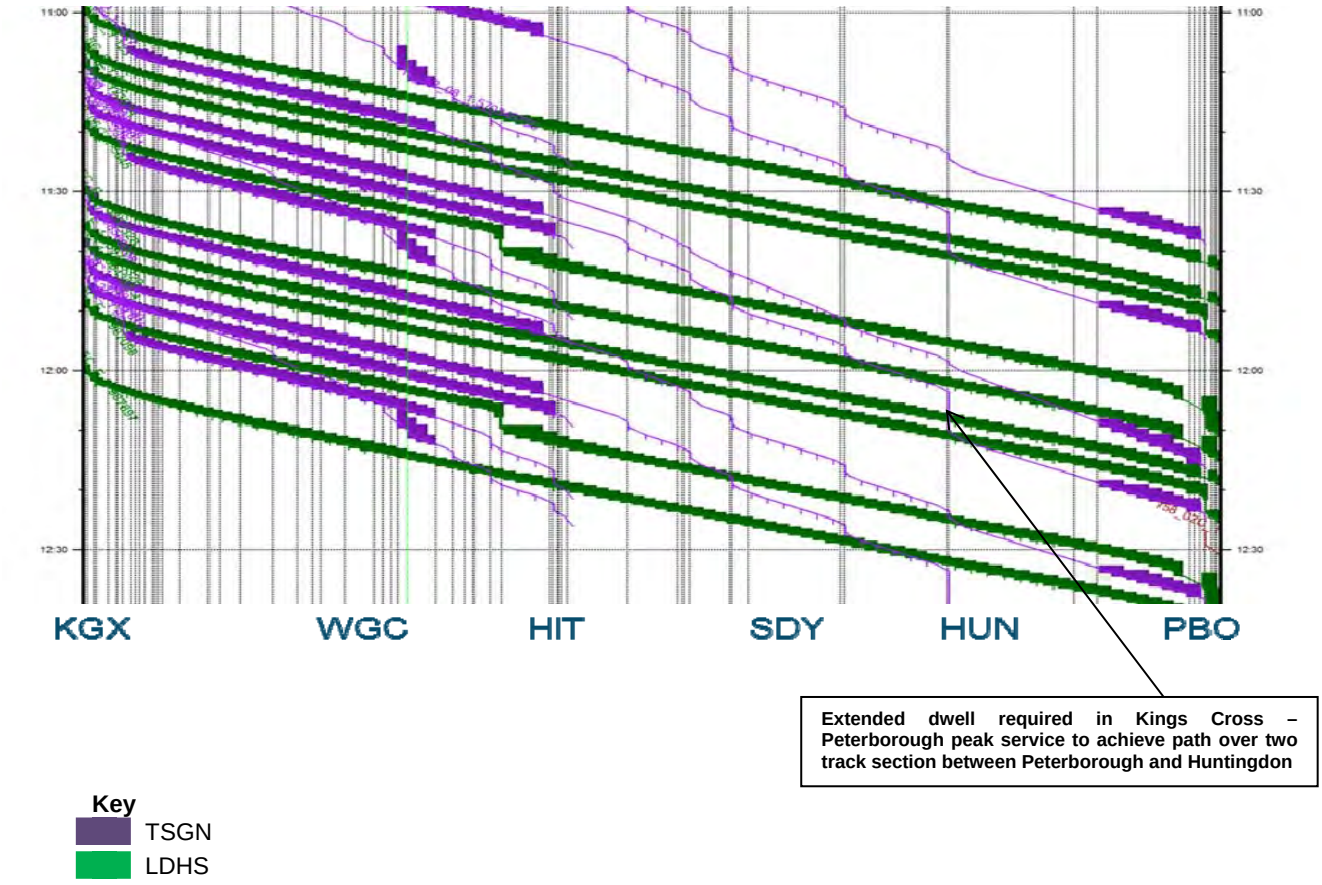

Figure 47 12/18 TSGN service interval Peak service Structure

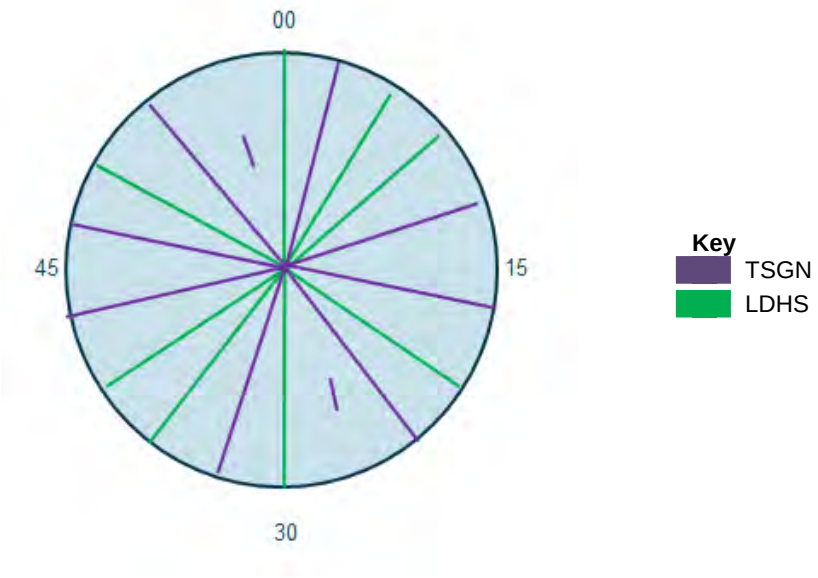

Figure 48 12/18 TSGN service interval illustrative service structure

In the off-peak, the required freight capacity from the 2020 ITSS and Freight Market Study can be achieved in the Down direction.

In the Up direction this is not met due to the longer two track section. To achieve one Class 4 freight path, Connington loop will have to be used and pathing time would need to be added to LDHS services to achieve a 1600 tonne path. A Class 6 path cannot be achieved in the Up direction.

7.7.1.2.3. Different service interval for TSGN northbound and southbound

At the industry sessions, it was highlighted that the current Govia proposals for TSGN service spacing are for a 12/18 minute split in the northbound direction and a 15 minute split in the southbound direction for semi-fast services. This has been developed based on the interaction with Sussex, Kent and the Midland Main Line. This will impact on LDHS by requiring a different flighting structure for northbound and southbound.

7.7.1.2.4. 9 LDHS service structures

Subset B includes 9 LDHS per hour and therefore reduces the number of TSGN services by one. To test this, a peak additional service between Kings Cross and Peterborough and has been removed to understand whether a 9th LDHS path can be achieved.

In both flighting options, a 9th LDHS can be achieved between Kings Cross and Peterborough in the peak although some pathing time was required to achieve the path. For example in the flighting structure with a 15/15 minute interval for TSGN semi-fast services 3 minutes of pathing was required in the 9th LDHS path between Huntingdon and Hitchin to achieve a compliant path. Further challenges are met north of Peterborough which will be discussed in later sections.

In the off-peak, the impact on freight very much depends on the timetable structure. In the 15/15 interval structure, the 9th LDHS path does not reduce freight capacity between Peterborough and Huntingdon due to the path it takes over the two-track section. In the 12/18 interval structure, the 9th LDHS path reduces the capacity available for freight to an extent that an Up freight path is not possible and only one Class 4 freight path is available in the Down direction.

7.7.1.2.5. 7 LDHS subsets

The 7 LDHS per hour subsets have the same constraints as previous options. The key difference is that there is one unused theoretical path an hour which allows for some flexibility in terms of calling patterns south of Doncaster. With a standard structure still required, this could be used to allow for one path to have a different pattern.

In the off-peak, there are still constraints to achieving the freight path requirement between Peterborough and Huntingdon.

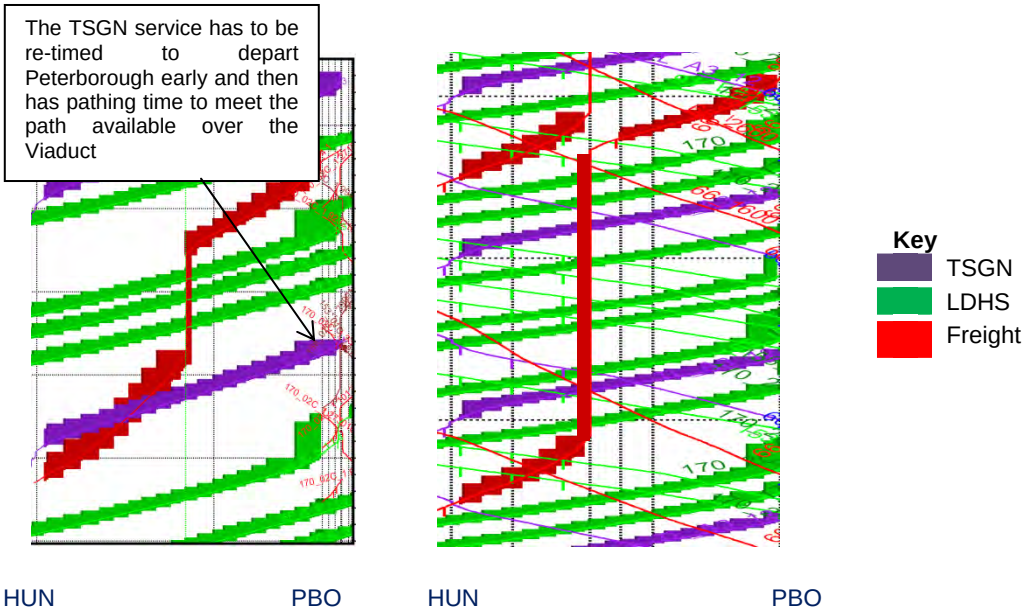

Figure 49 Example 7 LDHS structures and freight capacity

In the Up direction, the longer two-track section between Peterborough and Huntingdon is still a constraint with 7 LDHS services. A standard Class 4 freight path can be achieved but pathing time is required in LDHS to achieve this, or pathing time in the TSGN service (breaking the 30 minute service interval departure from Peterborough). In one structure tested, the resulting freight path has a large journey time extension with approximately 50 minutes required at Connington Loop.

7.7.2. Kings Cross Platforming

As a result of planned renewals and introduction of the European Train Control System (ETCS) an opportunity has arisen to redesign the approach to Kings Cross Station. A programme of work is currently in development to design and test the station layout options.

As a result of the Thameslink programme and TSGN services routed through the core, greater capacity exists within the station and its approaches for Fast line services. To optimise this capacity, an improved layout will allow Fast line services better access to platforms which were previously used by Slow line services.

A capacity study has recently been undertaken on the proposed new layouts. This tested a peak timetable, based on the new technical and planning margin assumptions that were derived from a Signalling Performance Assessment (SPA). The study showed that the options currently in design could achieve a 7 LDHS service alongside the TSGN service quantum, although only one of the layouts could achieve an 8 LDHS service alongside TSGN.

The recommendations from that study have been taken forward to develop Option 9 which is a hybrid option. This option has not been tested in detail with new SPA values calculated. However, previous work and a review of the new layout option both indicate that 8 LDHS can be delivered alongside TSGN services. The conclusion was that 9 LDHS would require the reduction of TSGN services by 1 TPH; therefore this layout could potentially achieve a 9th LDHS path if a TSGN Kings Cross service is removed.

It should be noted that turnround times for TSGN services at Kings Cross will be much shorter than LDHS services and therefore there may be some effect on Kings Cross platform workings. If 9 LDHS are to be considered, then further work will need to be undertaken on Kings Cross platform workings as the infrastructure option is developed.

7.7.3. Peterborough to Doncaster

This work has assumed that grade separation is provided at Werrington Junction to access the GN/GE Joint Line. Routing freight via the Joint line removes some of the speed differential constraints that exist today between Peterborough and Doncaster.

It should be noted though, that there is still an aspiration to run some freight services on the main line between Peterborough and Doncaster. The following section looks at different quantum and flighting structures between Peterborough and Doncaster alongside potential freight capacity over this section.

7.7.3.1. 8 LDHS subsets

The key challenge for 8 LDHS service structures is the LDHS calling pattern which results in a large speed differential between services over this two-track section. Given the different flighting choices from Kings Cross for LDHS services, and the aspiration for good journey times to Leeds, Newcastle and Edinburgh, the calling pattern at Newark North Gate, Grantham and Retford becomes the constraint.

In this subset, an option has been tested where 2 LDHS services per hour call at each of Newark, Grantham and Retford to retain connectivity between these intermediate stations. Due to the flighting of services from south of Peterborough, the journey times for the LDHS calling at these three stations are not fast enough to prevent the following non-stop LDHS overtaking at Retford.

The gap provided by the LDHS stopping service does allow space for the existing Norwich – Liverpool path and potential crossing moves at Newark Flat Crossing for up to two services an hour. This does not meet the full aspiration over Newark Flat Crossing which includes:

- 1 TPH Leicester – Lincoln
- 1 TPH Nottingham – Lincoln
- 1 TPH West Midlands – Immingham (Class 6)

In this example a standard Class 6 freight opportunity is provided and the passenger service between Nottingham and Lincoln.

