Technical Annex
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Promotion of Rail Priorities in the East Midlands: Regional Services

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1 Introduction

Introduction to the commission

1.1 Steer has been commissioned by Transport the East Midlands (TfEM) to support the promotion of three rail priorities in the East Midlands:

- Delivery of HS2 to the East Midlands
- Full electrification of the Midland Main Line
- Improvements and growth of regional and local rail

This technical annex

1.2 This technical annex provides and explains the analytical and evidence review work that has been carried out to evidence and support the case for improvements to regional and local services in the East Midlands.

2 Enhanced Regional Services

Introduction – the importance and value of regional rail

2.1 This chapter covers local and regional rail services within the East Midlands. These local services have a different, but equally important, socio-economic function to longer distance inter-city rail and investment in an enhanced region service is the third East Midlands priority.

2.2 The function and purpose of the East Midlands' rail network and services that use it can be summarised through the three channels of social, economic, and environmental:

- Social:
  - Enable residents of the East Midlands to access employment and learning opportunities, in turn increasing their social mobility
  - Providing an alternative (to private car use) way to access otherwise isolated and/or deprived communities
  - Provide an alternative means of transport to people who cannot or chose not to drive
  - Help bring people together and develop denser and more vibrant communities
- Economic:
  - Enable employers to reach a sufficiently wide and skilled pool of labour
  - Facilitate business to business contact, generating synergies and agglomeration benefits
  - Support the visitor and leisure economy by providing attractive means of reaching destinations and activities
- Environmental:
  - Reducing emissions from passenger transport by abstracting passengers from more polluting modes, namely private car
  - Provide a more sustainable alternative to road freight
  - Support housing and employment growth with public transport links, reducing car-dependency

The value of services in the East Midlands

2.3 Analysis has been carried out to estimate the monetised benefit of services that carry passengers between stations exclusively within the East Midlands.

2.4 The total annual user journey time benefits for passengers travelling within the East Midlands has been estimated as £343.2m, with the following flows the biggest generator of benefits.

Table 2.1: Intra-regional user benefits by flow

Flow (bi-directional)	Annual user journey time benefit (£m)
Leicester - Nottingham	24.7
Derby - Leicester	15.9
Loughborough - Leicester	12.4
Kettering - Nottingham	12.4
Kettering - Leicester	11.0
Derby - Nottingham	9.5
Grantham - Nottingham	9.0
Lincoln Central - Nottingham	7.9
Loughborough - Nottingham	7.4
Leicester - Market Harborough	7.0
Other flows	225.9
Total	**343.2**

2.5 Also as was presented for MML inter-city services the non-user externalities that the wider region experiences when passengers travel by rail instead of car has been estimated. These results are shown below, and show that the by these metrics the total annual user and non-user benefits of regional services are in excess of £350m.

Table 2.2: Non-user benefits by category

Marginal External Cost (MEC)	Annual impact (£000s)	Comments
Highway decongestion	£12,331	
Reduction in road infrastructure maintenance	£86	
Reduction in road accidents	£1,643	Equivalent to avoiding approximately 18 accidents.
Improved local air quality	£578	
Reduced noise pollution	£116	
Reduced greenhouse gas emissions	£3,021	Equivalent to approximately 11,000 tonnes of CO_2
Reduced fuel taxation	-£4,268	
Total	**£13,506**	

2.6 As further evidence of the scale of rail's influence in the East Midlands the Rail Delivery Group's 'More than a journey' report[1] provides quantification of some of these impacts. The report quantifies the importance of rail in the region. It demonstrates this through a simple 'what if' test. *If 20% of current rail usage switched to car*:

- There would be 270 million extra car miles travelled per annum
- An additional 60,000 tonnes of carbon dioxide equivalent emitted
- 11 million extra hours spent in road congestion
- A monetised cost of £110 million of extra time spent in congestion

[1] More than a journey, Rail Delivery Group

2.7 The report also shows how rail usage has a knock-on impact on consumer spending in the local economy. Through surveys RDG were able to show that in an average year, prior to the Covid-19 pandemic, rail passengers in the East Midlands spent:

- £1.3 billion per annum on food and drink as part of their trip by rail
- £2.0 billion per annum on shopping
- £1.3 billion on accommodation
- £0.7 billion on entertainment and culture
- £0.5 billion on other modes of travel as a part of their trip.

2.8 The remainder of this chapter introduces the existing regional rail service in the East Midlands, and provides some more detail on how this contributes to the socio-economic and environmental functions described above. The analysis presented in this chapter also identifies opportunities where an enhanced regional rail service could further support a stronger, fairer and greener East Midlands.

Network coverage

Introduction

2.9 Figure 2.1 overleaf illustrates the passenger rail services and principal stations in the East Midlands.

2.10 The Midland Main Line (MML) serves the region's biggest towns and cities. There are several east-west connections branching off the MML, including the Derby – Birmingham, Derby – Crewe, and Birmingham – Peterborough lines. The Corby branch is served by East Midlands Railway's (EMR) London – Corby services. Also branching off from the MML are the Erewash Valley and Robin Hood lines, both of which serve relatively dense populations, with the former serving Ilkeston, Langley Mill and Alfreton, and the latter serving Mansfield, Hucknall, and Bulwell. The Derwent Valley line connects the MML at Ambergate with the popular Derbyshire Dales town of Matlock and some other smaller destinations. The north west of the region is served by the Hope Valley, Buxton, and Glossop lines, all of which provide important connections to Greater Manchester.

2.11 The East Coast Main Line (ECML) also serves the region with strategic long-distance connections. Grantham, Newark North Gate, and Retford stations all benefit from stops on LNER services. Lincoln is also served by six LNER services per day to and from London Kings Cross. As well as the ECML, towns and cities in the eastern part of the region are served by a number of other routes. The Nottingham – Lincoln and Nottingham – Skegness routes provide important east-west connections within the region, and he northern parts of Lincolnshire and Nottinghamshire are served by the Sheffield – Lincoln – Market Rasen lines. The Peterborough – Lincoln line also serves intermediate towns and villages in Lincolnshire.

2.12 Figure 2.2 shows the biggest destination for rail journeys from each rail station in the East Midlands. The colour coding of each station shows which station is the biggest destination, and the size of each dot shows the share of journeys that go to that destination.

Figure 2.1: Map of passenger rail services in the East Midlands

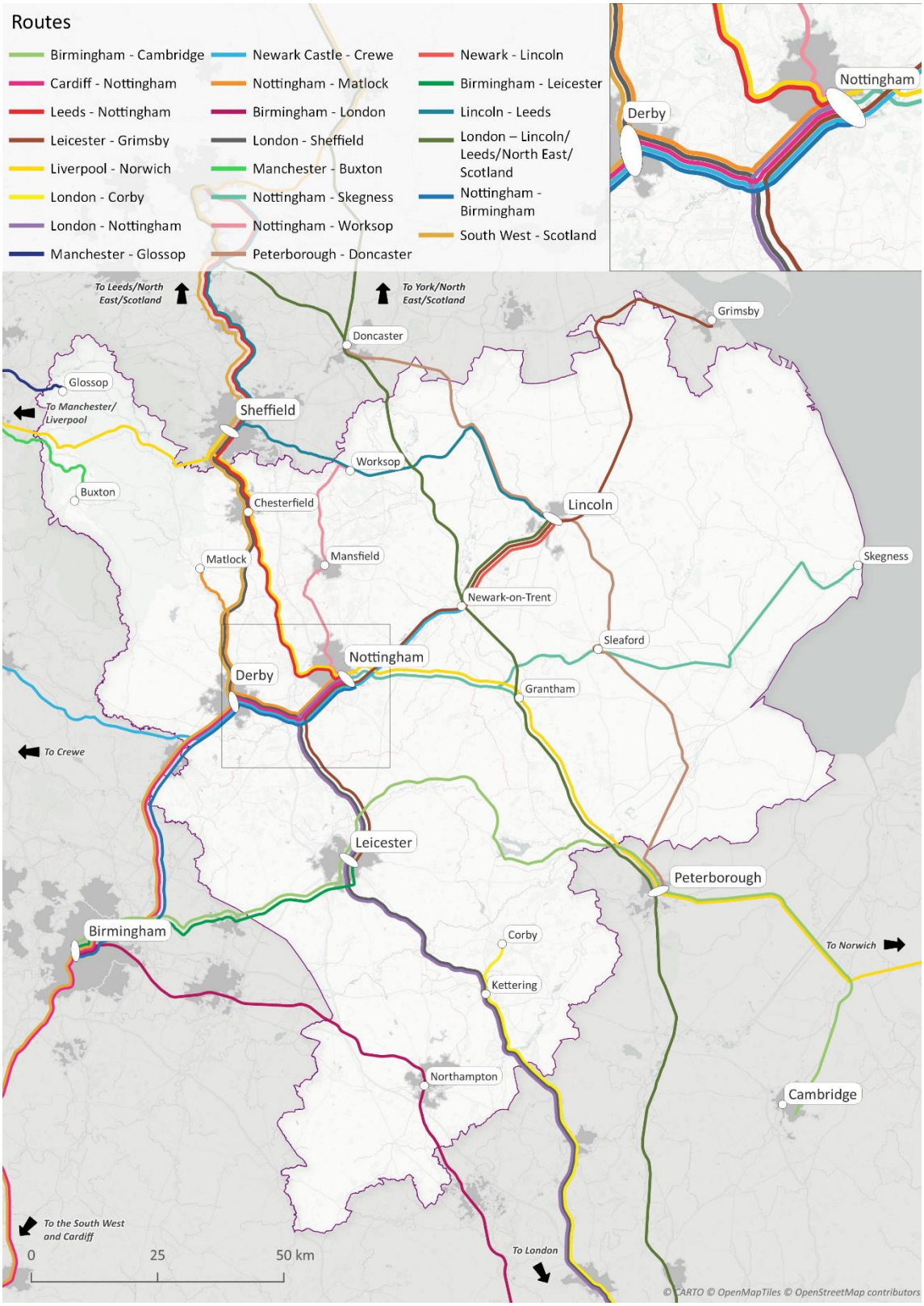
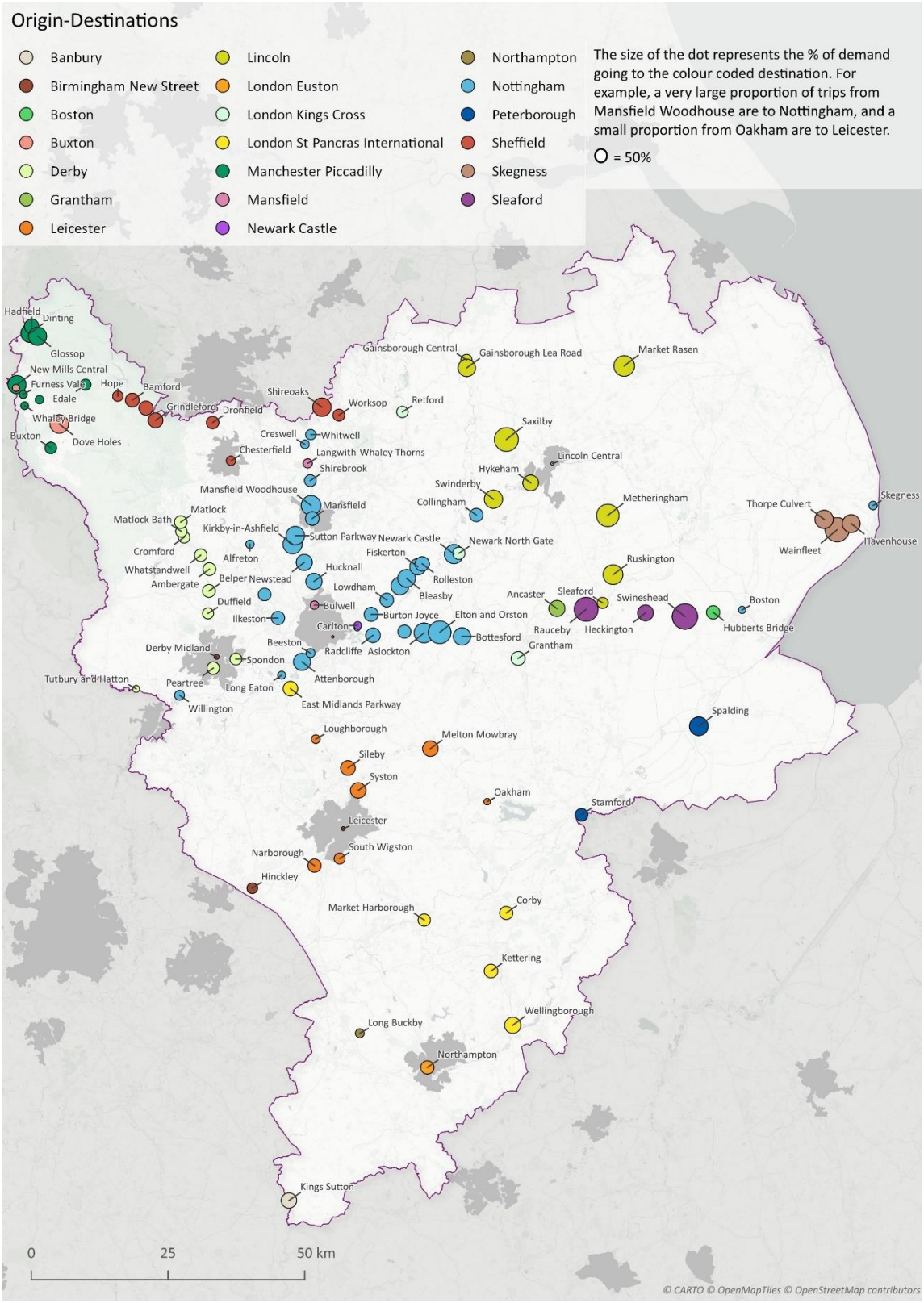


Figure 2.2: Biggest destination station by origin station



Source: ORR Station Usage Origin-Destination statistics

Accessibility of East Midlands residents to rail services

2.13 The table below shows the percentage of all English region's population within certain drive times of their nearest rail station. This serves as a good measure of the ease at which the population can access and benefit from the rail network.

2.14 The East Midlands has the lowest proportion of its population within five minutes' drive, which would be 15 to 20 mins walk or 10 minutes cycle of their nearest station. This figure is also substantially lower than most other English regions; for example it is half of the equivalent figure for the West Midlands. This is a clear demonstration of the low density of the rail coverage in the region and how it has lagged behind other regions in creating a joined-up network which supports people's daily lives.

Table 2.3: Population within X minutes of nearest rail station by region

Region	Population within X minute drive of nearest rail station			
	5 minutes	5–15 minutes	15–30 minutes	30+ minutes
London	55.8%	44.0%	0.2%	0.0%
North West	43.3%	53.7%	2.9%	0.0%
South East	39.2%	56.3%	4.4%	0.1%
West Midlands	32.4%	62.1%	5.3%	0.1%
East	29.6%	60.6%	9.2%	0.6%
Yorkshire and the Humber	27.7%	65.4%	6.4%	0.5%
South West	22.5%	58.1%	18.0%	1.5%
North East	19.3%	69.5%	10.6%	0.6%
East Midlands	16.3%	68.9%	14.4%	0.3%

Source: Steer TRACC analysis

Service frequencies

Why are service levels important?

2.15 For the short/medium distance intra-regional rail journey this chapter covers, the service frequency is crucial for attracting passengers to use rail and maximising the benefit rail can deliver.

2.16 When making longer-distance intercity journeys, for example from Nottingham to London, passengers are likely to identify a specific train to travel on days or even weeks in advance, purchase a ticket for that train, and arrive at the station at their desired time before the service departs.

2.17 For shorter distance trips, for example travelling from Syston to go shopping in Leicester city centre, or visiting friends in the next town/village, passengers are more likely want to plan trips less in advance and more spontaneously. If a passenger checks the next train is an hour for a 15 minute journey, or the next train would make them late for work, or going to the cinema, they are likely to travel by car, or not travel at all.

2.18 There is a wealth of empirical research and evidence used for rail demand forecasting that quantifies the impact service frequencies have on how passengers perceive the time it takes to

travel by rail. The Rail Delivery Group's Passenger Demand Forecasting Handbook[2] (PDFH) provides 'service internal penalties', which are the additional time added to a passenger's generalised journey time. These penalties for journeys outside London and the South East are presented below.

Table 2.4: Select service interval penalties for non-London/South East journeys

Service interval (minutes between services)	Time penalty (minutes)
30	24
60	33

2.19 In practice this means for a journey from Ilkeston to Nottingham, which is served by an hourly Northern service from Leeds, the total generalised journey time is 47 minutes, just 14 minutes (30%) of which is the time spent on the train, with the other 33 minutes coming from the relatively high service penalty. And this doesn't include the time to access or egress the train itself.

2.20 The key point here is that in terms of trying to abstract people from private car use, local rail in-vehicle journey times tend should be very competitive with car journey times, especially for journeys into the biggest city centres. For example, the journey above from Ilkeston to Nottingham the 14 minute rail journey is about half the time it would take to drive from Ilkeston to Nottingham city centre. And yet, where there are very low frequencies and where people have to travel relatively far to access their nearest station, then the attractiveness and convenience of a local rail journey (compared to driving) plummets.

Service levels in the East Midlands

2.21 Figure 2.3 and Figure 2.4 below show the one direction hourly service frequencies for stations in the East Midlands. These are based on the December 2022 timetable for weekdays and between 11:00 and 13:00.

2.22 The region's three biggest stations (by passenger entries and exits), Nottingham, Derby, and Leicester have the highest service frequencies with their combination of main line inter-city, CrossCountry, and local services. Grantham, Kettering, and Chesterfield all have four trains per hour thanks to their positions on main lines. Beeston also has four trains an hour, which is relatively high for a station of its population catchment and usage.

2.23 A number of the region's bigger towns, including Newark, Lincoln, and Loughborough have between two and three trains per hour. Outside of these stations, and as can be seen on the maps below, there are 74 stations with one train per hour or less. This excludes the nine stations with an extremely limited or 'parliamentary' service.

2.24 This means that despite there being a station and trains to where people want to go, rail in the East Midlands is predominantly offering a very poor level of service for residents. It is important to note that the diagrams below only cover weekday services, with some stations and routes less well served during weekends. They also do show how well a particular station is connected to key destinations, instead it shows any service for each station. For example Lincoln is marked as green with two to three trains per hour, but it only has one train per hour to Nottingham which is potentially an important connectivity shortfall.

[2] https://www.raildeliverygroup.com/pdfc/about-the-pdfh.html

Figure 2.3: December 2022 timetable inter-peak services per hour, one direction

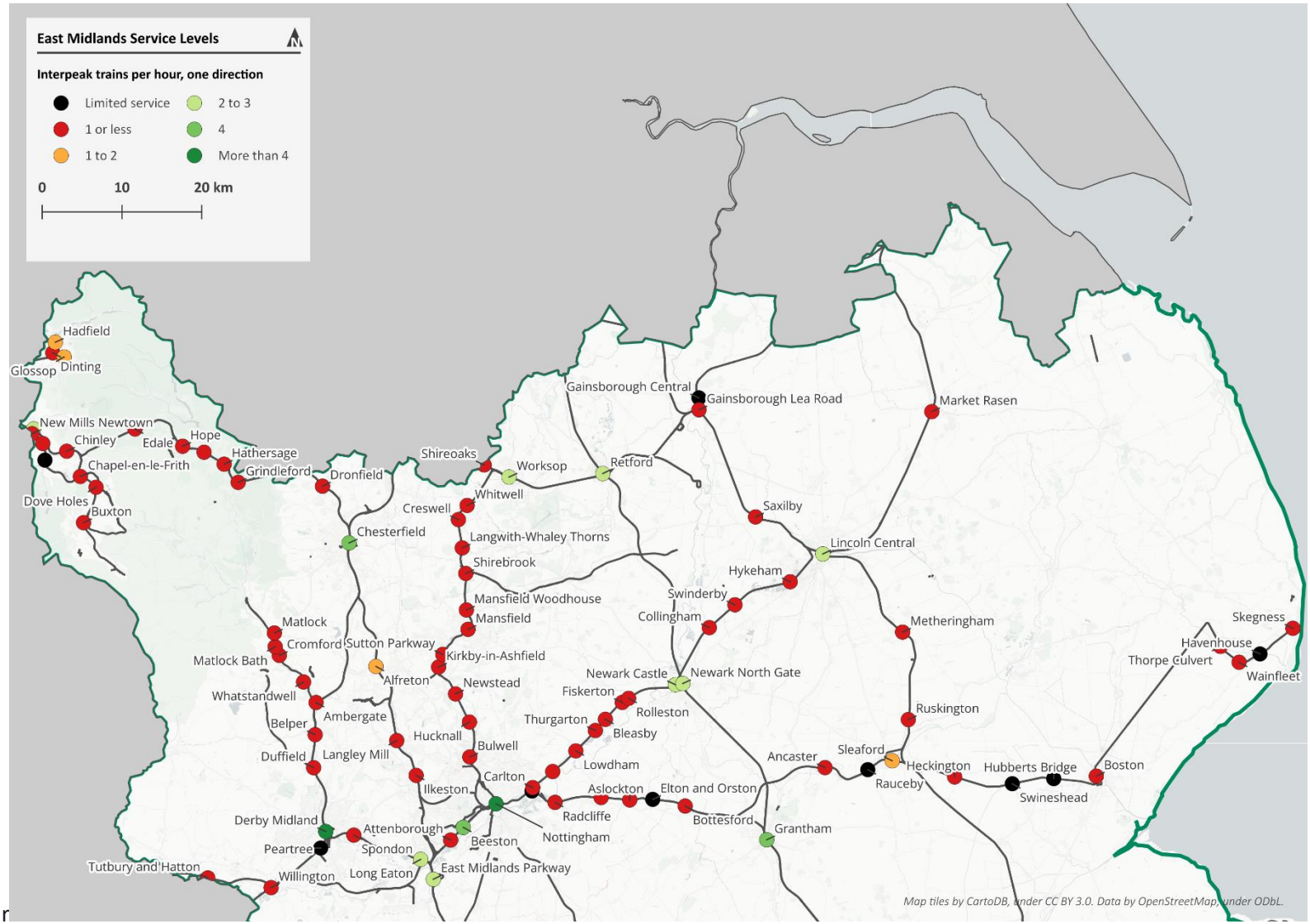
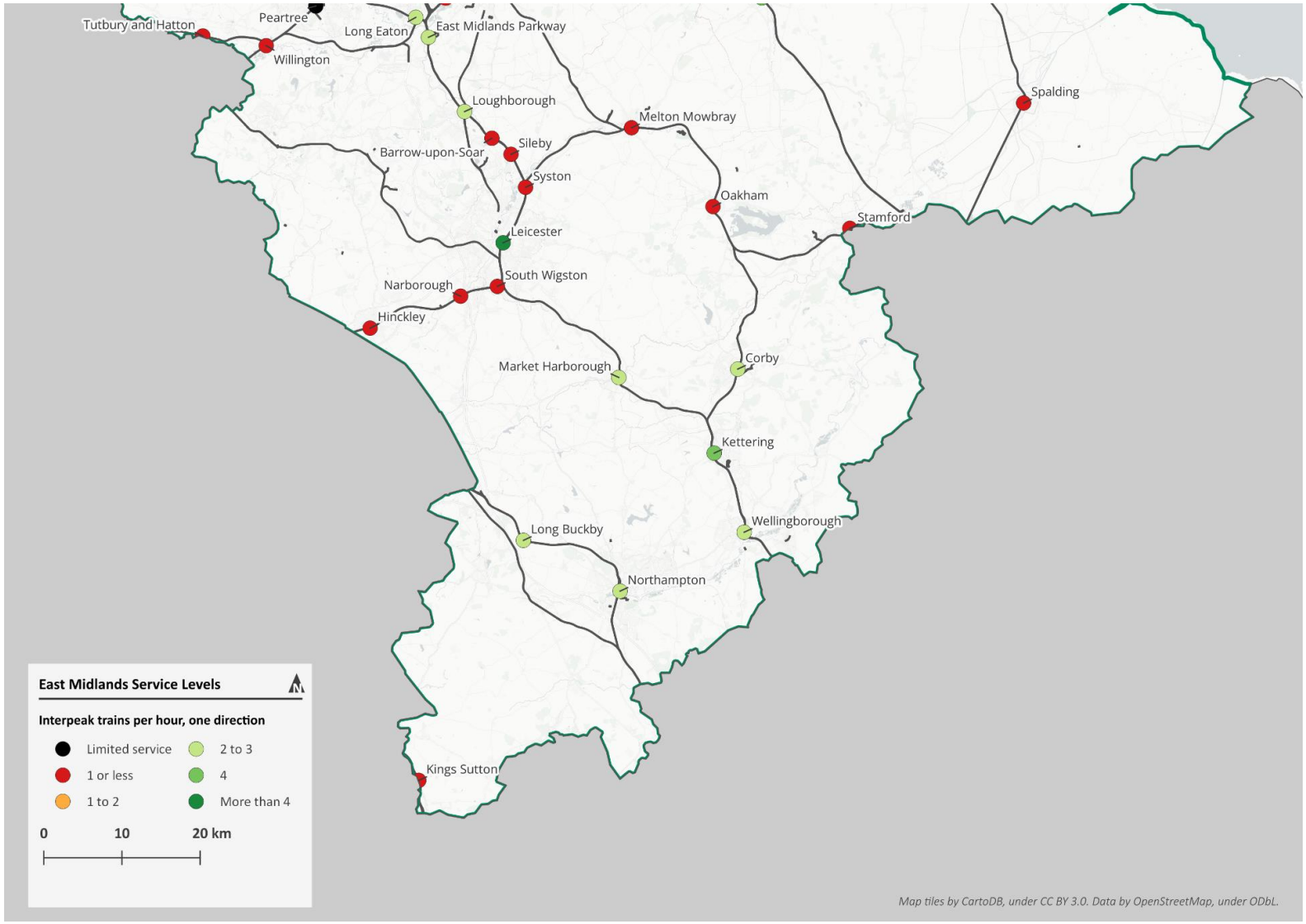