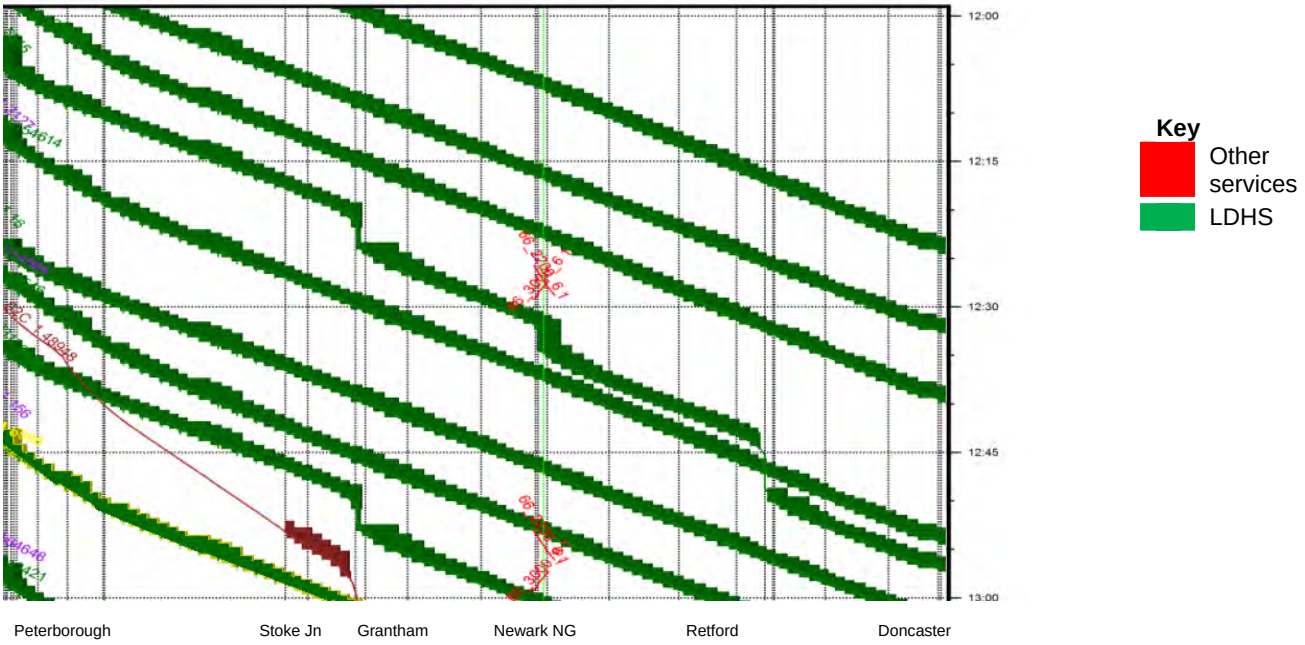

Figure 50 8 LDHS overtaking move at Retford

In the Up direction, this overtaking move occurs at Newark North Gate. This was tested for freight capacity between Stoke Junction and Loversall Carr Junction and a Class 4 path at 1600 tonnes cannot be found with this spacing and quantum of LDHS services.

With the 12/18 TSGN interval south of Peterborough, this calling pattern can be achieved without an overtaking move at Retford due to the larger gaps between LDHS flights.

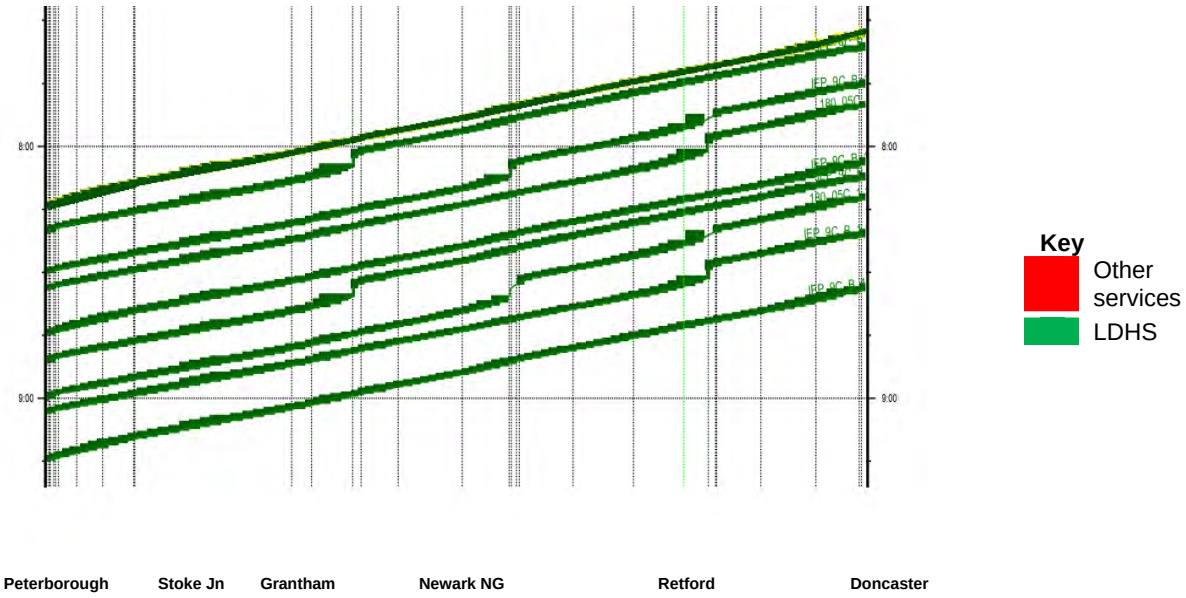

Figure 51 8 LDHS with no overtaking between Peterborough and Doncaster

Another choice for calling patterns over this section is for a skip-stop approach. This will impact on journey times and reduce connectivity between the three intermediate stations. The effect of skip-stopping on the use of network capacity is positive as it reduces the speed differential between services and removes the overtaking moves over this section. However, this may be unattractive from an end user perspective and would not support allow for any freight capacity over this section. This would only allow for a maximum of two crossing movements at Newark Flat Crossing per hour.

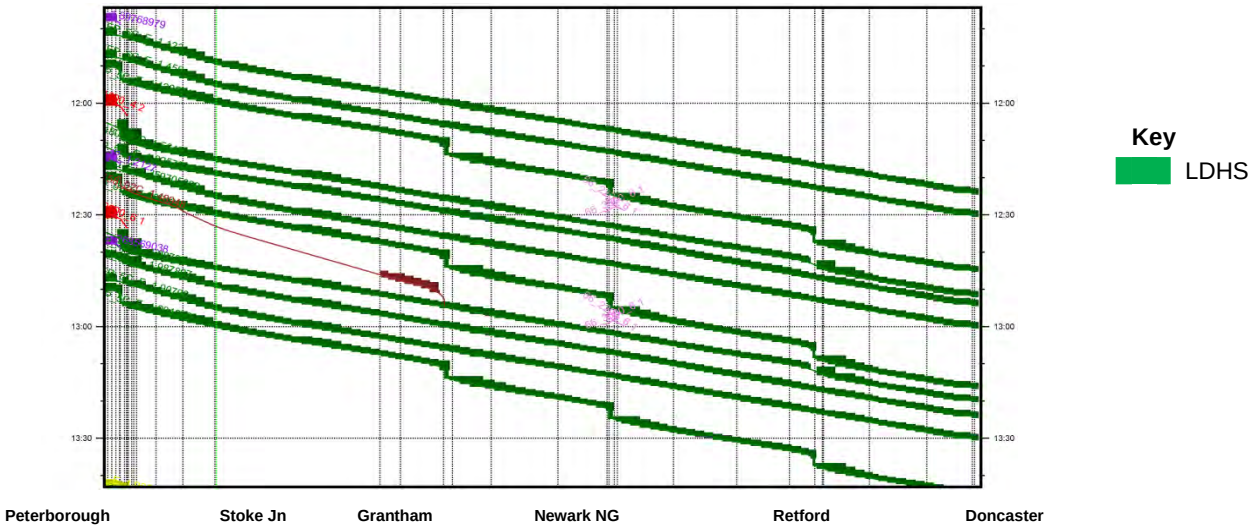

Figure 52 8 LDHS with skip-stopping between Peterborough and Doncaster

There is uncertainty over the calling pattern for LDHS. This work has demonstrated that the whole service structure and associated calling patterns need to be considered together to

maximise use of the network capacity and achieve the 7, 8 or 9 LDHS structures and the crossing movements at Newark Flat Crossing for east – west traffic. Where more bespoke calling patterns are required, a greater amount of pathing time will be needed to achieve the flighting and match the available capacity at the south end of the route. This therefore worsens overall journey times and could result in a reduction in the achievable number of LDHS paths.

7.7.4. Doncaster to Colton Jn

The key constraint is Doncaster Station and the crossing movements required. The number of conflicting moves at the south end of the station (where the Sheffield lines diverge); at Marshgate Junction at the north end of the station (where the Leeds and Goole/Scunthorpe routes diverge) and capacity in the platforms themselves drive this constraint.

The key issue at Doncaster is the combination of passenger services from 6 directions converging in the station, with many services required to cross each other. In addition, Doncaster is a significant location for freight, with Doncaster yards and again many different flows crossing in the area. Doncaster is also used as a location for crew change for freight services, this adds to the number of freight trains required to pass through the station which could otherwise divert around.

The diagram below shows schematically the different service groups that pass through the station. This highlights the number of crossing moves, which lead to high performance risk and a lack of flexibility in the timetable.

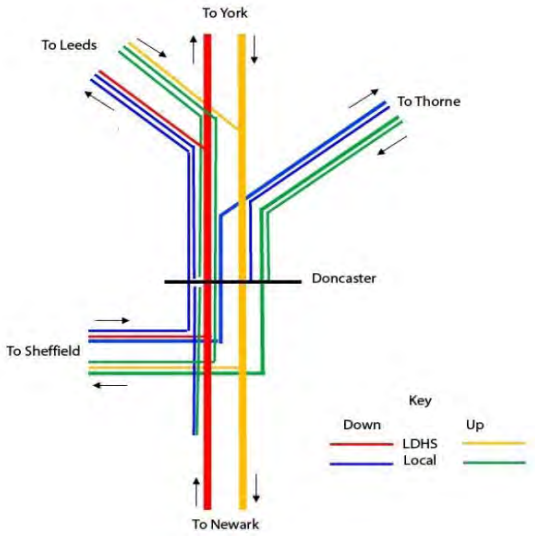

Figure 53 Service groups passing through Doncaster

The proposed CP5 scheme for east side bi-directional signalling and Platform 0 will help to reduce the number of conflicts in the Doncaster area. The scheme provides a link from the Lincoln lines to the east side of Doncaster station in both directions. This allows moves out

of Platforms 1 and the Up East Slow at the same time as trains departing from Platform 3 on to the Up Fast. This enables the Lincoln to Doncaster service to use Platform 2, eliminating the conflict between freight services going from the GN/GE to the Thorne lines and LDHS services on the main route of the ECML.

The crossovers provide parallel moves at both the north and south ends of the Platforms 1-3. Removing the Lincoln service from Platform 5 creates capacity in the west side of the station. Currently there is a high usage of the West Slow lines by freight services; therefore there is extra capacity and flexibility for freight.

Platform 0 allows terminating trains to/from the Thorne lines to terminate clear of the main station thus eliminating a conflict with the main lines.

Alterations to local services and cross-Doncaster flows would be required to fit with any subset identified where timings would not match the current structure. Once there is agreement on the service specification, a more detailed timetable study would need to be undertaken to make sure that changes to timings work outside the scope of this study and do not affect other routes or rolling stock requirements.

The route between Doncaster and York (Skelton Jn) is primarily two-track, with a Down freight loop at Arksey near Doncaster. Routes diverge at Shaftholme Jn (towards Knottingley), Joan Croft Jn (towards Hatfield), Temple Hirst Jn (towards Selby) and Hambelton Jns (towards Leeds and Selby). At Colton Junction the route from Leeds and Church Fenton joins the ECML and continues as a four-track section to York station.

The two-track section between Doncaster and Colton does not have any station calls so all passenger trains are roughly at the same speed (taking account of different traction types). Therefore it is the speed differential between freight and passenger which constrains how this section is used, the spacing and quantum of LDHS required over this section making it very difficult to achieve freight paths over the whole route section.

The main line route has only been examined during this study but it is acknowledged that a more detailed timing exercise will be required once there is agreement on the number of LDHS paths. Capacity for freight can be achieved for freight between Doncaster and Shaftholme Junction and Joan Croft and Hambleton South Junction for the required tonnage of freight. With 6 LDHS services over this section capacity cannot be achieved for a freight service between Doncaster and Colton Jn on the main line.

This example includes a London – Hull service which leaves the route at Temple Hirst Junction towards Selby.

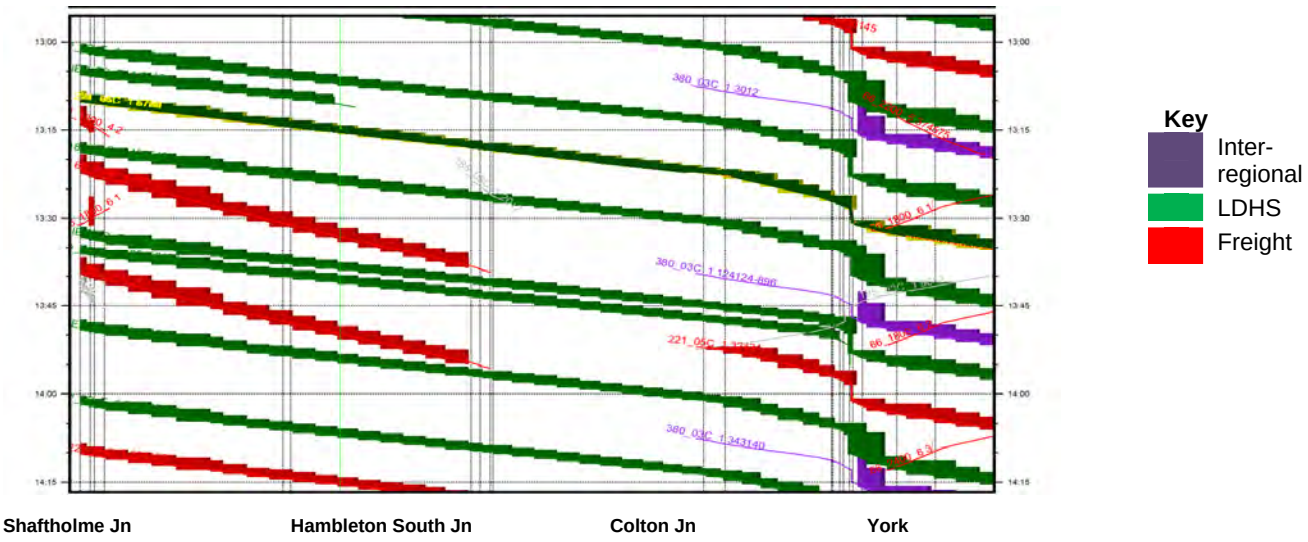

Figure 54 Service structure Doncaster – York and potential freight capacity

To accommodate freight capacity over this whole section without infrastructure intervention, the passenger service would need to be reduced. To achieve a standard Class 4 path over the full section between Doncaster and York the passenger level would need to be reduced to a maximum of 5 services over this section (including London and non-London LDHS).