Figure 2.4: December 2022 timetable inter-peak services per hour, one direction



City centre catchments

2.25 This section focuses on the service levels within the commuting catchments and hinterlands of the East Midlands three biggest cities, Nottingham, Leicester and Derby. As well as being the biggest population centres they are also the three biggest contributors to the East Midlands economy in terms of GVA production[3]. Over the last two to three decades rail has played an increasingly key role in how cities in the UK function as employment has shifted towards office-based professional services. In addition to attracting in thousands of commuters every day the three cities are also important retail and visitor centres for the region.

2.26 To provide a benchmark against other UK cities the service levels for stations in the same catchment area as Birmingham are shown. The four maps on the following pages show the one direction inter-peak service frequency, 10km, 20km, and 30km population buffers from the city centre station, as well as population density.

2.27 The most noticeable point on the maps is the density and number of routes and stations in the Birmingham catchment compared to the three East Midlands cities. The reasons for these differences are varied and historic, but the size of the rail networks doesn't mean their importance is any less.

2.28 The important point relating to service frequencies is how many stations in the Birmingham area are served by at least two trains per hour, and how few are for the main cities of the East Midlands. Only nine, 12%, of all stations within the 20km from Birmingham New Street have fewer than two trains per hour. Of these, seven stations (five on the Birmingham – Stratford line, Lapworth on the Birmingham – Warwick line, and Water Orton on the CrossCountry route) have relatively spare population catchments. Adderley Park and Bordesley are the other two stations with low frequencies, although both are within 2.5km of Birmingham city centre.

2.29 Within the 20km Nottingham catchment, four stations have at least two trains to Nottingham each hour, but the rest (83%) have one or fewer. A number of these stations, primarily those on the Nottingham – Lincoln/Grantham routes, have very sparsely populated catchments that wouldn't be expected to support a higher frequency service. However, there are still a number of stations in densely populated areas that have a relatively poor service that will mean that rail is an unattractive option for travel to Nottingham. These include:

- Attenborough
- Bingham
- Ilkeston
- Langley Mill
- Hucknall
- Kirkby-in-Ashfield

2.30 Centre for Cities' research[4] has previously identified that relatively few residents of Nottingham can reach the city centre within 30 minutes using public transport compared to European cities of a similar size (around 50% in Nottingham compared to 70% in Europe), and

[3] https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgrossvalueaddedbalancedbylocalauthorityintheuk

[4] https://www.centreforcities.org/wp-content/uploads/2021/11/Measuring-up-Comparing-public-transport-in-the-UK-and-Europes-biggest-cities.pdf

that this poor public transport accessibility causes an economic productivity gap of over £1billion per annum compared to European cities.

2.31 The maps show a similar conclusion for Leicester and Derby. With Leicester in particular having no real commuter rail network or service to speak of. The populations around Syston, Narborough, and Hinckley suggest that a higher frequency rail service to/from Leicester should perform an important socio-economic function, with the same being true for Spondon and stations on the Derwent Valley line to and from Derby.