7.7.4.1. Doncaster (exclusive) - Colton Jn via Leeds

The route between Doncaster and Leeds station area is two-track, with junctions at Carcroft and Adwick Jns (towards Hatfield), South Kirkby Jn (towards Moorthorpe and Sheffield), Hare Park Jn (towards Wakefield Kirkgate and Normanton) and Wakefield Westgate (towards Wakefield Kirkgate). Passing loops are provided at Hemsworth. Between Leeds Station and York, the route is two-track as far as Mickelfield (where the line to Hambleton and Selby diverges) and Church Fenton (where the lines from Milford and Gascoigne Wood converge). The route continues as a four-track section until it rejoins the ECML at Colton Jn, south of York.

The table below compares the aspired and current service level for Doncaster - Leeds.

From To Service	Current service level (TPH off peak)	Aspired service level (TPH off peak)
London – Leeds (via Wakefield)	2	3
Plymouth – Leeds/Edinburgh	1	1
Birmingham – Leeds	0	1
Huddersfield – Wakefield Westgate	1	1
Doncaster – Leeds	1	1
Sheffield – Leeds (via Doncaster)	0	1 (option on 2020 ITSS or retain Sheffield – Adwick service)
Sheffield – Adwick	1	
Sheffield – Leeds (via Wakefield Westgate)	1	2
Class 4 freight	0-2 (varies by hour)	1
Class 6 freight	0-1 (varies by hour)	1

Table 2: Comparison of current and aspired services level between Doncaster and Leeds

The key constraints on this route are:

- The number of services between South Kirby Junction and Hare Park Junction
- The flat junction moves
- Platform capacity at Leeds
- The speed differential of services – both between passenger and freight, and between stopping passenger and LDHS passenger
- The interaction with other routes

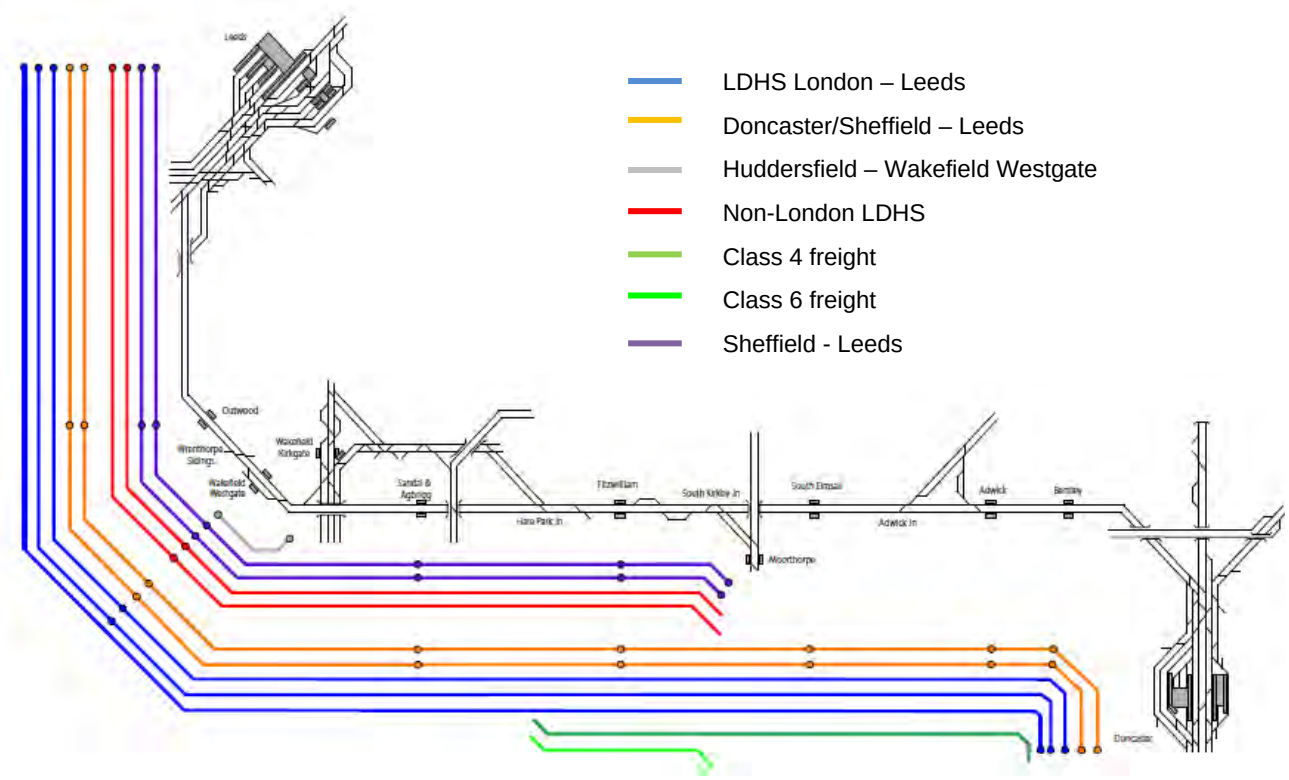

Figure 55 Aspired service level between Doncaster and Leeds

The full aspired service level cannot be achieved other this section without significant journey time extension or a reduction in the level of service. The service intervals and speed difference of services are the key constraint. Crossing movements at South Kirby Junction becomes a critical constraint with this level of service aspired from the Moorthorpe direction. This results in the junction movement needing to be made parallel to achieve the 5 paths over this junction.

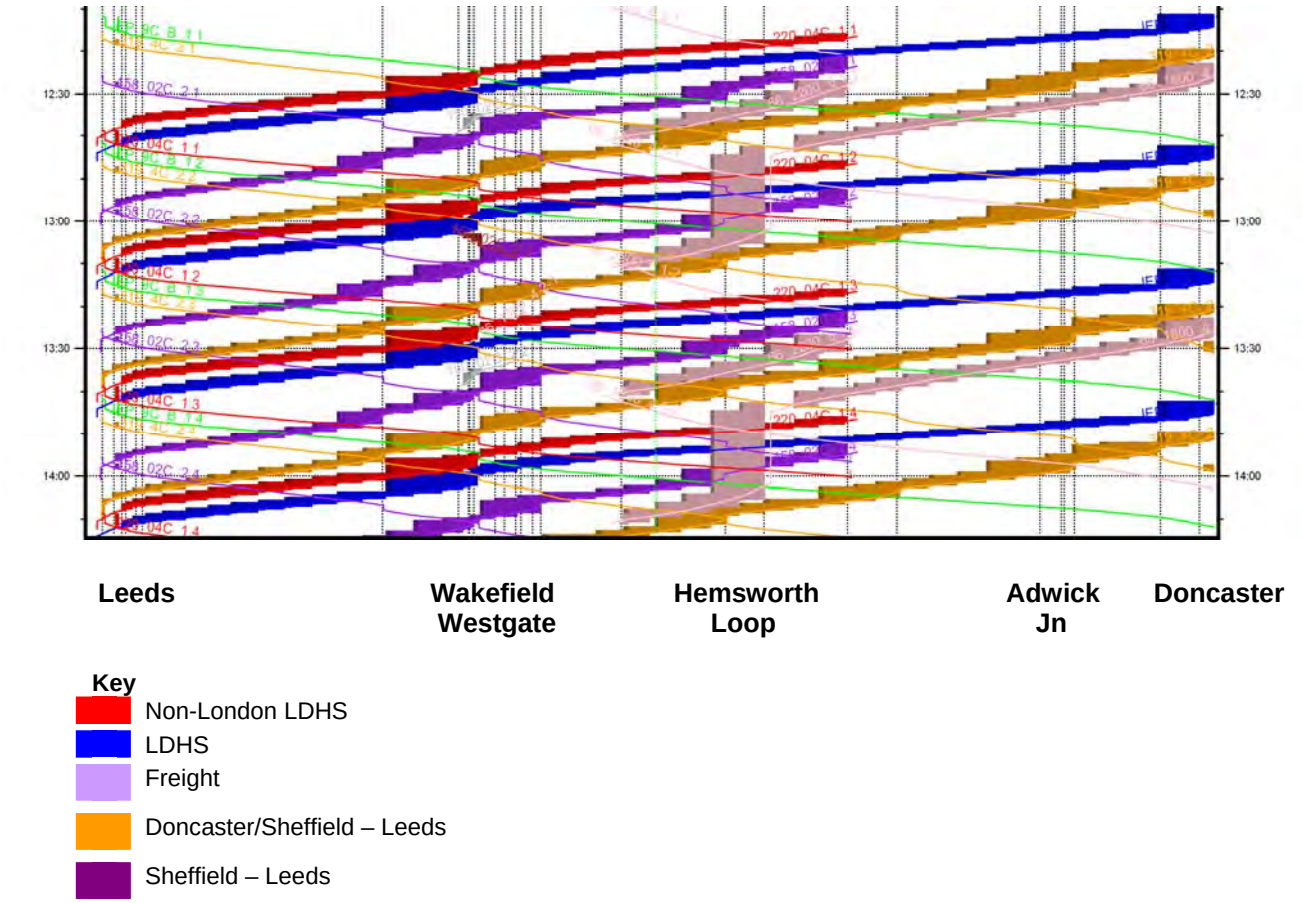

Figure 56 Train Graph showing service structure between Leeds and Doncaster

The example above achieves 2 x London LDHS alongside the other aspired services. This structure has many services on minimum margins and does not provide any spare capacity for a 3rd LDHS service. Therefore to achieve a 3rd LDHS path over this route will require a reduction in either non-London LDHS, local or freight service aspirations.

There are three Bradford - Kings Cross services per day which are currently routed between Doncaster and Hare Park Jn. In the hours these services are operating, a reduction in either LDHS, freight or the Doncaster – Leeds local service will be required.

Between Leeds and York the aspired service level is as follows

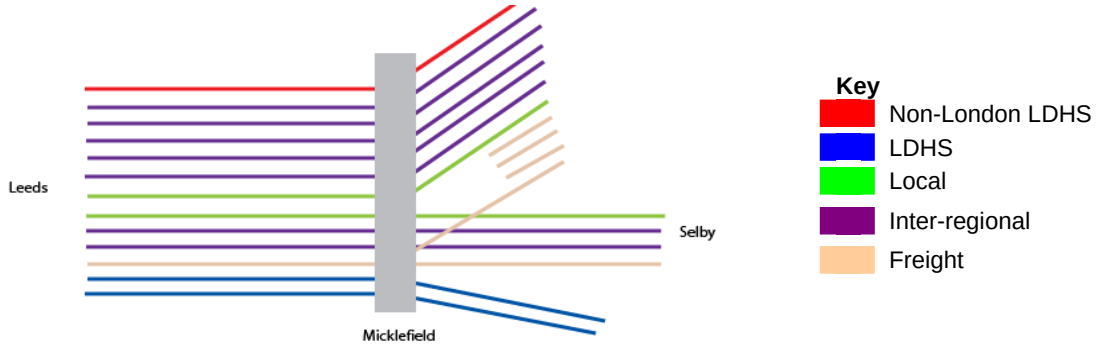

Figure 57 Aspired service level Leeds - York

This level of service can not be achieved on the infrastructure available without some trade-offs between service groups. The capacity is constrained due to the speed differential between stopping and non-stopping services and the junction margins required at Micklefield Junction.

In the example below a service level of 1 LDHS, 1 non-London LDHS, 5 inter-regional and 2 local services has been constructed and this effectively shows that the route is full. Therefore to achieve a 2nd LDHS service over this section would require a reduction in another service group. Existing levels of freight which operate along this route would need to be taken into account.

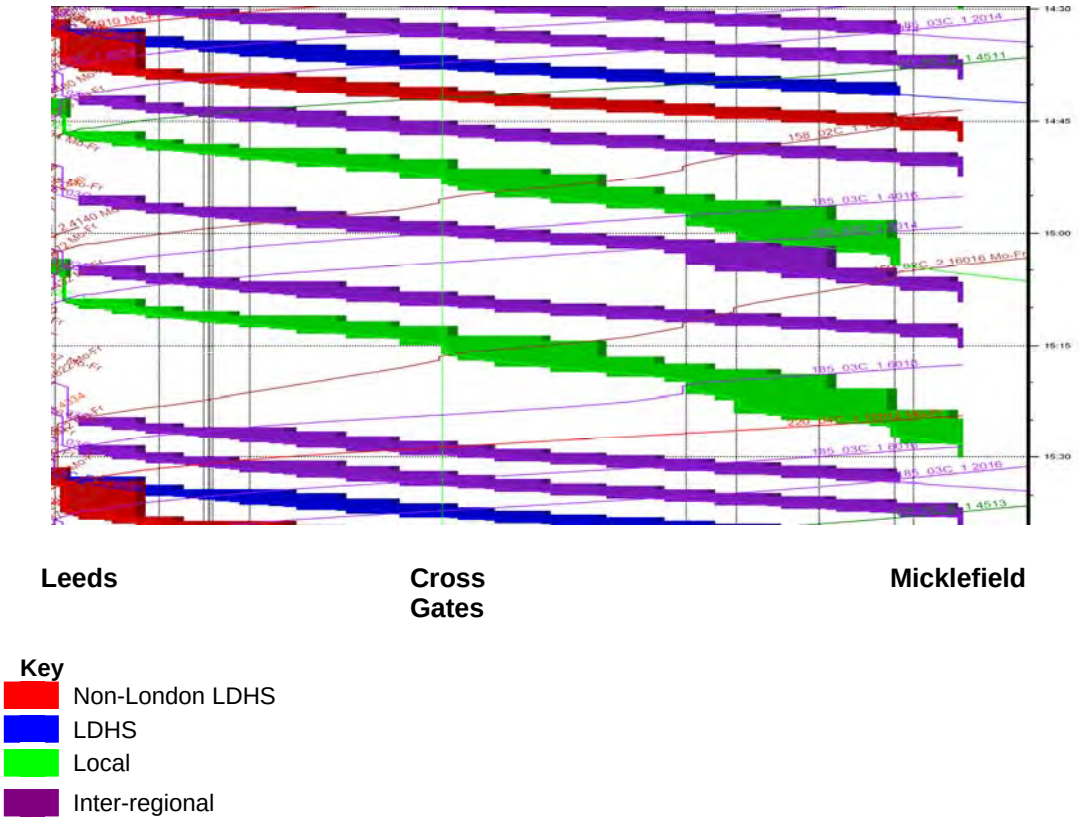

Figure 58 Leeds – Micklefield timetable structure

There is a programme of work being developed to look at East of Leeds capacity which will examine whether infrastructure changes are required. This work has demonstrated that the full service specification cannot be achieved on this section. It is recommended that the aspired level of service to/from Leeds is evaluated in more detail within this programme of work in particular the detailed platforming of Leeds Station.

7.7.5. Colton Jn to Northallerton

At Colton Junction the route from Leeds and Church Fenton joins the ECML and continues as a four-track section to York station. The York avoiding lines leave the ECML at Holgate Jn and rejoin at Skelton Jn, where the route to Harrogate diverges.

At York station the lack of parallel moves and overlap restrictions at the north of the station throat pose a significant performance risk and there is development work ongoing in the York area to explore enhancements alongside a new depot. This work assumes that a scheme at York Station north throat has been implemented, providing a new line from Platform 11 to the loco line to allow parallel moves into and out of platforms 9/10 and 11.

The constraints at York depend on freight routing in the area and whether freight is routed via the avoiding line or through the station. Down direction freight is routed via the avoiding line to remove any further constraints in York Station area. In the Up direction accessing the avoiding lines requires a crossing move at Skelton Bridge Junction. Paths for freight to cross the Down Fast have been found in all subsets.

There are currently crew changes for freight at York Station and it is therefore assumed that a small proportion of freight will have to continue using the York Station area.

Between York and Northallerton the four-track section accommodates all services. There are some challenges in terms of Slow Line service structure (taking into account the junction movements at either end and service intervals) but capacity exists for all services.

7.7.6. Northallerton to Newcastle

Here the two-track section is very constrained due to the number of services and the mix of speeds over this section. With the structures developed to the south of the route and the pairing of non-stop LDHS at 30 minute intervals, the passenger services over this section are not flighted together. The proposed CP5 Connectivity funded freight loops between Northallerton and Newcastle enable slower services to be overtaken.

The current service provision over this section involves the flighting of train services. This provides capacity for freight services to run, at the expense of optimal service intervals for passenger services. Platform re-occupation times at Durham and Darlington become critical if passenger services are flighted together. The required crossing movement for Up services calling at Darlington constrains the timetable structure and is a performance risk.

Even with the additional infrastructure assumed for CP5, all aspirations cannot be achieved and therefore there are choices over the number of services, journey times and service interval for this section.

This example shows the following service level:

- 3 London – LDHS (2 x Edinburgh, 1 x Newcastle)
- 2 non-London LDHS (1 x Plymouth – Edinburgh, 1 x Reading – Newcastle)
- 1 inter-regional (Liverpool – Newcastle)
- 2 freight paths (1 x Class 6, 1 x Class4)

In this example the Inter-regional service is overtaken at Darlington and the freight services are overtaken at two loops between Northallerton and Newcastle.

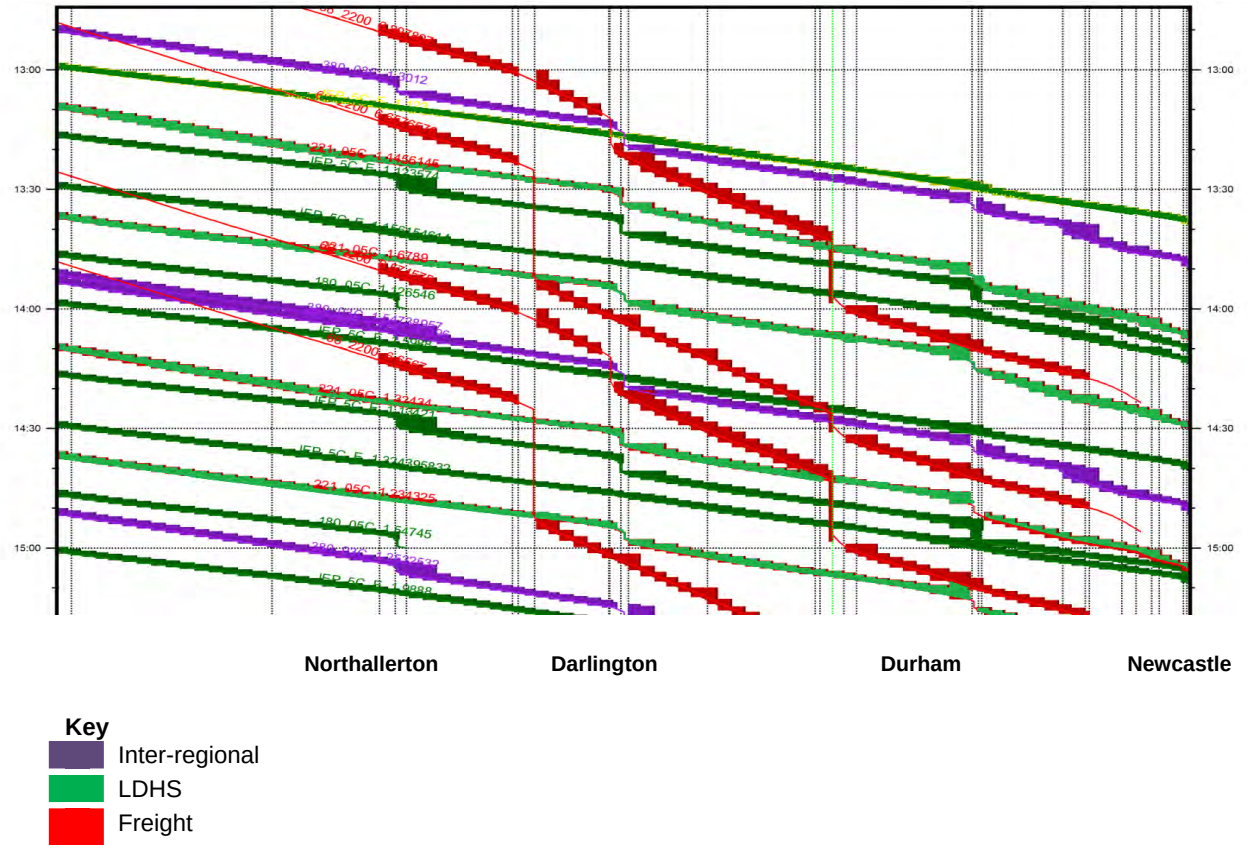

Figure 59 Northallerton – Newcastle possible service structure

Choices on potential service levels over this section are:

a. Increase journey times and reduce the speed differential of services over this section

Taking a Class 6 freight path as the slowest service on the route and then slowing down other services to a similar speed to reduce the speed differential of services would result in a requirement of approximately 20 minutes pathing time for passenger services. This would have a large impact on overall journey time and deemed to be an unacceptable outcome. This has therefore not been investigated any further at this point.

b. Reduce passenger service

A reduction in passenger service over this section would allow more capacity for freight services. The passenger service would have to be reduced to a maximum of 6 services if the optimal passenger interval was to be retained. Reducing to 6 would mean reducing inter-regional, non-London LDHS or London LDHS services over this section and would impact on achieving two standard freight paths with multiple looping points. This could potentially be made up of the following options:

	Option 1	Option 2	Option 3	Option 4
Non-London LDHS	2	1	1	2
London LDHS	3	4	3	2
Inter-regional passenger	1	1	2	2
Freight	2	2	2	2

Table 3: Choices for 6 passenger and 2 freight between Northallerton and Newcastle

c. Alter the passenger service interval

The service pattern over this section is one of the key constraints to achieving freight capacity. The service structure today is flighted therefore does not provide the optimal passenger service to allow for freight. To understand this, different flighting options have been examined to understand if this allows for freight capacity and the ability to increase the number of passenger services. Taking into account the constraints further south, the pairing of services on the south of Peterborough section makes achieving this very difficult. The calling patterns of services also constrains how flighting can be achieved on this section, with aspirations for fast journey times to Edinburgh alongside other LDHS calling at Durham, Darlington and Northallerton.

d. Alter the passenger service calling pattern

To be able to flight services over this section, there needs to be more consistency in the speed of passenger services over this section. This could be achieved by changing the calling patterns and using a skip-stop principle. This would have an impact on overall journey times and connectivity, so may not be acceptable.

e. Reduce freight service level

There is potential to achieve a 7th passenger path over this section if only one standard freight path is accommodated and the passenger service interval can be optimised over this section. The freight path would still require looping at least twice over this section due to the speed differential of services. Potential service choices are:

	Option 1	Option 2	Option 3
Non-London LDHS	2	2	1
London LDHS	4	3	4
Inter-regional	1	2	2
Freight	1	1	1

Table 4: Choices for 7 passenger and 1 freight between Northallerton and Newcastle

The number of service required to terminate a Newcastle from the south will depend on the chosen specification. The length of terminating services will dictate whether these can be terminated in the bay platforms 9-12 which is desirable from a capacity and performance view. It is likely that at least two of the services (Reading – Newcastle and Kings Cross – Newcastle) will not be a suitable length for these platforms and will therefore have to terminate in through platforms. It is recommended that this is assessed further in the next stage of work as part of a platforming exercise at Newcastle.

7.7.7. Newcastle to Drem

The route between Newcastle and Drem is mostly two-track beyond Heaton North Jn. The aspired service over this section is compared to the current level below.

	Aspirations	Current service (May 2014)
London LDHS	3 x Kings Cross – Edinburgh	2 x Kings Cross – Edinburgh
Non-London LDHS	1 x South West – Edinburgh	1 x South West – Edinburgh
Inter-regional	1 x Liverpool – Edinburgh 1 x Newcastle/Berwick/Dunbar – Edinburgh (2 hourly)	1 x Dunbar – Edinburgh (2 hourly)
Local	1 x local to Morpeth/Chathill	1 x local to Morpeth – extended to Chathill morning and evening
Freight	1 Class 4 1 Class 6	Varies between 0 and 2 per hour

Table 5: Service aspirations between Newcastle and Drem (vs. current service)

The key constraints over this section are the speed differentials for the mix of services, Dunbar station, which only has platforms in the Up direction resulting in Down trains crossing to use the single platform, and the location and length of possible overtaking points. The most significant differences in running times over this section are between a Class 390 (with tilting capability) and a Class 800/801 (IEP). This is shown below.

From	To			Assumed Class 390 SRT (mins)	Assumed IEP SRT (mins)
Edinburgh	Abbeyhill Junction	S	P	1.5	1.5
Abbeyhill Junction	Craigentinny Junction	P	P	1	1.5
Craigentinny Junction	Portobello Junction (Lothian)	P	P	1	0.5
Portobello Junction (Lothian)	Monktonhall Junction	P	P	1.5	2
Monktonhall Junction	Prestonpans	P	P	2	2
Prestonpans	Drem	P	P	4	4.5
Drem	Dunbar	P	P	5.5	6.5
Dunbar	Oxwellmains Crossover	P	P	1	1
Oxwellmains Crossover	Grantshouse	P	P	6.5	7
Grantshouse	Reston	P	P	2.5	4.5
Reston	Reston Signal EG402	P	P	5	4.5
Reston Signal EG402	Berwick Upon Tweed	P	P	2	2.5
Berwick Upon Tweed	Belford LC	P	P	8	8.5
Belford LC	Alnmouth	P	P	8.5	8.5
Alnmouth	Morpeth Station	P	P	10.5	11.5
Morpeth Station	Heaton South Junction	P	P	8	9
Heaton South Junction	Newcastle	P	S	3	2.5
Total				71.5	78

Table 6: Class 390 and IEP SRTs between Heaton South Jn to Edinburgh

7.7.7.1. Two IEP services

The graph below shows an example of a mix of services that includes:

- 2 x London LDHS (IEP services)
- 1 x Non-London LDHS
- 1 x Dunbar – Edinburgh (2 hourly)
- 1 x local service between Morpeth and Newcastle
- 2 x standard freight paths (at the tonnage specified in the 2020 ITSS).

With this level of service there are constraints in how the service can be structured and in the calling patterns that are possible.