Figure 2.5: Nottingham area service levels and population density

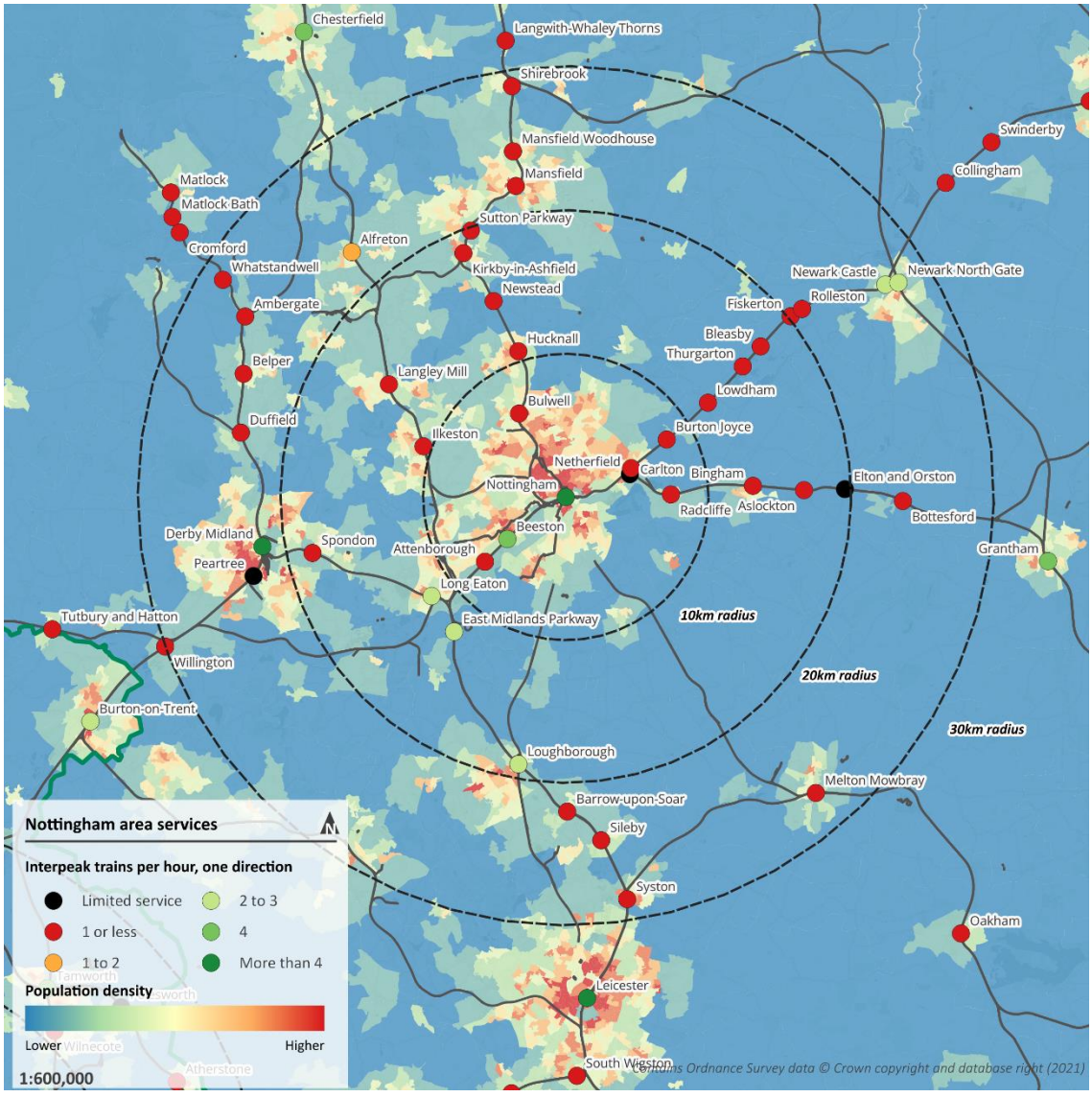


Figure 2.6: Leicester area service levels and population density

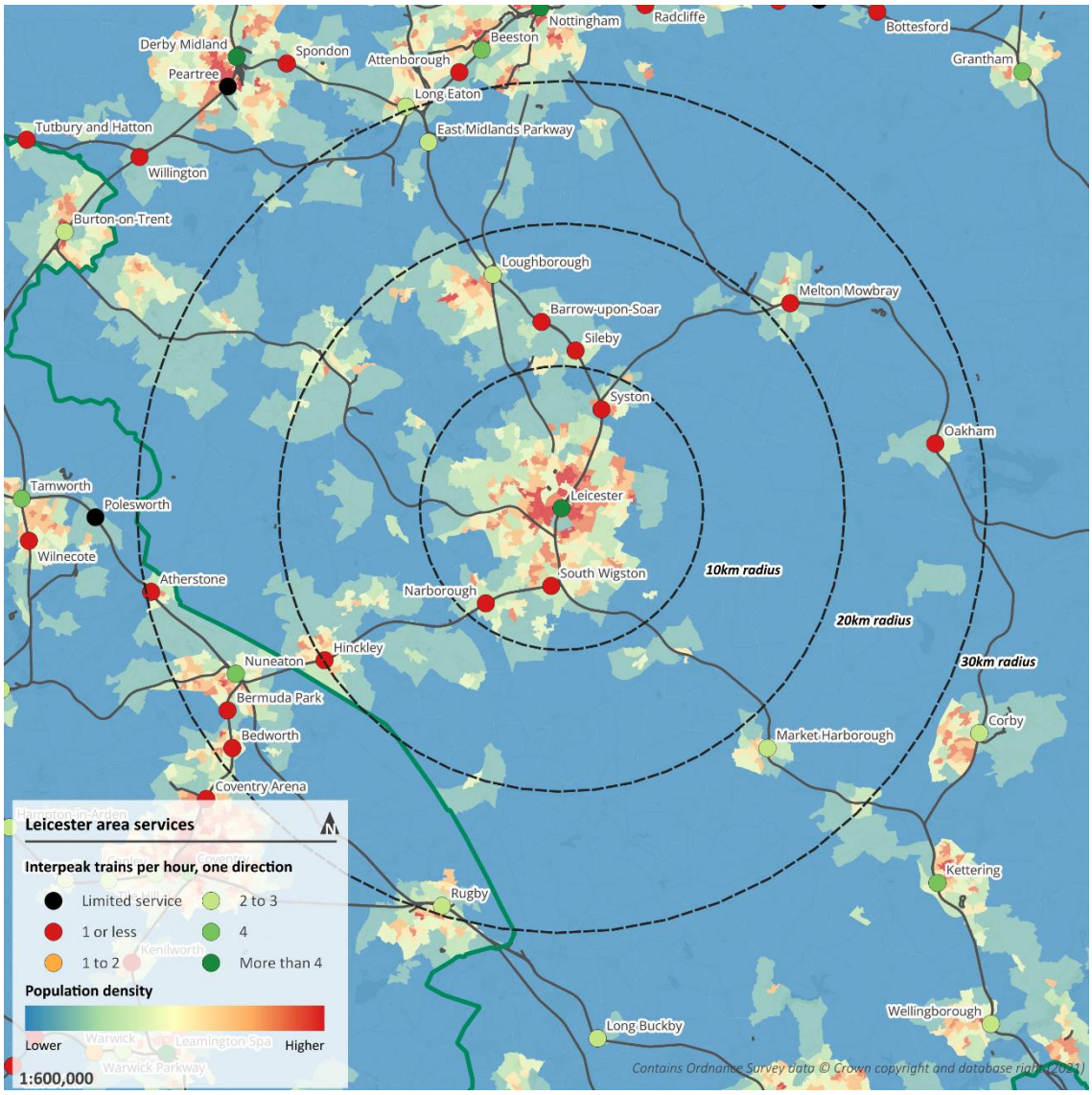


Figure 2.7: Derby area service levels and population density

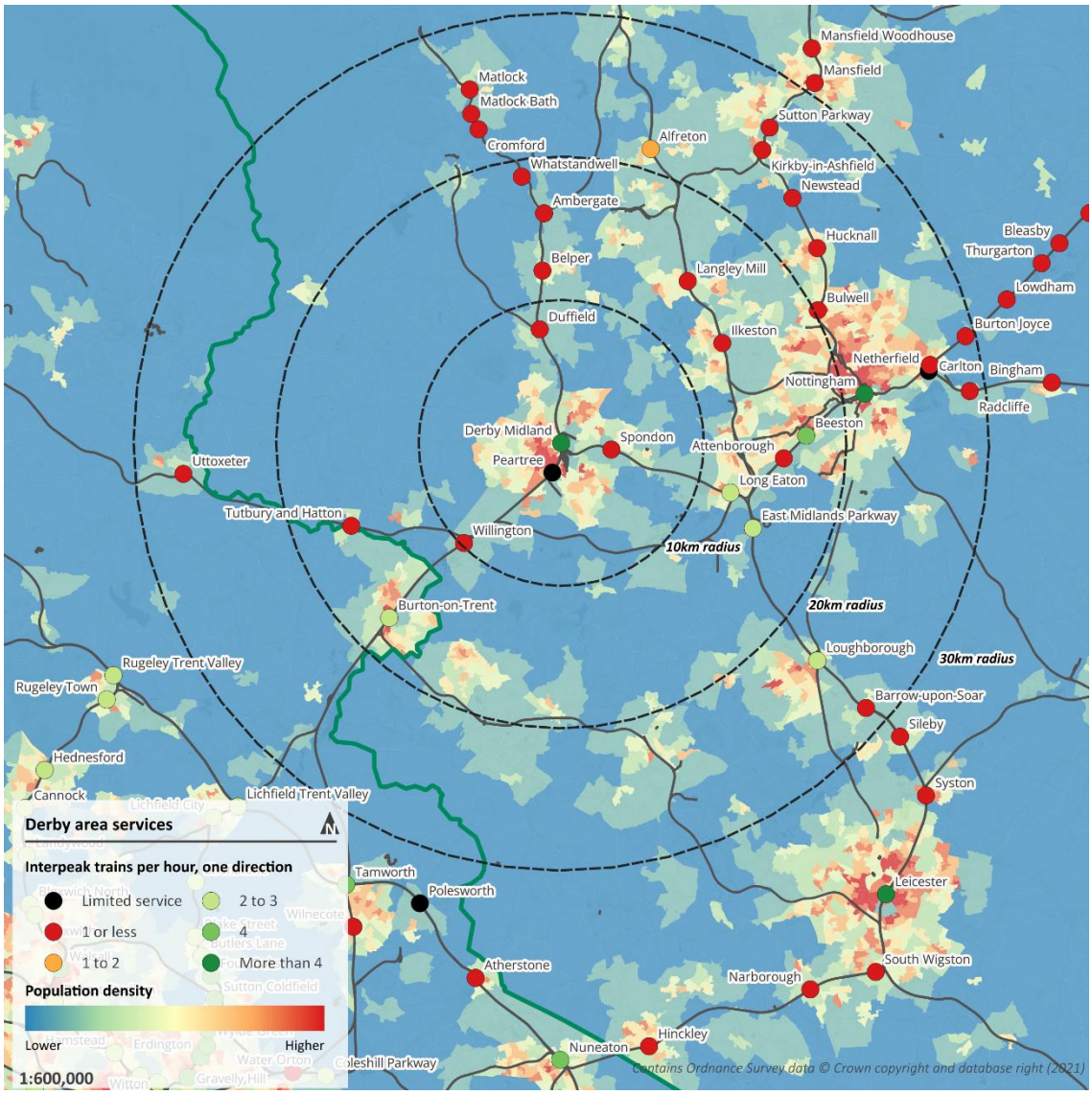
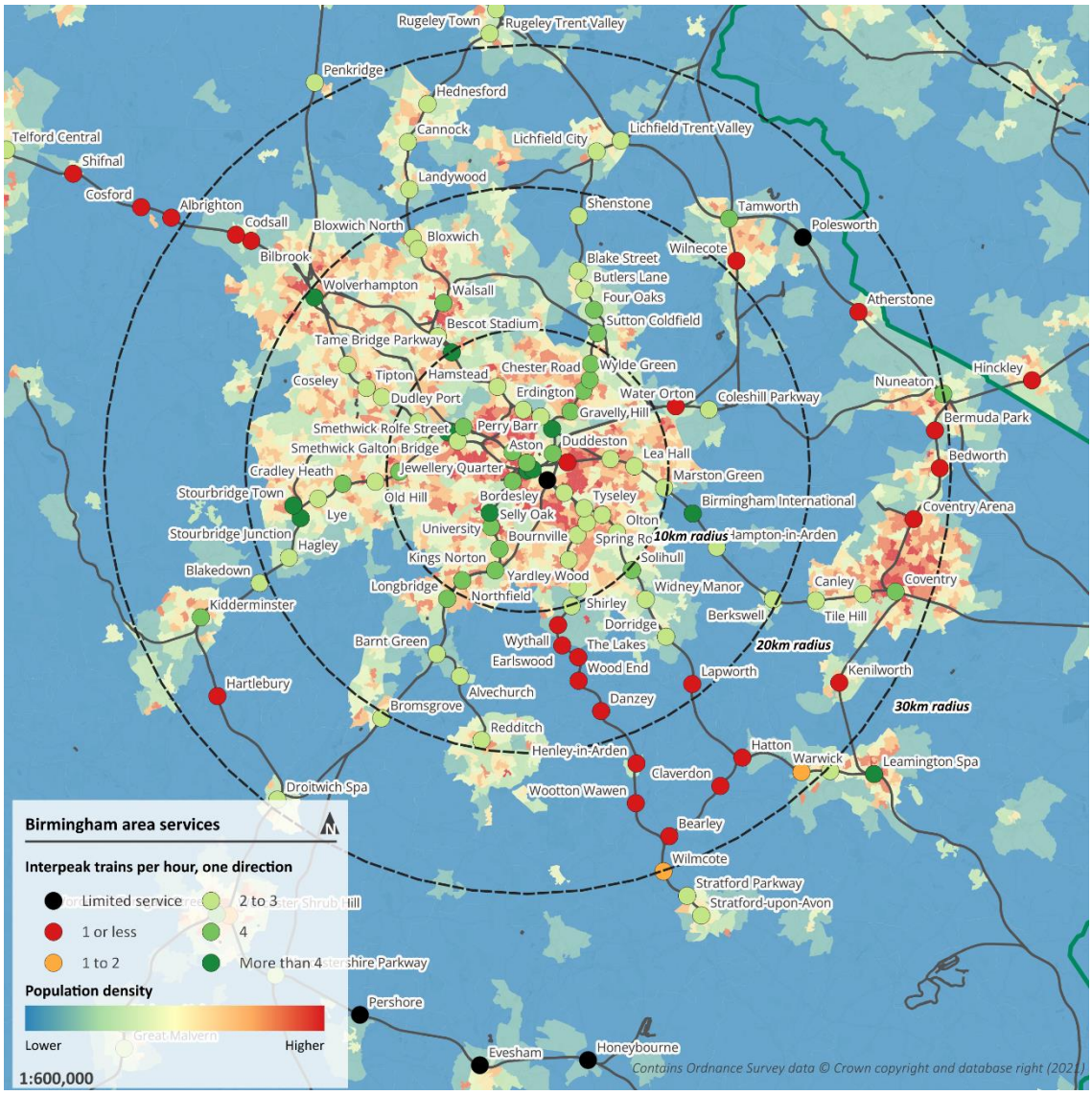


Figure 2.8: Birmingham area service levels and population density



Rail 'coldspots'

2.32 It is not just low frequency services in the biggest cities' catchments which potentially hold back the socio-economic and environmental function of rail in the East Midlands. Research produced by Transport for the North[5] has identified which parts of the country are at the highest risk of 'transport related social exclusion' (TRSE). With TRSE meaning "*being unable to access opportunities, key services, and community life as much as needed, and facing major obstacles in everyday life through the wider impacts of having to travel*."

2.33 Particularly in the east of the region, there are a number of reasonable sized conurbations that are served by a train station but with low service frequencies. The TfN research shows that are number of these are also at the highest risk of TRSE. Parts of Stamford, Spalding, and Hykeham

[5] https://transportforthenorth.com/press-release/over-3-million-people-at-risk-of-transport-related-social-exclusion/

are categorised as being at 'high' risk, whilst large parts of Boston, Skegness, and Gainsborough are all categorised as 'very high' risk, the highest possible category.

Summary of frequency gaps

2.34 The evidence above shows a number of stations, towns, and communities in the East Midlands have a relatively low provision of rail services. The top priorities for improving service frequency gaps should be a combination of those stations within a reasonable rail commuting distance of Nottingham, Derby, and Leicester, and the more 'standalone' but still major towns which currently have a poor level of service:

- Ilkeston
- Langley Mill
- Hucknall
- Syston
- Melton Mowbray
- Mansfield
- Boston
- Skegness
- Dronfield

Other factors driving rail patronage

2.35 Despite the frequency gaps described above, there are a number of stations in the East Midlands which attract a reasonable level of rail patronage despite low service frequencies, suggesting that factors other than service frequency are important in determining rail usage.

2.36 Some of these stations are more 'destination' stations which will attract passengers travelling into them, rather than solely generating demand from their surrounding catchment areas. These include Edale (station usage 45,800), Buxton (98,200), and Skegness (112,520). Other examples are stations close to major cities that may attract 'park and ride' style trips for passengers looking to avoid driving into and parking in city centres. These include Syston (50,490), Belper (50,948), and Hinckley (54,204).

2.37 Other examples, including Mansfield (92,192), Boston (59,220), and Stamford (49,894), are important towns in their own right and attract reasonable rail usage despite their poor service frequencies.

2.38 What these examples show is that frequency is not the sole driver of rail demand, but also that there is 'untapped potential' where even more rail usage could be generated were service frequencies to be improved.

Franchise specification service analysis

2.39 On several regional routes on the East Midlands network there are shortfalls in the services included in the 2019 East Midlands Railway franchise specification that are not currently operated as part of the existing National Rail Contract.

2.40 To estimate the impact of these services in terms of patronage, farebox revenue, and monetised user journey time impacts, a hypothetical timetable including these 'missing' services has been modelled in MOIRA. Table 2.5 shows the additional services included in this timetable, shown as incremental daily services compared to the December 2023 timetable. Where there were gaps between services in the timetable these have been filled at as regular an interval as possible, or if not, services have been included at the start and end of the day.