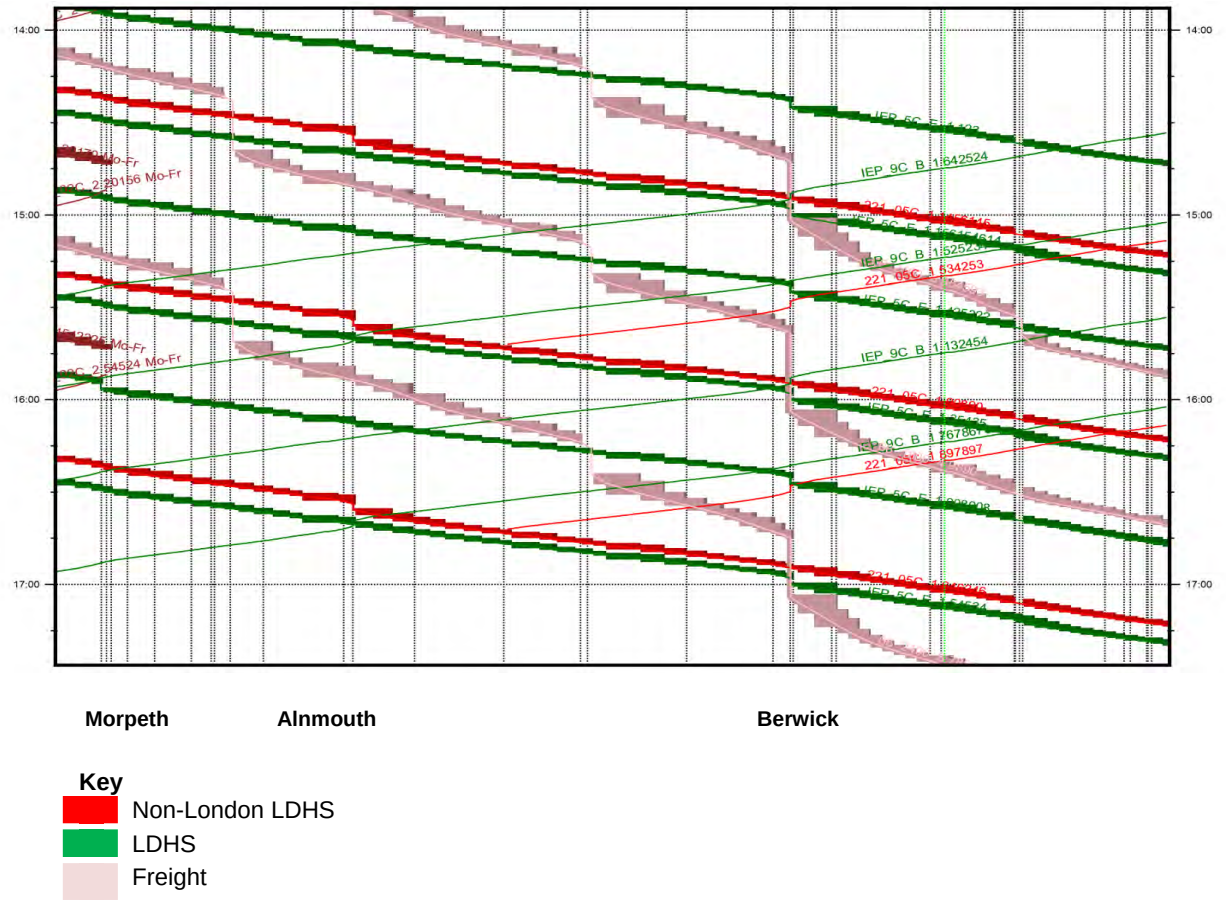

Figure 60 2 London LDHS to Edinburgh: 2 x IEP

In this example, the calls at Alnmouth, Morpeth, Dunbar and Berwick-upon-Tweed have been split as follows between London and non-London LDHS:

- London – York – Newcastle – Berwick – Edinburgh
- South West – Leeds – York – Darlington – Durham – Newcastle – Alnmouth – Dunbar – Edinburgh
- London – York – Newcastle – Morpeth – Berwick - Edinburgh

Between Newcastle and Edinburgh the calling pattern could potentially be reversed between the London and non-London LDHS services in the following hour at Morpeth, Alnmouth and Dunbar to provide connectivity to both routes.

If both London and non-London services were to call at all stations between Newcastle and Edinburgh this would help with network capacity by reducing the mix of services (and different speeds) over the section. However, this would increase end-to-end journey times.

7.7.7.2. IEP and Class 390

A further option has been tested with the following London LDHS services:

- London – Newcastle – Edinburgh (Class 390)
- London – York – Newcastle – intermediate stations (2 calls) – Edinburgh

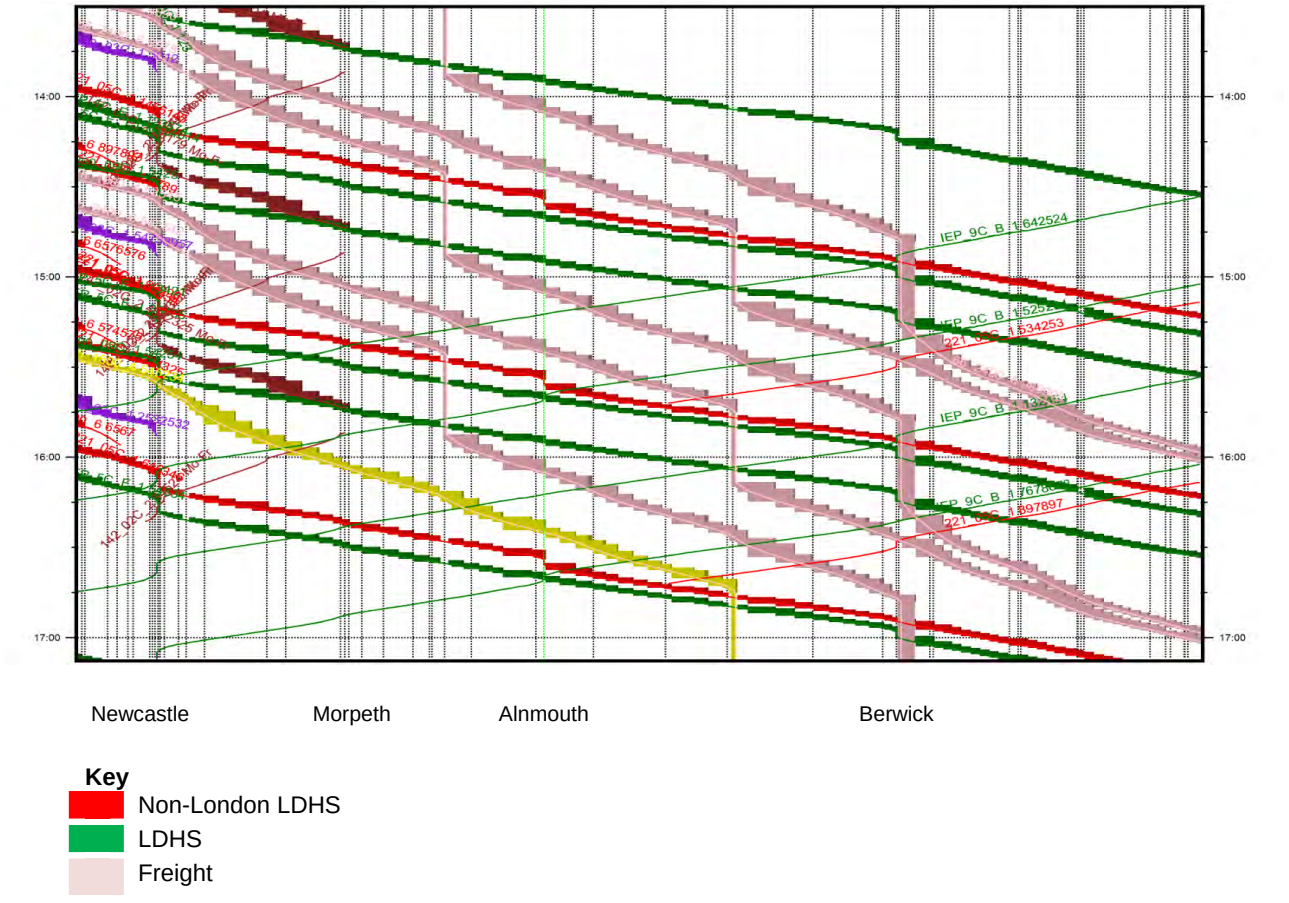

Figure 61 2 London LDHS to Edinburgh: 1 x IEP and 1 x Class 390

Both the level of service and structure for this option prevent any other services being accommodated over the whole route section. Therefore the 3rd London LDHS and the Inter-regional between Liverpool and Edinburgh have not been included in this option.

For the Inter-regional service there is potential for this to be accommodated if the non-London LDHS service was not needed over this section and was terminated further south.

Examining the aspiration to extend the current two-hourly Dunbar service further south, there is potential to achieve this as far as Berwick-upon-Tweed due to the spacing of services over this section. The key challenge would be timings and the rolling stock used, as these services currently have a short turnaround time at Dunbar.

7.7.7.3. Three London LDHS

To achieve three London LDHS services over this section, there would need to be a reduction in one of the other service groups. The main choices identified are:

- Remove non-London LDHS service over this section. This would reduce connectivity to non-London destinations for stations over this section and Edinburgh
- Reduce freight quantum to one standard path over this section. This would not meet the 2020 ITSS level of service
- Reduce freight tonnage. The ITSS specifies 1 x Class 6 at 2600 tonnes and 1 x Class 4 at 1800 tonnes. The resulting timing loads are considerably slower than many of the paths in the timetable north of Newcastle in the May 2014 timetable.

7.7.8. Drem to Edinburgh

Over this section there are significant junctions at Drem (for North Berwick), Monktonhall (Freight lines to Millerhill Yard) and Portobello (towards Niddrie and Newcraighall). The most constrained area is around Portobello Jn, based on the interaction with the Borders Railway. The services from Tweedbank to Edinburgh are half-hourly and the interval of the service is fixed by the single line sections and the junction movement at Portobello Jn. In summary, there is insufficient capacity available for the full aspired level of service.

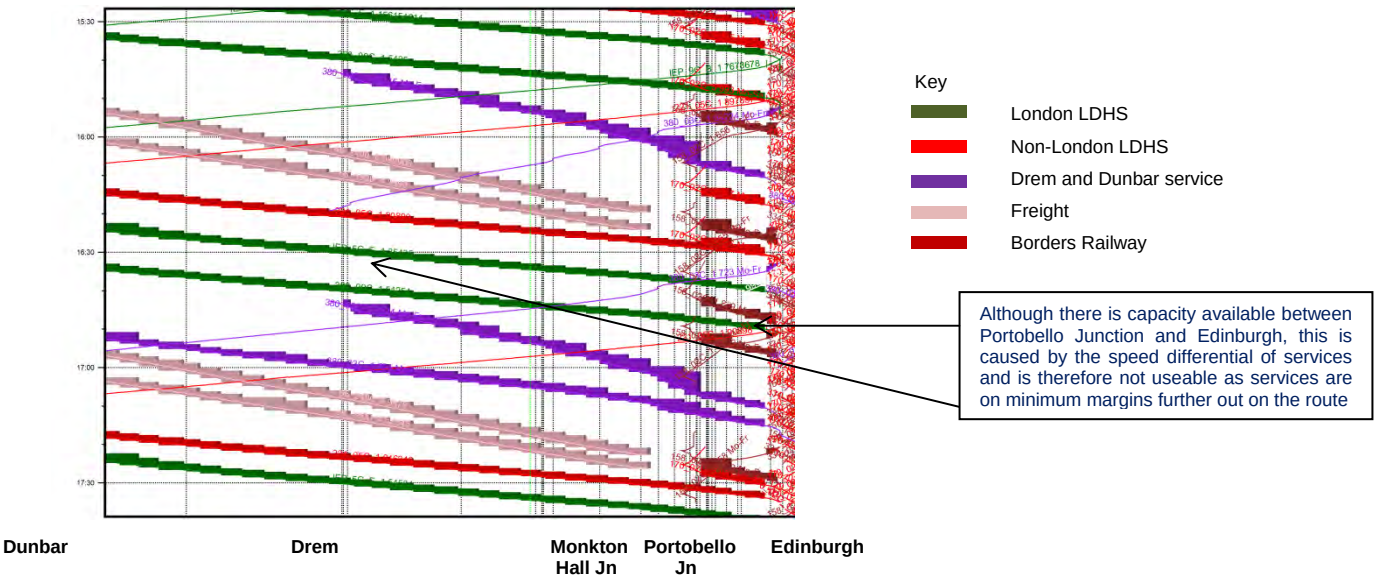

Figure 62 Dunbar – Edinburgh service structure example

Choices are available for how the capacity is used over this section. 2 x London LDHS, 1 x non-London LDHS, 1 x two-hourly Dunbar – Edinburgh and 1 x North Berwick service can be achieved with the Borders Railway service. If a third London LDHS or inter-regional service is required, then the level of service on the non-London LDHS, Dunbar, Drem or Borders service would have to be reduced.

The interaction between the service structure between Newcastle and Drem has a large impact on the ability to achieve a 3rd LDHS or an inter-regional path over this section. With only one freight path on the section between Newcastle and Drem there is potential for either a 3rd LDHS or an inter-regional service to be accommodated between Drem and Edinburgh by using pathing time (this will have an impact on achievable journey times).

Work is on-going to develop options for Edinburgh Station remodelling in CP5. The latest options would accommodate 2 x London LDSH, 1 x non-London LDHS, 1 x two-hourly Dunbar – Edinburgh service and 1 x North Berwick service with the Borders service.

An assessment of platform capacity at Edinburgh has indicated that there is potential platform capacity for a third London LDHS although issues at Portobello Jn and between Newcastle and Drem would need to be resolved to allow for this.