Table 2.5: Additional services per day included in franchise specification analysis

Service	Weekday	Saturday	Sunday
Leicester-Nottingham	0	0	13
Nottingham-Leicester	0	0	13
Derby-Matlock	0	0	2
Matlock-Derby	0	0	2
Crewe-Derby	0	3	6
Derby-Crewe	0	3	6
Nottingham-Derby	2	0	15
Derby-Nottingham	0	0	15
Nottingham-Boston	1	0	0
Boston-Nottingham	1	1	0
Nottingham-Norwich	2	1	0
Norwich-Nottingham	0	2	0
Nottingham-Lincoln	4	3	0
Lincoln-Nottingham	4	3	0
Nottingham-Newark Castle	4	3	0
Newark Castle-Nottingham	4	3	0
Nottingham-Liverpool	0	1*	0
Liverpool-Nottingham	0	2*	0
Nottingham-Worksop	2	0	13
Worksop-Nottingham	2	0	13
Nottingham-Mansfield	7	0	4
Mansfield-Nottingham	8	0	5
Doncaster-Lincoln	11	11	5
Lincoln-Doncaster	11	11	5
Peterborough-Lincoln	2	5	0
Lincoln-Peterborough	2	6	0
Cleethorpes-Lincoln	1	0	0
Lincoln-Cleethorpes	1	0	0
Newark Northgate-Lincoln	7	2	0
Lincoln-Newark Northgate	9	2	0
Lincoln-Grimsby	8	6	0
Grimsby-Lincoln	8	7	0
Cleethorpes-Barton	1	1	0

*The three Nottingham – Liverpool services included in this analysis were not included in EMR's 2019 franchise specification and as of March 2024 are running as truncated services.

2.41 The headline annual results of this analysis[6] are shown in Table 2.6, with the top ten flows by monetised user benefits shown in Table 2.7. The results show that over 400,000 journeys, an additional £2.4 million in farebox revenue, and over £10 million in user journey benefits could be generated (all per annum) if the services listed above were delivered. Of the user benefits, £1.1 million of them accrue to new users of the railway.

Table 2.6: Annual results of service analysis

Metric	Result
Additional demand (000s)	431
Additional farebox revenue (£m, 2024 prices)	2.4
Existing user benefits (£m, 2024 prices)	9.3
New user benefits (£m, 2024 prices)	1.1

Table 2.7: Top ten flows by user benefits for service analysis

Flow	Annual user benefits (£, 2024 prices)
Lincoln Central-Nottingham	270,990
Lincoln Central-Newark	263,794
Mansfield Town-Nottingham	244,681
Lincoln Central-Market Rasen	222,403
Grimsby Town-Lincoln Central	212,034
Nottingham-Newark	211,905
Mansfield Woodhouse-Nottingham	209,168
Lincoln Central-Sleaford	205,703
Gainsborough-Lincoln Central	195,927
Hucknall-Nottingham	193,532

2.42 A further test representing reinstating the previous hourly weekday and Saturday Gainsborough Central – Sheffield service which was introduced in the May 2019 timetable, but as of May 2022 only one service runs on weekdays, with no service on weekends. The introduction of the service also allowed reduced journey times on Leeds – Lincoln (via Gainsborough Lea Road and Worksop) services.

2.43 This test has been modelled in MOIRA, with a new timetable that includes both the 'new' hourly Gainsborough – Sheffield services and two to three minute journey time reductions on Leeds – Lincoln services. The headline results of this test are shown below:

[6] This analysis is an initial high level assessment of the potential impact of the additional services listed. A detailed timetable, capacity, or performance assessment has not been carried out and high-level assumptions regarding journey purposes were made using TAG parameters in the monetisation of the results.

Table 2.8: Annual results of Gainsborough – Sheffield service analysis

Metric	Result
Additional demand (000s)	59
Additional farebox revenue (£000s, 2024 prices)	390
Existing user benefits (£m, 2024 prices)	1.1
New user benefits (£000s, 2024 prices)	51

2.44 The biggest beneficiaries of this test are predominantly flows between Worksop, Sheffield, Retford, and Lincoln. With other big beneficiaries being Leeds – Lincoln trips.

Table 2.9: Top ten flows by user benefits for Gainsborough service analysis

Flow	Annual user benefits (£, 2024 prices)
Worksop-Sheffield	207,486
Sheffield-Worksop	113,727
Lincoln Central-Sheffield	68,677
Retford-Sheffield	66,966
Retford-Worksop	64,041
Worksop-Meadowhall	50,627
Sheffield-Lincoln Central	45,199
Lincoln Central-Leeds	30,252
Worksop-Retford	25,760
Leeds-Lincoln Central	20,820

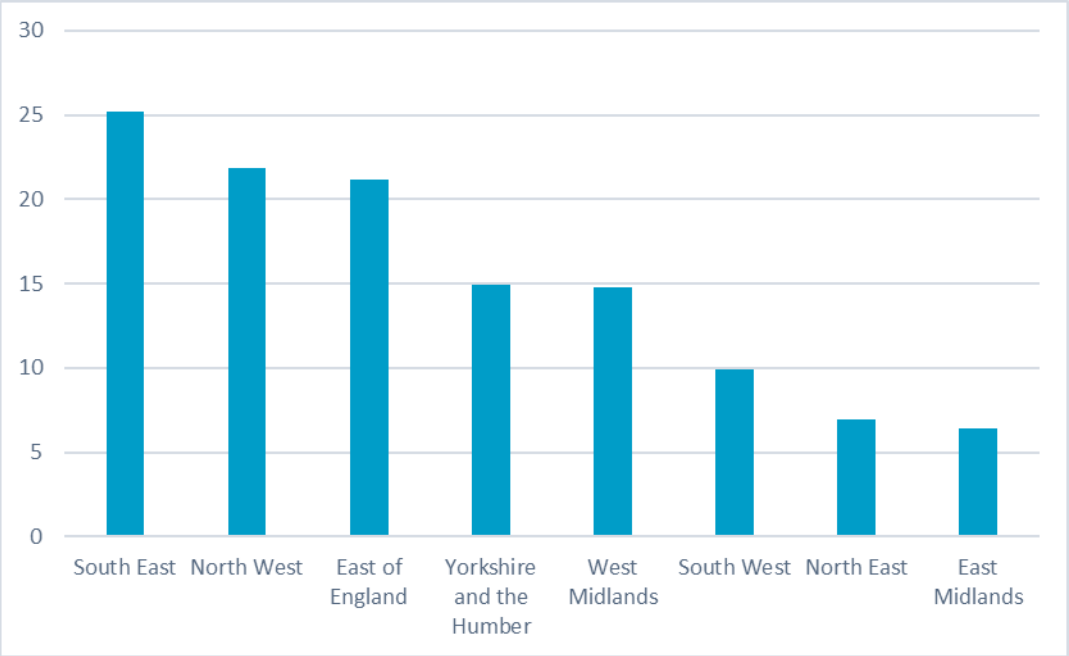
2.45 The two tests combined show that reinstated the services listed and described above could generate:

- Just under 500,000 additional rail trips in the East Midlands
- Just under £3m in additional farebox revenue
- Over £10 million in existing user journey time benefits
- Over £1 million in new user journey time benefits

East Midlands rail usage

2.46 The sparse nature of the network and low service frequencies offered to residents of the East Midlands has an obvious knock-on effect: not many people use rail. The East Midlands has the lowest usage of rail per capita than any other English region. The graph below shows the total entries and exits at rail stations per capita. This is the sum of the entries and exits at stations within each region divided by its population. Note that the value for London is 97.1, and isn't shown on the chart.

Figure 2.9: Station usage per capita by region



Source: Office of Rail and Road Station Usage statistics and Office for National Statistics population data

2.47 A key driver of rail demand is the population within a reasonable walking, cycling, or driving distance of the station. It is unsurprising that rail station usage in the more sparsely part of the East Midlands is relatively low. However, there are several East Midlands stations with relatively densely populated catchments, that still have low usage.

2.48 Of the stations in the East Midlands with more than 28,000 people in their catchment area, the table below shows the usage per capita and the service level for the six least used (per capita) stations.

Table 2.10: Station usage per capita and service level for select East Midlands stations

Station	Annual station usage	Usage per capita	Hourly service
Peartree	1,728	0.06	Limited service
Ilkeston	25,492	0.72	1
Hinckley	54,204	1.09	1
Dinting	42,068	1.38	1
Spalding	44,986	1.45	1
Boston	59,220	1.59	1
Melton Mowbray	47,012	1.65	1

2.49 The least used stations, on a per capita basis, in densely populated areas all have either one train per hour, or a limited service.

Rail market share and opportunities for growth

2.50 To identify further where there are opportunities for rail to grow and better serve the East Midlands, data from Midlands Connect's MiRANDA transport modelling suite has been analysed. The data provides an estimate of the number of road and public transport trips between different model zones across the Midlands. Although this is model data, it is in-part

informed by 'real world' mobile phone data and serves as a good source of estimates of modal shares for private car and public transport.

2.51 The public transport data is all public transport modes combined, so for some flows bus will carry a substantial portion of the demand, but it is reasonable to assume that rail also carries a significant share of these journeys. The number of car and public transport trips in the typical AM peak hour has been abstracted for zones in the urban built-up areas that are within 5km of a rail station.

2.52 There are some flows where rail, or public transport in general, has a high share of all trips according to the model data. Of the flows in the top 30% of all origin-destination pairs by number of trips (more than 24 across the AM peak period between 07:00 and 10:00), these are the top ten flows by public transport mode share. The flows are mainly inter-urban trips between the biggest cities in the East Midlands, but the list does also include trips from smaller towns and suburbs into bigger cities.

Table 2.11: Top ten flows by size of travel market and public transport mode share

Origin	Destination	Total AM peak trips	Highway share	PT share
Leicester	Nottingham	411	52%	48%
Nottingham	Leicester	376	53%	47%
Derby	Leicester	293	76%	24%
Leicester	Derby	269	77%	23%
Carlton	Leicester	96	82%	18%
Leicester	West Bridgford	53	82%	18%
Nottingham	Lincoln	38	64%	36%
Sileby	Nottingham	37	68%	32%
Borrowash	Leicester	30	83%	17%
Clifton	Leicester	27	74%	26%

2.53 The table below shows the opposite end of the flow data. The flows below are the bottom ten flows in terms of public transport share. The criteria for inclusion in this list again the inter-urban flows with in the top 30% of all flows, and where there are at least already five PT trips (showing it is at least possible/feasible to travel between the two places using public transport).

Table 2.12: Bottom ten flows by size of travel market and public transport mode share

Origin	Destination	Total AM peak trips	Highway share	PT share
Syston	Leicester	3,374	99%	1%
Nottingham	Beeston (Broxtowe)	2,280	99%	1%
Ilkeston	Nottingham	1,725	99%	1%
Stapleford (nearest station: Ilkeston)	Nottingham	1,531	99%	1%
Leicester	Narborough	722	99%	1%
Earl Shilton (nearest station: Hinckley)	Leicester	642	99%	1%
Derby	Beeston	622	99%	1%
West Bridgford (Nottingham)	Derby	527	99%	1%
Derby	Long Eaton	309	98%	2%
Heanor (nearest station: Langley Mill)	Nottingham	307	98%	2%

2.54 The flows in this list are ones that have a large market for travel, but currently the very large majority of that travel uses cars. The flows are all relatively short distance trips to or from Nottingham, Derby, and Leicester, and several of flows involve stations that were identified as having low service frequencies in the previous section.

Performance analysis

Introduction

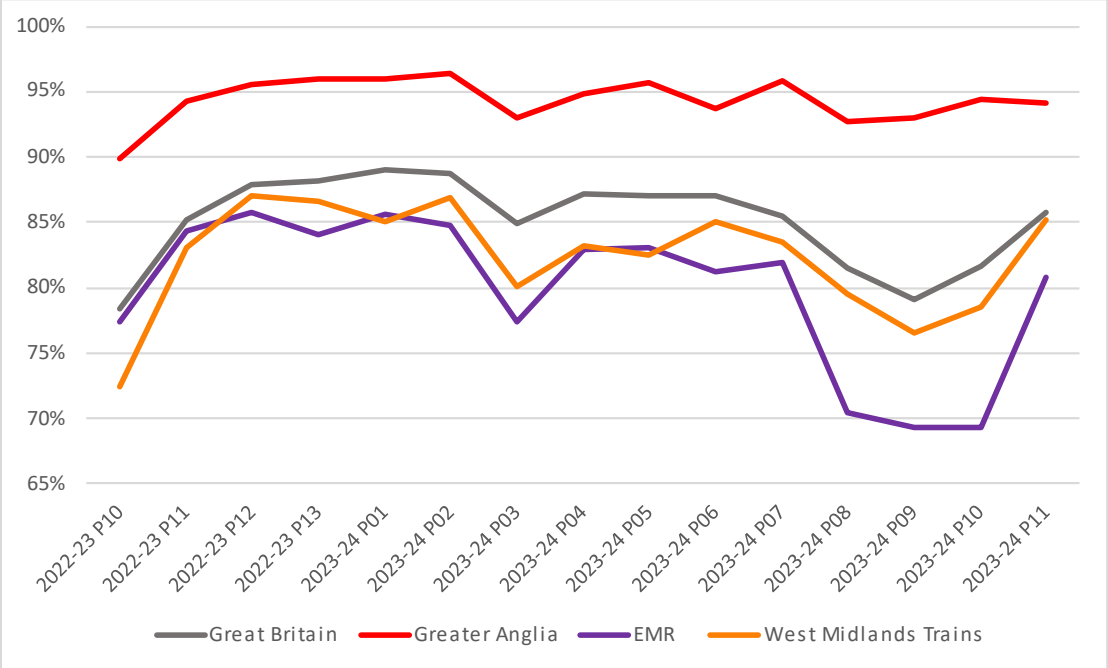
2.55 This section focuses on the performance of regional rail services in the East Midlands. Rail performance refers to the extent to which services run (and aren't cancelled) and run on time as per the advertised timetable. Good and reliable rail performance is a crucial factor in making rail an attractive transport option.

2.56 Transport Focus' research[7] into rail passengers' priorities for improvements found that improved reliability and punctuality ranked as the number one priority for rail passengers nationally. For East Midlands Railway passengers specifically, it ranked as the second highest priority after better value for money train tickets.

2.57 The Office of Rail and Road report the 'public performance measure'[8] for each train operator in the UK. This measure represents the percentage of passenger trains that arrive on time at their final destination. The measure for East Midlands Railway and the Great Britain average are shown for the last fifteen rail periods below. For comparison, the measure is also shown for Greater Anglia and West Midlands Trains are two similar operators.

2.58 The evidence shown below means that for passengers in the East Midlands roughly every one in five services will arrive late at their final destination.

Figure 2.10: Public Performance Measure Moving Annual Average for select train operating companies and GB



[7] https://d3cez36w5wymxj.cloudfront.net/wp-content/uploads/2020/07/16120106/TF-Rail-passenger-priorities-July20_link.pdf

[8] https://dataportal.orr.gov.uk/statistics/performance/passenger-rail-performance/table-3114-public-performance-measure-by-operator-and-sector-periodic/

Network Rail Performance Data

2.59 Network Rail provided detail data on individual delays and cancellations that can be used to understand the distribution and causes of performance issues on services in the East Midlands[9].

2.60 The services that run on the East Midlands network have been grouped by operators and the type of service. The table below shows the number of delays by each group of services for the data covering rail periods between 2023/24 Period 1 and 2023/24 Period 8[10], a period of just over 28 weeks, or 197 days.[11]

Table 2.13: Number of delays by service operator and group

Operator/service	Number of delay incidents
EMR Intercity (includes Norwich – Liverpool services and MML services)	61,912
East Midlands regional services	29,727
Northern Nottingham – Leeds	5,848
Other (Chiltern and Great Western)	27,173
ECML	59,953
CrossCountry	27,860
West Midlands Trains	35,982

2.61 Whilst the absolute number of delay incidents is an interesting and important metric, it is more useful when compared against the number of services that run, as a service that runs more frequently is more likely be included in the Network Rail data of delay incidents.

2.62 For EMR regional, EMR intercity, Northern Nottingham – Leeds, and CrossCountry services the table below shows the number of delay incidents divided by the number of services that run on a weekly basis[12].

[9] The data is available via Network Rail's publicly available **Open Data Feeds**.

[10] This data excludes 2023/23 Period 5, for which the data published by Network Rail is supplied in a different format to the other periods and so has been excluded from this analysis.

[11] It is important to note that this period included a relatively high number of extreme weather events in the UK and the East Midlands specifically. The winter period of late-2023 and early 2024 sae the highest number of 'named storms' than any other period on record.

[12] Calculated using the December 2023 timetables in MOIRA by summing the number of services coded with the corresponding service code in the timetable.

Table 2.14: Delays per services by service code

MOIRA Code	Service Description	Services per week	Delays/ services
EM2690	Liverpool - Nottingham - Norwich	269	3.0
XC2680	Birmingham New St - Leicester - Cambridge - Stansted Airport	256	1.4
EM1500	London St Pancras - Derby - Sheffield (Fast)	201	1.3
EM1520	London St Pancras - Derby - Sheffield (Semi-Fast)	301	1.2
EM1530	London St Pancras - Nottingham (Fast)	206	1.2
XC3330	Cardiff Central - Birmingham - Nottingham	418	1.2
EM1540	London St Pancras - Nottingham (Semi-Fast)	240	1.1
NT8650	Nottingham - Sheffield - Leeds	250	0.8
EM8320	Nottingham - Grantham - Skegness	248	0.8
EM3200	Derby - Stoke - Crewe	171	0.7
XC2600	Birmingham New St - Leicester (Local Services)	239	0.6
EM8360	Lincoln - Grimsby - Cleethorpes	102	0.6
EM1560	London St Pancras - Kettering/Corby	518	0.5
EM3250	Nottingham - Mansfield - Worksop	264	0.5
EM2770	Nottingham - Newark - Lincoln	433	0.5
EM8120	Peterborough - Spalding - Lincoln - Doncaster	152	0.5
EM2750	Derby - Nottingham (stopping)	246	0.4
EM3210	Leicester - Nottingham (Local)	198	0.4
EM3230	Derby - Matlock	218	0.4

2.63 This analysis shows that the inter-urban longer distance services, primarily the EMR Liverpool – Norwich services and CrossCountry Birmingham – Stansted services, are have the highest ratio of delay incidents to the number of services that run. More local services, including EMR's Derby – Nottingham, Leicester – Nottingham, and Dery – Matlock services score better on this metric.

2.64 The evidence does show the potential room for improvement for some of the more regional EMR services, with the Nottingham – Skegness and Derby – Crewe services suffering nearly one delay incident per number of services, compared to those lower scoring services which are closer to one delay incident for every two services.

Locations of delays

2.65 The locations for delays and cancellations varies by the different type of services. For example the top stations for CrossCountry services being delayed included stations in the East Midlands such as Nottingham, Hinckley, and Leicester, but also much further away stations including Cardiff Central and Gloucester. This reflects the longer distance nature of these services, but also the complexity and wide geographic scope of them running punctually.

2.66 The table below shows the number of primary delay incidents on EMR's regional and Northern's Nottingham – Leeds services for the top ten highest locations.

Table 2.15: Number of primary delay incidents on EMR regional and Northern Nottingham – Leeds services by location

Location	Number of primary delay incidents
Nottingham	923
Lincoln	271
Derby	210
Sheffield	194
Sleaford	162
Boston	96
Mansfield Woodhouse	92
Newark Castle	80
Leicester	74
Grantham	71

2.67 It is important to make the distinction between primary and reactionary delays. Primary delays are where the incident that has caused delay (for example a member of train crew being unavailable, or where a section of railway is flooded) is also where the train is delayed. Reactionary delays are those where a train is delayed because of an incident elsewhere.

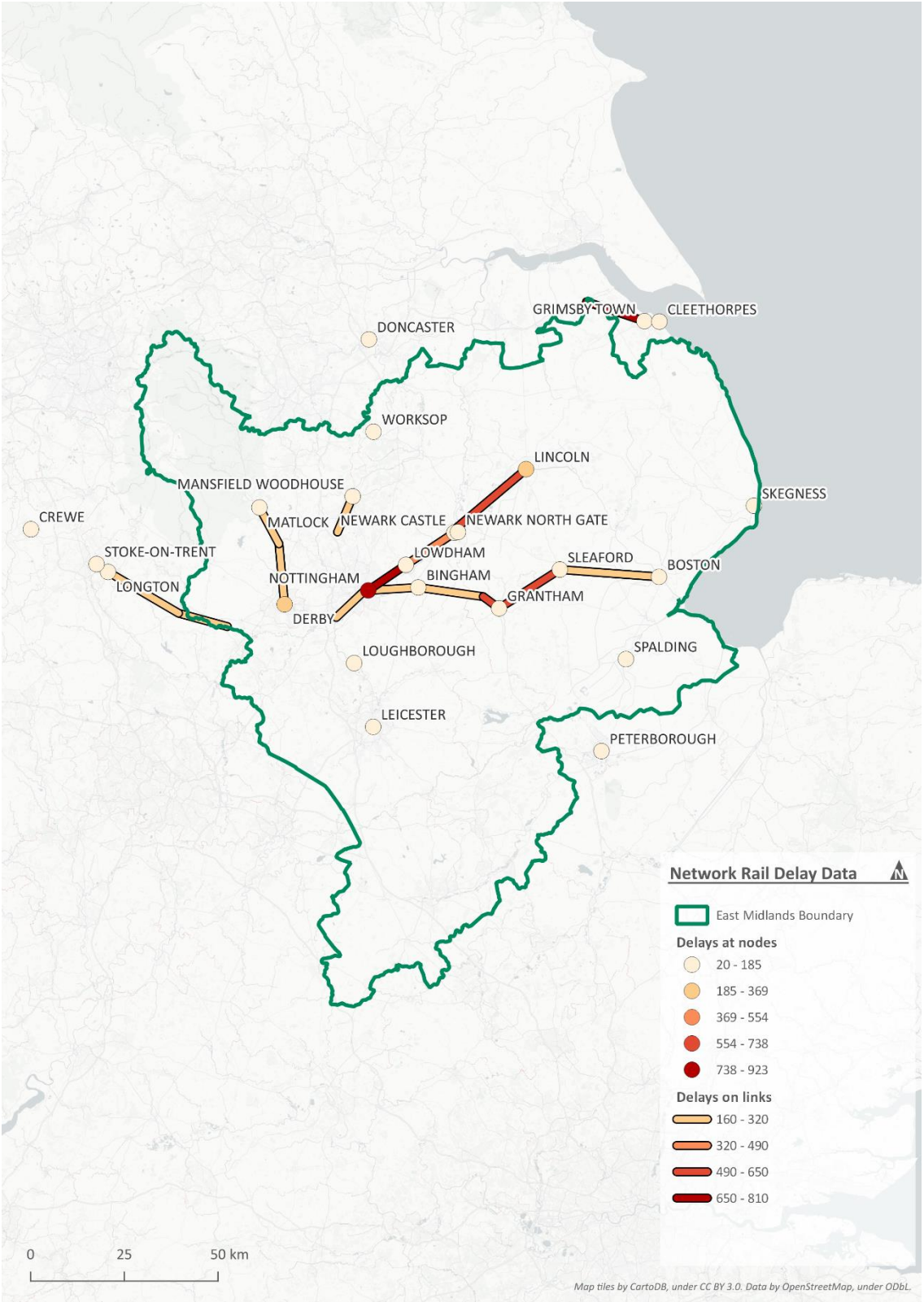
2.68 Focussing on primary delays on local and regional East Midlands Railway services, Figure 2.11 shows the number of primary delays by node (station or junction) and link (a stretch of track between two nodes). The map shows that delays do occur across the network, but across the 28 week period this data covers there are some clear concentrations of delays at certain stations and links. The nodes with the highest number of delays are Nottingham (923 delays), Lincoln (271), Derby (210), Sheffield (194), Sleaford (162), and Boston (96).

2.69 The large number of delays at Nottingham is in part due to it being the region's busiest station, both in terms of passenger usage and number of service that operate. Across all service codes (not just EMR regional services) the five biggest causes of delay at Nottingham are classified as:

1. Delays not investigated by Network Rail – 1,209
2. Driver – 351
3. Technical failures above the solebar – 277
4. Technical failures below the solebar – 267
5. Trespass - 185

2.70 In terms of links where delay occurs the biggest contributors are Grimsby – Brocklesby Junction (810), Nottingham – Lowdham (703), Grantham - Sleaford (570), Lincoln – Newark Crossing East Junction (560), and Grantham – Allington West Junction (537).

Figure 2.11: East Midlands Regional Service Primary Delay Locations[13]



[13] Note this map only shows the links with the highest number of delays (above 160) due to the sheer number of links included in the Network Rail data.