7.7.9. Other routes and locations

Every option has not been examined for how timings of services off the route would be affected. This is due to the number of choices available over the quantum of services and therefore the timings of services. On taking forward an option for further development, more detailed timetabling will be required to understand the impact of services off the core ECML route and make sure that any changes to timings can be linked with other known timetable changes which are due to happen before 2020.

8. Appendix D – Performance Impact Assessment

8.1. General notes

All subsets are planned on existing TPRs (see section 2.2.4), therefore there is expected to be an unexpressed performance benefit gained from the introduction of ETCS in 2020. There is, however, a risk that the ETCS system will cause an increase to some planning margins or allowances but this is an unknown quantity at present.

Increasing the number of LDHS services may aid delivery of PPM as each service could have a reduced PPM value depending upon the ultimate allocation of paths between operating companies.

PPM delivery for LDHS operators will still be challenging due to the layout of the route requiring all operators to share the route to the south of Peterborough (Hertford services excepted). This means that the route remains susceptible to incidents affecting this area.

For all timetable options LNE & EM route will not support any access rights sales without a mechanism to agree resilient service recovery principles with all operators involved, this should include an understanding of any limitations arising from unit or traincrew diagrams.

8.2. Assessment of increase in quantum

When increasing the quantum of services operating on the ECML in any given hour, it is probable that there will be an impact on the operator and overall PPM.

In seeking to quantify any impact Network Rail has examined three timetable changes which delivered an increase in the hourly quantum for a particular operator. These are:

- Introduction of the Virgin West Coast VHF timetable in December 2008
- Introduction of East Coast's "Eureka Timetable" in May 2011
- Introduction of TPE's 5th Transpennine path in May 2014

For each of these timetable changes, Network Rail has looked at the key measures seen on weekdays either side of the change.

8.2.1. May 2008 vs. December 2008 – Virgin West Coast VHF Timetable

This timetable change resulted in an increase in the quantum and a wholesale structural change to the timetable including moving to a broadly clock face timetable. Timetable change was in the winter period so performance may have been affected by this.

The data in the table below examines 50 weekdays either side of the timetable change.

	May 2008 Timetable	Dec 2008 Timetable	Change
Average lateness at terminating station	1.77	6.28	+4.51
PPM (%)	84.5	70.7	-13.8
Ratio of primary to reactionary delay	0.86	1.2	+0.34
Right Time (%)	61.2	45.7	-15.5

Table 7: Assessment of performance impact from introduction of Virgin West Coast VHF Timetable

8.2.2. December 2010 vs. May 2011 – East Coast "Eureka Timetable"

This timetable change resulted in an increase in the quantum of services and a wholesale structural change to the timetable including moving to a broadly clock face timetable.

The data in the table below examines 50 weekdays either side of the timetable change.

	Dec 2010 Timetable	May 2011 Timetable	Change
Average lateness at terminating station	1.12	0.76	-0.36
PPM (%)	86.8	85.3	-1.5
Ratio of primary to reactionary delay	0.85	1.1	+0.25
Right Time (%)	64.6	66.1	+1.5

Table 8: Assessment of performance impact from introduction of East Coast "Eureka" timetable

8.2.3. December 2013 vs. May 2014 – Introduction of 5th Transpennine path

This timetable change resulted in an increase in the quantum of services and a wholesale structural change to the timetable on the North Transpennine route including moving to a broadly clock face timetable.

The data in the table below examines 35 weekdays either side of the timetable change.

	Dec 2010 Timetable	May 2011 Timetable	Change
Average lateness at terminating station	0.21	2.34	+2.13
PPM (%)	93.4	87.2	-6.2
Ratio of primary to reactionary delay	2.2	3.1	+0.9
Right Time (%)	64.7	47.5	-17.2

Table 9: Assessment of performance impact from introduction of 5th Transpennine path

8.3. Assessment against Route timetable structure themes

When any individual subsets are progressed into developing indicative timetables there are a number of areas which LNE & EM Route would like to see being considered to aid the performance of the network. The ability to take full advantage of these should form part of the decisions for any trade-off between capacity and performance.

8.3.1. New infrastructure

The opportunities provided by the new infrastructure developed in CP4 and planned for delivery in CP5 should be maximised.

New infrastructure will aid the segregation of services with different speed profiles.

8.3.2. Planned segregation

Where possible, the plan should seek to segregate services to minimise the need to make a regulating decision.

8.3.3. Repeating Plan

A repeating plan minimises the number of recovery options which need to be developed.

Where overtaking moves are required, these should be regular in nature to allow familiarity with the movements and appropriate regulation policies to be developed.

8.3.4. Flighting

Flighting of services on the ECML means that performance is often dependant upon the first train in a flight.

The ordering of flighting should have stopping services at the rear.

Flighting at headway on the ECML does not lend itself to resilient performance, this needs to be taken into account and any opportunity to timetable an even spread of LDHS services considered.

8.3.5. Robustness

Hourly overtaking moves and the looping of freight places a reliance on Right Time operation.

As part of developing regulation statements for the overtaking moves, modelling of the interactions should be undertaken to understand the exact reliance on right time operation.

A 9 LDHS timetable would mean a high quantum of services throughout the day over the two track section between Digswell Jn and Woolmer Green Jn. This will leave very little opportunity for recovery at times of perturbation.

9. Appendix E - Assumptions

9.1. Infrastructure and Timetable Planning Rule assumptions

The following section details the infrastructure that is assumed to be in place at the end of CP5 and has been used as the basis for this study.

Programme	Enhancement	Assumption & TPR Implications
CP4 scheme	North Doncaster chord	Included as per TPR
Thameslink	Belle Isle connection between ECML and Thameslink	Included as per DTT2011 assumptions for TPR
CP4 scheme	GN/GE Joint Line upgrade	Included and assumed freight can be routed via this route
Track renewals	Shaftholme Jn upgrade	Assumed but no impact on capacity
InterCity Express (IEP)	IEP depot at Doncaster Carr	Included but no impact on standard hour timetable
EC Connectivity	Doncaster: new east side platform (platform 0)	Included as per GRIP 2 scheme sketch
EC Connectivity	Doncaster: east side new tracks and bi-directional working	Included as per GRIP 2 scheme sketch
Thameslink	New EMU depot, Hornsey	Included but no impact on standard hour timetable
Resignalling	North Lincolnshire resignalling	Does not improve capacity but passive provision for improved headways between Wrawby Jn and Scunthorpe
InterCity Express (IEP)	Edinburgh station – additional platform(s)	Included but multiple options still under consideration therefore no detailed work undertaken
EGIP	Portobello Junction doubling	Not assumed
EC Connectivity	York: north throat additional track	Included as per GRIP 2 scheme sketch
Track renewals	Belford Loops entry and exit speeds	Assumed but no impact on capacity
InterCity Express (IEP)	ECML gauge clearance for Super Express Train	Assumed there is no gauge restriction on aspired services within timetable work
EC Connectivity	Woodwalton Jn to Huntingdon: reinstate Up Slow line	Not assumed
--	Works necessary to provide EPS for Class 390	Included as per information provided by Alliance Rail
--	East Leeds Parkway station	Not assumed
Thameslink	ATO through Thameslink Core	Included as per TPR values assumed for DTT2011
Thameslink	New EMU depot, Eastfield (Peterborough)	Included but no impact on standard hour timetable
EC Connectivity	Fletton to Peterborough Down Slow upgrade	Included as per GRIP 2 scheme sketch
North of England	East of Leeds corridor (possible remodelling around Neville Hill, Micklefield etc.)	Not assumed as insufficient information available to include a single option in timetable development
EC Connectivity	Additional freight loops between	Included as per GRIP 2 scheme sketch

	Northallerton and Newcastle	
HLOS capacity	Stevenage turnback (new platform)	Included and assumed there is a bay platform to the west of Platform 4
North of England	Leeds station – additional through platform / other alterations	Not assumed as insufficient information available to include a single option in timetable development
Electrification in the North	Electrification Neville Hill to Colton Jn and Selby	Assumed
ERTMS	ETCS implementation Kings Cross to Alexandra Palace and Hertford North	Assumed to be implemented but no change in existing headways or margins has been assumed. Therefore the basic assumption is that ETCS will at least deliver current signalling capability.
Track renewals	Kings Cross area S&C renewals	Included with Option 9 layout assumed
Level Crossing Upgrade	Upgrade St Germains LC (near Drem)	Included but not impact on TPRs assumed
EC Connectivity	GN/GE southern access	Included and assumes a dive under at Werrington as per GRIP 2 option
EC Connectivity	Peterborough station remodelling	Included and assumes the central turnback GRIP 2 option
ERTMS	ETCS implementation Alexandra Palace to Peterborough	Assumed to be implemented but no change in existing headways or margins has been assumed. Therefore the basic assumption is that ETCS will at least deliver current signalling capability.
ERTMS	ETCS implementation Peterborough to Bawtry	Assumed to be implemented but no change in existing headways or margins has been assumed. Therefore the basic assumption is that ETCS will at least deliver current signalling capability.

Table 10: Infrastructure and TPR assumptions for ECML in 2020

Note that for the purpose of this study, it has been assumed that power supply will not limit the train service that can operate. Work is currently ongoing to develop power supply options, and the outputs of this, as they emerge, may need to inform the findings of this report. This is particularly the case if it emerges that there are material capacity implications.

9.2. Train service assumptions

9.2.1. Known Access Rights post 2016 (SX)

Cross Country Trains (due to expire December 2017)

- 1 TPH Birmingham via Leeds to Scotland
- 1 TPH Birmingham via Doncaster to Newcastle

DRS

- 2 trains per day serving Torness power station.

9.2.2. Known Applications

Alliance Rail Section 17 Application to operate:-

- 1 TPH in each direction Kings Cross to Edinburgh calling at Newcastle

Alliance Rail Section 17 Application to operate:-

- One train per two hour Kings Cross to West Yorkshire / Cleethorpes
- Kings Cross to Bradford Forster Square via Hambleton West Junction and Leeds approximately every two hours, with one train per day serving Ilkley instead of Bradford.
- Kings Cross to Cleethorpes via Doncaster – up to four trains per day.

First Hull Trains

- 7 trains per day in each direction Kings Cross to Hull

Grand Central

- 4 trains per day in each direction Kings Cross to Bradford Interchange
- 5 trains per day in each direction Kings Cross to Sunderland

East Coast Section 17 to operate:-

- Up to 7 TPH (from 2020) from Kings Cross outlined as a minimum:
    - 2 x fast services Kings Cross to Edinburgh.
    - 2 x fast services Kings Cross to Leeds (via Wakefield).
    - 1 x semi fast Kings Cross to Newcastle / Northallerton
    - 1 x stopping service Kings Cross to Newark (extendable to a number of possible destinations, including Leeds via Micklefield).
    - A 3rd hourly service to Leeds will be considered for the 7th train per hour for the basis of this study.

9.2.3. Known Aspirations

Thameslink Key Output 2 specification as included in the TSGN ITT and further informed by Govia as the winning bidder:

2 TPH all day Kings Lynn to London Kings Cross – operated by Class 377
2 TPH all day Cambridge to Tattenham Corner – operated by Class 700
2 TPH all day Peterborough to Horsham – operated by Class 700
4 TPH high-peak Peterborough to London Kings Cross – operated by Class 365
2 TPH peak Welwyn Garden City to Caterham **(starting back at Letchworth for services arriving St Pancras 0700-0859)** – operated by Class 700
2 TPH peak **(4 TPH in the high-peak hour)** Welwyn Garden City to London Kings Cross – operated by Class 365
4 TPH all day Welwyn Garden City to Moorgate – operated by 313 replacement
4 TPH all day Hertford North to Moorgate – operated by 313 replacement
4 TPH peak Gordon Hill to Moorgate – operated by 313 replacement
2 TPH high peak Hertford North to Moorgate – operated by 313 replacement
2 TPH all day Cambridge to Brighton – operated by Class 700

Regional Urban

- North of England ITSS

Freight

- QJ strategic paths will be factored in to all analysis
- Growth as identified in the Freight market study
- Freight capacity as per the East Coast ITSS 2020

Transport Scotland aspirations

Cross Country

- Aspirations for an additional Birmingham – Leeds via Wakefield
- Aspirations to improve the journey times on services using the ECML

9.3. Rolling stock assumptions

Unless changes are explicitly stated below, it is assumed that all other traffic on the ECML in the period until December 2020 will continue to operate using its existing rolling stock and therefore existing SRTs will be used in any detailing timetabling work.

The rolling stock changes assumed at the time of this analysis are:

- Alliance – proposed new services assumed to be operated using Class 390s *
- ICEC franchise – introduction of IEP Class 800/801 trains from December 2018.
- TSGN franchise – Class 700 trains introduced from 2018.
- TPE franchise – EMUs for Leeds to Newcastle from December 2018
- Northern franchise – EMUs for Leeds to York services from December 2018, withdrawal of Pacers from 2020.
- Grand Central – all Sunderland services use Class 180s from December 2016

* Note Doncaster - Cleethorpes is not electrified, IEP SRTs have been used for the analysis to Doncaster.