Distribution of primary and reactionary delays

2.71 As discussed previously, the Network Rail data draws a distinction between primary and reactionary delays. On the links where EMR regional services are delayed the data shows a large variation in the proportion of delays that are primary or reactionary. The table below shows the top 20 highest links by number of EMR regional services, ordered by the percentage of delays that are classified as primary.

Table 2.16: Biggest links by EMR regional delays with percentage of primary delays, sorted by share of primary delays

Link description	Number of delays	% of delays classified as primary
Grantham - Allington West Jn	537	99%
Uttoxeter Signal Box - Longton	167	98%
Tutbury & Hatton - Uttoxeter Signal Box	187	95%
Kirkby South Junction - Mansfield Woodhouse	262	95%
Grantham - Sleaford	570	95%
Grimsby Town - Brocklesby Jn.	810	93%
Lowdham - Newark Castle	536	92%
Newark Castle - Lowdham	453	89%
Nottingham - Lowdham	703	86%
Ambergate Jn - Derby	207	66%
Sleaford - Boston	212	64%
Newark Crossing East Jn - Lincoln	277	59%
Lincoln - Newark Crossing East Jn	560	54%
Matlock - Ambergate Jn	250	52%
Derby - Ambergate Jn	202	50%
Allington West Jn - Bingham	171	49%
Boston - Sleaford	192	39%
Lowdham - Nottingham	268	38%
Bingham - Nottingham	188	33%
Mansfield Jn - Trent East Jn	219	31%

2.72 This data shows several interesting results. It shows that there are several parts of the network where a large number of delays occur relative to rest of the network and a large majority of them are primary, i.e. the incident occurs on that same link. Causes and lengths of delay are discussed further in subsequent sections, but by inspecting the data further for some of these links some more important patterns emerge.

2.73 On the Grimsby – Brocklesby Junction the data shows that the large majority (85%) have the reason classified as “"Ops Safety TSR implemented for sighting issues relating to foot crossings, level crossings or signals (Not vegetation caused)". Whilst the number of delays on this link is high, and they appear to have a predominant cause, the data shows that the average delay on this link is 1.5 minutes, a relatively small delay compared to other links on the network, suggesting it wouldn’t be a top priority for addressing performance improvements.

2.74 Instead, the data below shows links (again for East Midlands regional services only) that have at least 50 delay incidents in the data, and their average length of delay as well as their percentage of delays that are primary. Links that score highly on both metrics (the top right of the graph below) could be priority areas for addressing performance issues as the data suggests they consistently have incidents occurring on them which cause relatively long delays.

Figure 2.12: Average length of delay and % of primary delays by link for EMR regional services

2.75 For the links labelled on the graph above, their biggest causes and the percentages of delays they cause are shown below.

Table 2.17: Causes of delay to East Midlands regional services for select links

Link	Biggest cause	% of delays on that link
Tutbury & Hatton-Uttoxeter Signal Box	No Cause Identified After investigation by both Parties	17%
Uttoxeter Signal Box-Longton	No Cause Identified After investigation by both Parties	12%
Longton-Uttoxeter Signal Box	Driver	13%
Lincoln-Holton-Le-Moor S.B.	Severe flooding beyond that which could be mitigated on Network Rail infrastructure	19%
Holton-Le-Moor S.B.-Lincoln	Severe flooding beyond that which could be mitigated on Network Rail infrastructure	26%
Wrawby Jn-Holton-Le-Moor S.B.	Severe flooding beyond that which could be mitigated on Network Rail infrastructure	56%
Nottingham - Lowdham	Driver	17%

2.76 The data shown above shows some common patterns, including flooding being a frequent cause for delay in the Holton-Le-Moor area, but other links (including those in the Uttoxeter area) do not have a dominant infrastructure-related cause of delay.

Length of delays

2.77 The length of delays, as discussed for East Midlands regional services above, is also available in the Network Rail data. The average length of delay is shown below for each of the service codes used previously in Table 2.18.

Table 2.18: Average length of delay by service code

MOIRA Code	Service Description	Average length of delay (minutes)
EM8120	Peterborough - Spalding - Lincoln - Doncaster	6.1
EM3250	Nottingham - Mansfield - Worksop	5.5
EM8320	Nottingham - Grantham - Skegness	5.3
XC2600	Birmingham New St - Leicester (Local Services)	5.2
EM3200	Derby - Stoke - Crewe	5.1
XC2680	Birmingham New St - Leicester -Cambridge - Stansted Airport	5.0
EM2770	Nottingham - Newark - Lincoln	4.9
EM2750	Derby - Nottingham (stopping)	4.9
EM1560	London St Pancras - Kettering/Corby	4.8
EM3230	Derby - Matlock	4.8
EM3210	Leicester - Nottingham (Local)	4.7
NT8650	Nottingham - Sheffield - Leeds	4.6
EM2690	Liverpool - Manchester - Sheffield - Nottingham - Peterborough - Norwich	4.6
XC3330	Cardiff Central - Birmingham - Nottingham	4.5
EM1540	London St Pancras - Nottingham (Semi-Fast)	4.5
EM1530	London St Pancras - Nottingham (Fast)	4.5
EM1520	London St Pancras - Derby - Sheffield (Semi-Fast)	4.5
EM1500	London St Pancras - Derby - Sheffield (Fast)	4.4
EM8360	Lincoln - Grimsby - Cleethorpes	4.0

2.78 From the perspective of regional and local services in the East Midlands the data above is interesting, with the top five service codes by length of delay being local/regional East Midlands-based services (including CrossCountry Birmingham – Leicester stopping services) as opposed to, for example, East Midlands Railway MML services, which are all towards the lower end of the table.

2.79 The data above shows that at a service code level, the average lengths of delay have quite a low level of variation, ranging between four and six minutes. Inspecting the data at a link level shows that there are some links and nodes that are responsible for consistently longer delays than others. For example, the table shows the links that cause the highest average delay for Northern services between Nottingham and Leeds.

Table 2.19: Number and average length of delay for select links on Nottingham – Leeds services

Link name	Number of delays	Average length of delay (minutes)
Sheffield-Chesterfield	29	10.5
Chesterfield-Sheffield	31	11.2
Mansfield Jn-Radford Jn	139	7.6
Trowell Jn-Ironville Jn	77	8.6
Leeds-Whitehall Jn	175	10.0

2.80 Similar examples are seen in terms of delays being caused at specific stations. The table below shows the top five stations by length of delay on CrossCountry Birmingham – Leicester – Cambridge services.

Table 2.20: Number and average length of delay for select stations on Birmingham – Leicester – Cambridge services

Station	Number of delays	Average length of delay (minutes)
Leicester	1,274	10.9
Peterborough	1,018	11.3
Birmingham New Street	3,687	6.6
Cambridge	204	10.3
Nuneaton	199	7.8

Spread of delays

2.81 The rail network in the East Midlands, like in most of the rest of the UK, is a mixture of main line, local/regional, and other routes. They converge at a number of key nodes on the network, and some sections of the network are used by a number of different services. The spread of delays at a node or on a link measures how many different services/operators are delayed at that location, with a lower (or 'thinner') spread figure showing more services are impacted.

2.82 The table below shows the top ten lowest nodes and links with more than 300 delays incidents in the period covered by this analysis. These are the parts of the network where causes of delay impact the widest range of services, and therefore passengers.

Table 2.21: Concentration of delays for ten lowest links and nodes

Location	Number of delays	Spread of delays
Links		
Sheet Stores Jn-Derby	1,894	31%
Mansfield Jn-Trent East Jn	1,775	32%
Derby-Sheet Stores Jn	1,095	35%
Mansfield Jn-Nottingham	1,198	35%
Trent East Jn-Mansfield Jn	2,015	39%
Leicester-Syston South Jn	418	46%
Ironville Jn-Chesterfield	778	47%

Syston South Jn-Leicester	1,000	47%
Trent East Jn-Sheet Stores Jn	548	48%
Ambergate Jn-Derby	753	48%
Nodes		
Nottingham	5,501	32%
Leicester	1,274	34%
Derby	2,062	35%
Grantham	606	36%
Manchester Piccadilly	1,023	37%
Peterborough	1,018	38%
Norwich	510	50%
Crewe	1,659	50%
Newark Castle	1,147	50%
Edinburgh	746	54%

Causes of delay

2.83 The causes of delay and cancellations vary across the different types of services and locations on the network. The tables below show the top 20 causes of delay and their average length, first for all service groups that operate in the East Midlands and then second for East Midlands regional and Northern Nottingham – Leeds services. The table shows that the causes of delay are varied, and often unidentified or not investigated. The reasons vary from staffing issues (primarily train drivers) to physical issues with the track and other infrastructure.

Table 2.22: Biggest causes and average length of delay for all services in the East Midlands

Cause of delay provided by Network Rail	Number of delays	Average length of delay
Delays not Investigated by Network Rail	15,744	1.4
Driver[14]	14,965	4.3
Track defects (other than rail defects) inc. Fish plates, wet beds etc.	11,372	4.2
Trespass (including non-intentional)	10,938	6.4
No Cause ascertainable for a Sub-Threshold Delay causing Threshold Reactionary (where agreed by both parties)	8,299	2.7
Technical failures below the solebar	7,536	5.6
Broken/cracked/twisted/buckled/flawed rail	6,721	3.5
Points failure (including no fault found)	6,395	6.5
Technical failures above the Solebar	5,903	5.6
Condition of Track TSR outside the Timetable Planning Rules	5,842	1.4
Track circuit failure (including no fault found)	5,515	6.0

[14] The Network Rail data uses “Driver” as one of the causes of delay/cancellation incidents. Feedback from East Midlands Railway confirms that this category actually includes more causes than simply driver availability, and this category is used as a ‘catch all’ for a number of different causes of small delays.

Structures - Bridges/tunnels/buildings/retaining walls/sea defences (not bridge strikes)	5,280	4.2
Signaller including mis-routing (not ERTM /ETCS related)	5,222	4.1
Cutting or embankment earthslip, rock fall or subsidence (not the result of severe weather on the day of failure)	5,149	3.8
No Cause Identified After investigation by both Parties	5,026	2.7
Takeback pumps	4,650	1.8
Signal failure (including no fault found)	4,379	5.1
Train Describer/Panel/ARS/SSI/TDM Remote Control failure	4,241	8.0
TSR speed restrictions for track work outside of the Timetable Planning Rules	3,966	1.3
Fatalities or injuries caused by being hit by train (including non-intentional)	3,703	10.7

Table 2.23: Biggest causes and average length of delay for EMR regional and Northern Nottingham – Leeds services

Cause of delay provided by Network Rail	Number of delays	Average length of delay
Driver	2,800	4.3
Takeback pumps	1,729	1.8
Trespass (including non-intentional)	1,539	6.4
Delays not Investigated by Network Rail	1,536	1.4
Condition of Track TSR outside the Timetable Planning Rules	1,347	1.4
Technical failures below the solebar	1,084	5.6
No Cause ascertainable for a Sub-Threshold Delay causing Threshold Reactionary (where agreed by both parties)	946	2.7
Technical failures above the Solebar	886	5.6
Level crossing faults and failure incl. Barrow/foot crossings and crossing treadles	877	5.3
Nz pumps t	867	1.8
Passengers joining/alighting	802	3.5
No Cause Identified After investigation by both Parties	769	2.7
Ops Safety TSR implemented for sighting issues relating to foot crossings, level crossings or signals (Not vegetation caused)	765	1.1
Track circuit failure (including no fault found)	754	6.0
Track defects (other than rail defects) inc. Fish plates, wet beds etc.	709	4.2
Train Describer/Panel/ARS/SSI/TDM Remote Control failure	664	8.0
Signal failure (including no fault found)	659	5.1
Signaller including mis-routing (not ERTM /ETCS related)	640	4.1
Axle counter failure	577	6.3
(Senior) conductor/train manager	565	4.9

2.84 Specifically looking at the biggest infrastructure-related causes in Table 2.22, there are specific links on the network where these issues are particularly prominent. The table below shows the top five links for the top five infrastructure-related causes for all services.