9.4. East Coast Main Line Indicative Train Service Specification (ITSS) for 2020

East Coast Main Line 2020 ITSS

	ID	Option / scenarios		From	To	Service group	Peak/off-peak variations	Typical stock / trailing load	Service Pattern	Suggested calling pattern (portion affecting ECML)
Passenger	EC1		Long Distance High Speed	London King's Cross	Leeds (via Wakefield Westgate)	ECML LDHS	All day	9 car IEP	60 min interval	tbc - to be informed by the outputs of modelling
	EC2			London King's Cross	Leeds (via Wakefield Westgate)	ECML LDHS	All day	9 car IEP	60 min interval	tbc - to be informed by the outputs of modelling
	EC3a	Option		London King's Cross	Leeds (via Hambleton)	ECML LDHS	All day	5 car IEP (10 car in peak)	60 min interval	tbc - to be informed by the outputs of modelling
	EC3b	Option		London King's Cross	Leeds (via Wakefield)	ECML LDHS	All day	5 car IEP (10 car in peak)	60 min interval	tbc - to be informed by the outputs of modelling
	EC4			London King's Cross	Edinburgh	ECML LDHS	All day	9 car IEP	60 min interval	tbc - to be informed by the outputs of modelling
	EC5			London King's Cross	Edinburgh	ECML LDHS	All day	9 car IEP	60 min interval	tbc - to be informed by the outputs of modelling
	EC6			London King's Cross	Newcastle	ECML LDHS	All day	5 car IEP (10 car in peak)	60 min interval	tbc - to be informed by the outputs of modelling
	EC7			London King's Cross	Hull	ECML LDHS	High peak hour only	9 car IEP	n/a	tbc - to be informed by the outputs of modelling
	EC8			London King's Cross	Lincoln	ECML LDHS	Late shoulder peak hour only	9 car IEP	n/a	tbc - to be informed by the outputs of modelling
	EC9			London King's Cross	Bradford Interchange (via Mirfield)	ECML LDHS	Off-peak	5/10 car Class 180	2-hourly. EC9/10/11 equate to 3 trains every 2 hours	King's Cross, Doncaster, Pontefract Monkhill…
	EC10			London King's Cross	Sunderland	ECML LDHS	Off-peak	5/10 car Class 180	2-hourly. EC9/10/11 equate to 3 trains every 2 hours	King's Cross, York, Thirsk, Northallerton, Eaglescliffe…
	EC11			London King's Cross	Hull	ECML LDHS	Off-peak	5 car Class 180 or Class 38x	2-hourly. EC9/10/11 equate to 3 trains every 2 hours	King's Cross, Grantham, Retford, Doncaster, Selby…
	EC12			London King's Cross	Edinburgh	ECML LDHS	All day	9 car Class 390	60 min interval	King's Cross, Newcastle, Edinburgh
	XC1a	Option		Plymouth	Leeds	Cross- Country LDHS	All day	4/5/8/9/10 car Class 220/1	60 min interval	…Sheffield, Wakefield Westgate, Leeds
	XC1b	Option		Plymouth	Edinburgh / Glasgow (via Leeds)	Cross- Country LDHS	All day	4/5/8/9/10 car Class 220/1	60 min interval	…Sheffield, Wakefield Westgate, Leeds, York, Darlington, Durham, Newcastle, (Alnmouth), (Berwick), (Dunbar), Edinburgh
	XC2			Reading	Newcastle (via Doncaster)	Cross- Country LDHS	All day	4/5/8/9/10 car Class 220/1	60 min interval	…Sheffield, Doncaster, York, Darlington, Durham, Newcastle
	XC3			Birmingham or Nottingham	Leeds	Cross-Country LDHS	All day	4/5/8/9/10 car Class 220/1	60 min interval	…Sheffield, Wakefield Westgate, Leeds
	NTP1a	Option	Interurban	Liverpool	Edinburgh	Trans-Pennine interurban	All day	4/8 car Class 38x	60 min interval. N1/2/3/4 to be as close to 15 min apart a	…Leeds, York, Northallerton, Darlington, Durham, Newcastle, Cramlington, Morpeth, Alnmouth, Berwick, Dunbar, Edinburgh
	NTP1b	Option		Liverpool	Glasgow	Trans-Pennine interurban	All day	4/8 car Class 38x	60 min interval. N1/2/3/4 to be as close to 15 min apart a	…Leeds, York, Northallerton, Darlington, Durham, Newcastle, Cramlington, Morpeth, Alnmouth, Berwick, Dunbar, Edinburgh, Motherwell, Glasgow
	NTP2			Liverpool	Newcastle	Trans-Pennine interurban	All day	4/8 car Class 38x	60 min interval. N1/2/3/4 to be as close to 15 min apart a	…Leeds, York, Thirsk, Northallerton, Darlington, Durham, Chester-le-Street, Newcastle
	NTP3			Manchester Airport	York	Trans-Pennine interurban	All day	4/8 car Class 38x	60 min interval. N1/2/3/4 to be as close to 15 min apart a	…Leeds, (Cross Gates), (Garforth), (Church Fenton), York
	NTP4			Manchester Airport	York	Trans-Pennine interurban	All day	4/8 car Class 38x	60 min interval. N1/2/3/4 to be as close to 15 min apart a	…Leeds, (Cross Gates), (Garforth), (Church Fenton), York
	NTP5			Blackpool North	Scarborough	Trans-Pennine interurban	All day	2/5 car Class 158	60 min interval	…Garforth, York, Malton…
	NTP6			York	Middlesbrough	Trans-Pennine interurban	All day	2/5 car Class 158	60 min interval	York, Thirsk, Northallerton, Yarm…
	STP6			Manchester Airport	Cleethorpes	Trans-Pennine interurban	All day	3/6 car Class 185	60 min interval	…Meadowhall, Doncaster, Scunthorpe…
	P1			Norwich	Liverpool	East Midlands interurban	All day	4/6 car Class 158	60 min interval	…March, Peterborough, Grantham, Nottingham…
	P2			Stansted Airport	Birmingham New St	Cross-Country interurban	All day	3 car Class 170	60 min interval	…March, Peterborough, Stamford…
	P3			Cambridge	Birmingham New St	Cross-Country interurban	All day	3 car Class 170	60 min interval	…March, Peterborough, Stamford…
	MS1		London suburban	Moorgate	Stevenage (via Hertford North)	Moorgate Suburban	All day	6 car Class 313	30 min interval	
	MS2			Moorgate	Stevenage (via Hertford North)	Moorgate Suburban	All day	6 car Class 313		
	MS3			Moorgate	Hertford North	Moorgate Suburban	All day	6 car Class 313	30 min interval	
	MS4			Moorgate	Hertford North	Moorgate Suburban	All day	6 car Class 313		
	MS5			Moorgate	Hertford North	Moorgate Suburban	Peak hours	6 car Class 313	30 min interval	
	MS6			Moorgate	Hertford North	Moorgate Suburban	Peak hours	6 car Class 313		
	MS7			Moorgate	Gordon Hill	Moorgate Suburban	Peak hours	6 car Class 313	30 min interval	
	MS8			Moorgate	Gordon Hill	Moorgate Suburban	Peak hours	6 car Class 313		
	MS9			Moorgate	Gordon Hill	Moorgate Suburban	High peak hour only	6 car Class 313	30 min interval	
	MS10			Moorgate	Gordon Hill	Moorgate Suburban	High peak hour only	6 car Class 313		
	MS11			Moorgate	Welwyn Garden City	Moorgate Suburban	All day	6 car Class 313	30 min interval	
	MS12			Moorgate	Welwyn Garden City	Moorgate Suburban	All day	6 car Class 313		
	MS13			Moorgate	Welwyn Garden City	Moorgate Suburban	All day	6 car Class 313	30 min interval	
	MS14			Moorgate	Welwyn Garden City	Moorgate Suburban	All day	6 car Class 313		
	KXS1			London King's Cross	Ely or Kings Lynn	King's Cross Suburban	All day	12 car Class 365 / 377	30 min interval	King's Cross, (Letchworth), (Royston), Cambridge,…
	KXS2			London King's Cross	Ely or Kings Lynn	King's Cross Suburban	All day	12 car Class 365 / 377		King's Cross, (Letchworth), (Royston), Cambridge,…
	KXS3			London King's Cross	Royston	King's Cross Suburban	Peak hours	8 car Class 365 / 377	30 min interval	King's Cross, Welwyn GC, Welwyn North, Knebworth, Stevenage, Hitchin, Letchworth, Baldock, Ashwell
	KXS4			London King's Cross	Royston	King's Cross Suburban	Peak hours	8 car Class 365 / 377		King's Cross, Welwyn GC, Welwyn North, Knebworth, Stevenage, Hitchin, Letchworth, Baldock, Ashwell
	KXS5			London King's Cross	Peterborough	King's Cross Suburban	Peak hours	12 car Class 365 / 377	30 min interval	
	KXS6			London King's Cross	Peterborough	King's Cross Suburban	Peak hours	12 car Class 365 / 377		
	KXS7			London King's Cross	Cambridge	King's Cross Suburban	Morning peak hour only	12 car Class 365 / 377	30 min interval	
	KXS8			London King's Cross	Cambridge	King's Cross Suburban	Morning peak hour only	12 car Class 365 / 377		
	TLC1			Thameslink Core	Peterborough	Thameslink Core Suburban	All day	8/12 car Class 700	30 min interval	Finsbury Park, Stevenage, Hitchin, Arlesey, Biggleswade, Sandy, St Neots, Huntingdon
	TLC2			Thameslink Core	Peterborough	Thameslink Core Suburban	All day	8/12 car Class 700		Finsbury Park, Stevenage, Hitchin, Arlesey, Biggleswade, Sandy, St Neots, Huntingdon
	TLC3			Thameslink Core	Cambridge	Thameslink Core Suburban	All day	8/12 car Class 700	30 min interval	Finsbury Park, Stevenage, Hitchin, Letchworth
	TLC4			Thameslink Core	Cambridge	Thameslink Core Suburban	All day	8/12 car Class 700		Finsbury Park, Stevenage, Hitchin, Letchworth
	TLC5			Thameslink Core	Letchworth or Cambridge	Thameslink Core Suburban	Off-peak	8 car Class 700	30 min interval	Potters Bar, Hatfield, Welwyn Garden City, Welwyn North, Knebworth, Stevenage, Hitchin, Letchworth
	TLC6			Thameslink Core	Letchworth or Cambridge	Thameslink Core Suburban	Off-peak	8 car Class 700		Potters Bar, Hatfield, Welwyn Garden City, Welwyn North, Knebworth, Stevenage, Hitchin, Letchworth
	TLC7			Thameslink Core	Welwyn Garden City	Thameslink Core Suburban	Peak hours	8 car Class 700	30 min interval	
	TLC8			Thameslink Core	Welwyn Garden City	Thameslink Core Suburban	Peak hours	8 car Class 700		
	TLC9			Thameslink Core	Welwyn Garden City	Thameslink Core Suburban	Peak hours	8 car Class 700	30 min interval	
	TLC10			Thameslink Core	Welwyn Garden City	Thameslink Core Suburban	Peak hours	8 car Class 700		
	EM1			Leicester	Lincoln	East Midlands local	All day	2 car Class 156	60 min interval	Newark Castle, Collingham

	ELC10			Thamesiink Core	Welwyn Garden City	Thamesiink Core Suburban	Peak hours	8 car Class 700	
	EM1			Leicester	Lincoln	East Midlands local	All day	2 car Class 156	60 min interval	...Newark Castle, Collingham...
	EM6			Nottingham	Lincoln	East Midlands local	All day	2 car Class 156	60 min interval	...Newark Castle, Lincoln
	EM2			Nottingham	Skegness	East Midlands local	All day	2 car Class 156	60 min interval	...Bottesford, Grantham, Sleaford...
	EM3			Peterborough	Spalding or Lincoln	East Midlands local	All day	2 car Class 156	60 min interval	Peterborough, Spalding...
	EM4			Newark Northgate	Lincoln or Grimsby	East Midlands local	All day	2 car Class 156	60 min interval	Newark Northgate, (Collingham)...
	EM5			Lincoln	Doncaster (via Finningley)	East Midlands local	All day	1/2 car Class 15x	60 min interval	...Gainsborough Lea Road, Doncaster
	EA1			Ipswich	Peterborough	East Anglia local	All day	2 car Class 156	60 min interval	...Whittlesea, Peterborough
	Y1			Leeds	York (via Micklefield)	Yorkshire local	All day	4 car Class 319	60 min interval	...(Ulleskelf), York
	Y2			Leeds	York (via Micklefield)	Yorkshire local	Afternoon high peak hour only	4 car Class 319	n/a	...(Ulleskelf), York
	Y3			Huddersfield	Wakefield Westgate	Yorkshire local	All day	2 car Class 14x/15x	60 min interval	...Wakefield Kirkgate, Wakefield Westgate
	Y4			Doncaster	Leeds (via Wakefield Westgate)	Yorkshire local	All day	4 car Class 3xx	60 min interval	Doncaster, Bentley, Adwick, South Elmsall, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y5			Doncaster	Leeds (via Wakefield Westgate)	Yorkshire local	High peak hour only	4 car Class 3xx	n/a	Doncaster, Bentley, Adwick, South Elmsall, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y6			Doncaster	Leeds (via Wakefield Westgate)	Yorkshire local	High peak hour only	4 car Class 3xx	n/a	Doncaster, Bentley, Adwick, South Elmsall, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y7			Sheffield	Leeds (via Wakefield Westgate)	Yorkshire local	All day	2/4 car Class 158	30 min interval	...Moorthorpe, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y17			Sheffield	Leeds (via Wakefield Westgate)	Yorkshire local	All day	2/4 car Class 158		...Moorthorpe, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y8a	Option		Sheffield	Hull	Yorkshire local	All day	2/4 car Class 158	60 min interval	...Meadowhall, Doncaster, Goole...
	Y8b	Option		Sheffield	Hull	Yorkshire local	All day	4 car Class 319	60 min interval	...Meadowhall, Doncaster, Selby...
	Y9			Sheffield	Scunthorpe	Yorkshire local	All day	2/4 car Class 158	60 min interval	...Conisbrough, Doncaster, Kirk Sandall...
	Y10a	Option		Lincoln	Adwick (via Sheffield)	Yorkshire local	All day	3 car Class 15x	60 min interval	...Conisbrough, Doncaster, Bentley, Adwick
	Y10b	Option		Sheffield	Adwick	Yorkshire local	All day	4 car Class 319	60 min interval	...Conisbrough, Doncaster, Bentley, Adwick
	Y10c	Option		Sheffield	Leeds (via Doncaster)	Yorkshire local	All day	4 car Class 319	60 min interval	...Conisbrough, Doncaster, Bentley, Adwick, South Elmsall, Fitzwilliam, Sandal and Agbrigg, Wakefield Westgate, Outwood, Leeds
	Y11			Doncaster	Hull	Yorkshire local	All day	2/4 car Class 158	60 min interval	Doncaster, Kirk Sandall...
	Y12	Option		Doncaster	Goole	Yorkshire local	All day	2/4 car Class 158	60 min interval	Doncaster, Kirk Sandall...
	Y13a	Option		Sheffield	York (via Rotherham Central and Pontefract	Yorkshire local	Off peak	2 car Class 14x/15x	2 trains per day	...Ulleskelf, York
	Y13b	Option		Sheffield	York (via Rotherham Central and Pontefract	Yorkshire local	All day	2 car Class 14x/15x	60 min interval	...(Ulleskelf), York
	Y14a	Option		Hull	York (via Sherburn)	Yorkshire local	All day	2 car Class 158 or 4 car Class 319	60 min interval	...(Ulleskelf), York
	Y14b	Option		Hull	York (via Hambleton North)	Yorkshire local	All day	2 car Class 158 or 4 car Class 319	60 min interval	...Selby, York
	Y15			York	Harrogate (and Leeds)	Yorkshire local	All day	2/3/4 car Class 14x/15x or 4 car Class 319	30 min interval	York, Poppleton...
	Y16			York	Harrogate (and Leeds)	Yorkshire local	All day	2/3/4 car Class 14x/15x or 4 car Class 319		York, Poppleton...
	NE1			Saltburn	Bishop Auckland	North East local	All day	2 car Class 14x/15x	60 min interval. NE1/2/3 to provide as close as possible 2	...Dinsdale, Darlington, North Road...
	NE2			Saltburn	Darlington	North East local	All day	2 car Class 14x/15x	60 min interval. NE1/2/3 to provide as close as possible 2	...Dinsdale, Darlington
	NE3			Saltburn	Darlington	North East local	All day	2 car Class 14x/15x	60 min interval. NE1/2/3 to provide as close as possible 2	...Dinsdale, Darlington
	NE4			Saltburn or Middlesbrough	Newcastle (via Darlington)	North East local	Morning peak hours only	2 car Class 14x/15x	60 min interval (3 trains per day)	...Dinsdale, Darlington, Durham, (Chester-le-Street), Newcastle
	NE5			Hexham	Middlesbrough	North East local	All day	2 car Class 14x/15x	60 min interval. NE4/6/7/8 to be as close to 15mins apart	...(Dunston), Newcastle, (Heworth)...
	NE6			Newcastle	Middlesbrough	North East local	High peak hour only	2 car Class 14x/15x	n/a	Newcastle, (Heworth)...
	NE7			Carlisle	Newcastle	North East local	All day	2 car Class 156	60 min interval. NE4/6/7/8 to be as close to 15mins apart	...Metrocentre, Newcastle
	NE8			Metrocentre	Newcastle	North East local	All day	2 car Class 14x/15x	60 min interval. NE4/6/7/8 to be as close to 15mins apart	Metrocentre, Newcastle
	NE9			Metrocentre	Morpeth or Chathill	North East local	All day	2 car Class 14x/15x	60 min interval. NE4/6/7/8 to be as close to 15mins apart	Metrocentre, Newcastle, (Manors), Cramlington, Morpeth, (Pegswood), (Widdrington), (Acklington), (Alnmouth), (Chathill)
	NE10			Newcastle	Woodhorn	North East local	All day	2 car Class 14x/15x	60 min interval	Newcastle, (Manors), Northumberland Park...
	NE11			Newcastle	Woodhorn	North East local	Peak hours	2 car Class 14x/15x	60 min interval. NE11 to be as close to 30mins apart from	Newcastle, (Manors), Northumberland Park...
	SC1a	Option		Dunbar	Edinburgh	Scotland local	All day	4 car Class 380	2-hourly	Dunbar, Musselburgh, Edinburgh
	SC1b	Option		Berwick	Edinburgh	Scotland local	All day	4 car Class 380	2-hourly	Berwick, Dunbar, Musselburgh, Edinburgh
	SC1c	Option		Newcastle	Edinburgh	Scotland local	All day	4 car Class 380	2-hourly	Newcastle, Cramlington, Morpeth, Alnmouth, Berwick, Dunbar, Musselburgh, Edinburgh
	SC2			North Berwick	Edinburgh	Scotland local	All day	4 car Class 380	60 min interval	North Berwick, Drem, Longniddry, Prestonpans, Wallyford, Musselburgh, Edinburgh
	SC3			North Berwick	Edinburgh	Scotland local	Peak hours	4 car Class 380	60 min interval. SC3 to be as close to 30mins apart from	North Berwick, Drem, Longniddry, Prestonpans, Wallyford, Musselburgh, Edinburgh
	SC4			Tweedbank	Edinburgh	Scotland local	All day	2/4 car Class 158	30 min interval	...Brunstane, Edinburgh
	SC5			Tweedbank	Edinburgh	Scotland local	All day	2/4 car Class 158		...Brunstane, Edinburgh
	SC6			Newcraighall	Edinburgh	Scotland local	High peak hour only	2/4 car Class 158	30 min interval. SC4/5/6 to be as close to 15mins apart a	...Brunstane, Edinburgh
Freight	F1	Min		Felixstowe	Nuneaton	Freight	All day	75mph, 1800t trailing, Class 66	2 per hour	Routed via March, Peterborough and Stamford
	F2	Max		Felixstowe	Nuneaton	Freight	All day	75mph, 1800t trailing, Class 66	3 per hour	Routed via March, Peterborough and Stamford
	F1	Min		Nuneaton	Felixstowe	Freight	All day	75mph, 1800t trailing, Class 66	2 per hour	Routed via Stamford, Peterborough and March
	F2	Max		Nuneaton	Felixstowe	Freight	All day	75mph, 1800t trailing, Class 66	3 per hour	Routed via Stamford, Peterborough and March
	F3		Class 4	London	Doncaster Europort / Wakefield / Selby / St	Freight	Off-peak (London to Peterborough	75mph, 1800t trailing, Class 66	1 per hour	Routed from Finsbury Park via Hertford Loop, then ECML to Peterborough, then GN/GE Joint Line, then from Doncaster to destination
	F4			Doncaster Europort / Wakefield / Selby / Sto	London	Freight	Off-peak (London to Peterborough	75mph, 1800t trailing, Class 66	1 per hour	Routed from origin to Doncaster, then GN/GE Joint Line, then ECML to Stevenage, then via Hertford Loop to Finsbury Park
	F5			Doncaster Yards	Teesside	Freight	All day	75mph, 1800t trailing, Class 66	1 per hour	Routed on the ECML between Doncaster Yards and Longlands Jn
	F6			Teesside	Doncaster Yards	Freight	All day	75mph, 1800t trailing, Class 66	1 per hour	Routed on the ECML between Longlands Jn and Doncaster Yards
	F7			Doncaster Europort	Millerhill	Freight	All day	75mph, 1800t trailing, Class 66	1 per hour	Routed on the ECML between Doncaster Yards and Monktonhall Jn
	F8			Millerhill	Doncaster Europort	Freight	All day	75mph, 1800t trailing, Class 66	1 per hour	Routed on the ECML between Monktonhall Jn and Doncaster Yards
	F9			Drax or Eggborough	Tyne Dock or Carlisle (via Darlington)	Freight	All day	75mph, 800t trailing, Class 66	1 per hour	Routed on the ECML between Colton Jn and King Edward Bridge South Jn
	F10			Drax or Eggborough	Tyne Dock or Teesside (via Eaglescliffe)	Freight	All day	75mph, 800t trailing, Class 66	2 per hour	Routed on the ECML between Colton Jn and Longlands Jn
	F11			East Anglia	East Midlands	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed via March, Peterborough and Stamford
	F12			East Midlands	East Anglia	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed via Stamford, Peterborough and March
	F13	Option		London	Doncaster Yards	Freight	Off-peak (London to Peterborough	60mph, 1800t trailing, Class 92	2-hourly	Routed via Hertford Loop and then ECML via Grantham
	F14	Option		Doncaster Yards	London	Freight	Off-peak (London to Peterborough	60mph, 1800t trailing, Class 92	2-hourly	Routed on ECML via Grantham then via Hertford Loop
	F15	Option		London	Doncaster Yards	Freight	Off-peak (London to Peterborough	60mph, 2600t trailing, Class 66	2-hourly	Routed from Finsbury Park via Welwyn GC, then ECML to Peterborough, then GN/GE Joint Line
	F16	Option		Doncaster Yards	London	Freight	Off-peak (London to Peterborough	60mph, 2600t trailing, Class 66	2-hourly	Routed via GN/GE Joint Line to Peterborough, then ECML via Welwyn GC to Finsbury Park
	F17			West Midlands	Immingham	Freight	All day	60mph, 2200t trailing, Class 66	1 per hour	Routed across Newark flat crossing
	F18			Immingham	West Midlands	Freight	All day	60mph, 3000t trailing, Class 66	1 per hour	Routed across Newark flat crossing
	F19			Scotland	Teesside or Doncaster Yards	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed on the ECML between Monktonhall Jn and Tursdale Jn or Colton Jn
	F20			Teesside or Doncaster Yards	Scotland	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed on the ECML between Colton Jn or Tursdale Jn and Monktonhall Jn
	F21			Tyne Dock or Carlisle	Drax or Eggborough (via Darlington)	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed on the ECML between King Edward Bridge South Jn and Colton Jn
	F22			Tyne Dock or Teesside	Drax or Eggborough (via Eaglescliffe)	Freight	All day	60mph, 1800t trailing, Class 66	2 per hour	Routed on the ECML between Longlands Jn and Colton Jn
	F23			Teesside	West Midlands / Wales	Freight	All day	60mph, 2400t trailing, Class 66	1 per hour	Routed on the ECML between Longlands Jn and Colton Jn
	F24			West Midlands / Wales	Teesside	Freight	All day	60mph, 2400t trailing, Class 66	1 per hour	Routed on the ECML between Colton Jn and Longlands Jn
	F25			Doncaster Yards	Immingham (via Skellow Jn)	Freight	All day	60mph, 2200t trailing, Class 66	1 per hour	Routed on the ECML between Doncaster Yards and Adwick Jn
	F26			Immingham (via Skellow Jn)	Doncaster Yards	Freight	All day	60mph, 2200t trailing, Class 66	1 per hour	Routed on the ECML between Adwick Jn and Doncaster Yards
	F27			West Midlands	West Yorkshire	Freight	All day	60mph, 2200t trailing, Class 66	1 per hour	Routed on the ECML between South Kirkby Jn and Hare Park Jn
	F28			West Yorkshire	West Midlands	Freight	All day	60mph, 2200t trailing, Class 66	1 per hour	Routed on the ECML between Hare Park Jn and South Kirkby Jn
	F29			Doncaster Yards	Drax or Eggborough	Freight	All day	60mph, 2600t trailing, Class 66	1 per hour	Routed on the ECML between Doncaster Yards and Shaftholme Jn
	F30			Drax or Eggborough	Doncaster Yards	Freight	All day	60mph, 1800t trailing, Class 66	1 per hour	Routed on the ECML between Shaftholme Jn and Doncaster Yards
	F31			Peterborough Yards	Whitemoor	Freight	All day	60mph, 2400t trailing, Class 66	1 per hour	Routed via Whittlesea
	F32			Whitemoor	Peterborough Yards	Freight	All day	60mph, 2400t trailing, Class 66	1 per hour	Routed via Whittlesea
	F33			Peterborough Yards	Toton	Freight	All day	60mph, 2400t trailing, Class 66	2-hourly	Routed via Stamford
	F34			Toton	Peterborough Yards	Freight	All day	60mph, 2400t trailing, Class 66	2-hourly	Routed via Stamford
	F35		RM	Willesden PRDC	Low Fell RMT	Freight	All day	12 car Class 325	2 trains per day	Routed along ECML via Grantham
	F36			Low Fell RMT	Willesden PRDC	Freight	All day	12 car Class 325	2 trains per day	Routed along ECML via Grantham

Figure 63 ECML ITSS 2020

10. Appendix F - Abbreviations

Acronym	Meaning
ALCRM	All Level Crossing Risk Model
ATO	Automatic Train Operation
CP4	Control Period 4
CP5	Control Period 5
DfT	Department for Transport
DRS	Direct Rail Services
DTT	Development Timetable
EC	East Coast
ECML	East Coast Main Line
EGIP	Edinburgh to Glasgow Improvement Programme
EMU	Electric Multiple Unit
EPS	Enhanced Permissible Speed
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
GE	Great Eastern
GN	Great Northern
GRIP	Guide to Railway Investment Projects
HS2	High Speed 2
ICEC	Inter City East Coast
IEP	InterCity Express Programme
ITSS	Indicative Train Service Specification
LDHS	Long Distance High Speed
LNE & EM	London North Eastern & East Midlands (Network Rail Route)
NMT	New Measurement Train
OLE	Overhead Line Equipment
ORR	Office of Rail Regulation
PPM	Public Performance Measure
PPRP	Performance Planning Reform Programme
S&C	Switches and Crossings
SPA	Signalling Performance Assessment
SRT	Sectional Running Time
SX	Monday to Friday (applies to timetable)
TSGN	Thameslink, Southern and Great Northern
TPE	Trans Pennine Express
TPH	Trains per Hour
TPR	Timetable Planning Rules
TPS	Train Planning System
WCML	West Coast Main Line
WTT	Working Timetable

Table 11: List of abbreviations