Table 2.24: Top five locations of delay for infrastructure-related causes for all EM services[15]

Location	Number of delays
Track defects	
Leamington Spa-Banbury	1,363
Harrow & Wealdstone-Willesden West Londn Jn	356
Ely North Jn-Thetford	355
Bourne End Jn (Herts)-Watford Junction	319
March-Ely North Jn	185
Technical failure below the solebar	
Neasden South Jn-London Marylebone	91
Gerrards Cross-High Wycombe	90
Holme Jn.-Peterborough	77
Luton-St Albans City	75
Tallington Jn.-Peterborough	72
Broken/cracked/twisted/buckled/flawed rail	
Willesden West Londn Jn-Harrow & Wealdstone	827
Northampton Bay-Rugby	429
Sharnbrook Jn.-Bedford	297
London Euston-Willesden West Londn Jn	225
Earles Sdgs S.B.-Totley Tunnel East	223
Points failure (including no fault found)	
Tring-Bourne End Jn (Herts)	292
Ledburn Jn-Tring	173
Bletchley-Ledburn Jn	128
Willesden West Londn Jn-London Euston	123
Tallington Jn.-Peterborough	81
Technical failures above the solebar	
St Albans City-West Hampstead Thameslink	140
Luton-St Albans City	113
West Hampstead Thameslink-St Albans City	101
West Hampstead Thameslink-St Pancras International	98
Wellingborough-Kettering	86

[15] Note that this analysis covered service codes for any service that passes through, starts, or ends in the East Midlands. Therefore locations including Leamington Spa-Banbury are included here because delays there will impact Chiltern Railway's London – Birmingham services, a small section of which passes through and stops in the East Midlands.

Cost of performance issues in the East Midlands

2.85 The information and analysis presented above has explored the causes, locations, and length of delay in detail, however it is also important to consider the cost and impact of performance issues on the East Midlands network as a whole.

2.86 Using average lateness data published by the ORR[16] and TAG/PDFH guidance on the monetised impact of performance issues and how passengers perceive them when making travel decisions, it is possible to illustrate the impact of performance issues. The average lateness for East Midlands Railway in the latest periodic data is 9.4 minutes and there approximately 7.7 million rail journeys made between stations in the East Midlands in the latest annual data. If that lateness was halved by 4.7 minutes, each of those passengers on average would receive a benefit. This can be monetised using the values of time in TAG, and the results of this analysis are shown below.

Table 2.25: Illustrative example of potential performance benefits for existing passengers

Journey purpose	Annual passengers	Benefit (hours)	VoT (£ per hour)	Total benefit
Commute	2,649,662	0.08	£15.09	£3,132,033
Business	445,397	0.08	£44.25	£1,543,857
Other	4,625,166	0.08	£6.89	£2,496,279
			Total	**£7,172,169**

2.87 As well as the benefit that could be experienced by existing passengers, improving performance would help attract new passengers to travel by rail. The benefits of this, including economic, social, and environmental factors, have been discussed and articulated throughout this technical annex. The PDFH provides elasticities which predict how passengers react to improvements in performance, applying this to the same potential 4.7 minute improvement to passengers in the East Midlands is shown below, with the result showing an additional 617,000 passengers could be attracted to travel by rail per annum.

Table 2.26: Illustrative example of potential performance benefits for existing passengers

Variable/calculation	Result
East Midlands Passengers	7,720,225
New AML/existing EML	4.7/9.4 = 50%
Demand uplift	50%^-0.115 = 1.08
8% more passengers in East Midlands	617,618

Summary of performance analysis

- Performance of services in the East Midlands is lower than the national average, and PPM recently dropped to much below the national average at 70%, although has since recovered to around 80% (shown in Figure 2.10).
- Regional services including Nottingham – Leeds, Nottingham – Skegness, and Derby – Crewe have a relatively high number of delays for the number of services that are operated.

[16] https://dataportal.orr.gov.uk/statistics/performance/passenger-rail-performance/table-3144-average-passenger-lateness-by-operator-and-sector-periodic/

- There are a number of places on the network that have a high number of primary delays that are also relatively long in length. Several of these are in the Uttoxeter and Holton-le-Moor areas.
- Services including Peterborough – Doncaster, Nottingham – Worksop, Nottingham – Skegness, and Derby – Crewe services have a high average length of delay, all above five minutes.
- The causes of delay in the East Midlands are varied and complex, with availability of drivers causing the highest number of delays to regional and local services.
- Performance issues come with a high cost in the East Midlands, both to existing rail passengers but also in terms of the number of passengers who could be attracted to rail were performance to improve.

Interchange analysis

2.88 Across the East Midlands network, interchanging between services is an important part of how rail connects the towns and cities across the region. Figure 2.1 shows the routes in the region and that a number of them converge at key interchange locations, predominantly Nottingham, Leicester and Derby, but also other small interchange locations including Lincoln, Sleaford, and Worksop.

2.89 Figure 2.13 and Figure 2.14 show the annual patronage and number of weekday direct connections between the 30 largest stations in the East Midlands. The data shows some expected results, with stations like Northampton, Glossop and Hadfield having relatively low flows as they are on relatively 'standalone' parts of the network.

2.90 The data also shows that there are some relatively substantial markets between stations that generally require an interchange. For example, Corby – Leicester (17,000 journeys each way), Derby – Skegness (7,800), and Wellingborough – Nottingham (7,400) all have substantial flows without being directly connected throughout the day. This shows that where interchange times can be optimised rail patronage can grow.

2.91 The data also shows that there are some very small rail markets between places that are relatively close, but not connected directly. For example Worksop – Chesterfield, Mansfield – Newark, and Melton Mowbray – Loughborough are all less than 30km away from each other but have fewer than 1,000 rail journeys per annum in one direction. This suggests that on flows like these, potential passengers are deterred from travelling by rail in part because of the need to interchange.

Figure 2.13: Journeys between 30 largest East Midlands stations (one-way patronage)

Annual journeys	Nottingham	Leicester	Derby	Northampton	Lincoln	Chesterfield	Grantham	Kettering	Loughborough	Newark North Gate	Glossop	Newark Castle	Market Harborough	Wellingborough	Long Eaton	Retford	Worksop	Beeston	Skegness	Corby	Buxton	Mansfield	Alfreton	Hadfield	Stamford (Lincs)	Sleaford	Long Buckby	Hinckley (Leics)	East Midlands Parkway	Melton Mowbray
Nottingham																														
Leicester	205,127																													
Derby	99,856	105,500																												
Northampton	1,192	3,850	1,038																											
Lincoln	67,798	14,134	5,503	129																										
Chesterfield	46,506	12,252	52,565	104	1,070																									
Grantham	93,813	2,314	1,899	14	11,494	681																								
Kettering	70,567	85,758	4,850	28	762	988	27																							
Loughborough	83,200	128,009	17,757	211	3,779	2,254	483	6,413																						
Newark North Gate	5,230	719	480	18	65,218	76	17,898	10	39																					
Glossop	19	24	32	31	15	26	0	0	0	4																				
Newark Castle	89,349	2,754	2,810	5	18,549	141	2,224	101	866	3																				
Market Harborough	13,908	68,016	1,814	2	603	419	50	29,772	4,952	5	1	103																		
Wellingborough	7,460	17,832	1,319	11	396	189	69	29,827	898	4	1	48	3,113																	
Long Eaton	55,595	15,580	40,779	46	1,024	3,206	227	421	13,433	53	2	858	342	87																
Retford	2,068	156	331	5	19,138	443	1,819	7	186	2,661	2	414	6	6	11															
Worksop	14,874	91	604	2	10,300	875	104	28	31	305	3	49	11	3	88	23,938														
Beeston	44,455	12,188	13,760	41	3,040	333	499	3,045	9,957	315	1	1,797	717	187	7,747	42	50													
Skegness	40,034	6,570	7,819	77	2,018	1,423	9,285	208	1,683	662	11	26	155	86	975	287	284	564												
Corby	5,534	17,832	1,116	29	61	229	7	17,343	652	12	2	4	2,357	4,019	102	8	6	183	81											
Buxton	96	38	25	14	13	83	5	9	16	3	72	0	1	6	0	4	6	1	11	2										
Mansfield	53,946	2,316	1,086	20	997	39	353	93	751	31	0	662	147	69	198	387	11,320	438	1,635	15	0									
Alfreton	31,145	916	321	10	506	18,204	321	255	213	13	19	79	91	44	90	40	122	351	913	31	16	2								
Hadfield	5	1	17	0	3	5	1	0	2	6	45,621	1	0	0	2	0	0	7	0	2	39	1	3							
Stamford (Lincs)	1,371	14,156	326	22	235	15	682	58	289	81	0	0	118	16	56	6	4	78	39	4	3	4	2	0						
Sleaford	8,050	404	340	5	37,762	45	13,460	5	102	285	0	68	8	16	30	28	18	39	2,634	4	2	30	13	0	48					
Long Buckby	22	225	75	28,585	7	6	1	5	2	0	1	0	0	0	1	0	0	3	0	6	0	0	1	0	2	1				
Hinckley (Leics)	2,658	26,913	730	230	48	43	38	408	1,335	6	0	26	217	40	80	2	14	129	168	37	12	48	2	1	72	4	21			
East Midlands Parkway	8,901	13,749	3,863	25	1,173	381	45	2,276	3,320	83	0	25	559	65	3,543	2	5	4,783	79	135	0	30	2	0	32	8	2	52		
Melton Mowbray	1,974	43,380	1,288	44	78	39	46	255	733	27	4	7	223	125	71	2	0	87	8	188	2	26	17	0	4,274	2	7	215	95	

Figure 2.14: Number of weekday direct connections between 30 largest East Midlands stations

Connections per weekday	Nottingham	Leicester	Derby	Northampton	Lincoln	Chesterfield	Grantham	Kettering	Loughborough	Newark North Gate	Glossop	Newark Castle	Market Harborough	Wellingborough	Long Eaton	Retford	Worksop	Beeston	Skegness	Corby	Buxton	Mansfield	Alfreton	Hadfield	Stamford (Lincs)	Sleaford	Long Buckby	Hinckley (Leics)	East Midlands Parkway	Melton Mowbray
Nottingham																														
Leicester	50																													
Derby	55	36																												
Northampton	0	0	0																											
Lincoln	16	12	0	0																										
Chesterfield	35	33	48	0	0																									
Grantham	31	0	0	0	6	13																								
Kettering	35	37	2	0	1	0	0																							
Loughborough	35	54	20	0	12	19	0	19																						
Newark North Gate	1	0	0	0	11	0	18	0	0																					
Glossop	0	0	0	0	0	0	0	0	0	0																				
Newark Castle	28	12	12	0	16	0	0	2	10	0																				
Market Harborough	34	34	0	0	1	0	0	36	19	0	0	1																		
Wellingborough	1	4	3	0	0	1	0	39	2	0	0	0	1																	
Long Eaton	43	21	60	0	0	19	0	3	20	0	0	10	2	0																
Retford	1	0	0	0	16	1	17	0	0	8	0	0	0	0	0															
Worksop	20	0	0	0	16	1	0	0	0	0	0	0	0	0	0	22														
Beeston	77	32	40	0	12	0	0	18	29	0	0	22	18	1	39	0	0													
Skegness	15	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0												
Corby	0	0	0	0	0	0	0	36	0	0	0	0	0	34	0	0	0	0	0											
Buxton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										
Mansfield	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0									
Alfreton	33	0	0	0	0	32	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
Hadfield	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0							
Stamford (Lincs)	1	17	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0						
Sleaford	16	0	0	0	13	0	15	0	0	2	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0					
Long Buckby	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Hinckley (Leics)	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0			
East Midlands Parkway	38	55	20	0	12	19	0	23	50	0	0	12	21	1	20	0	0	34	0	0	0	0	0	0	1	0	0	0		
Melton Mowbray	1	17	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	18	0	0	2	1	

2.92 The generally limited service frequencies as discussed earlier in this chapter have a major impact on interchange times between services in the East Midlands. At the extreme interchanging on to a service that operates once per hour could mean waiting at a station for up to 60 minutes between trains. In most cases this will make the end-to-end rail journey time extremely uncompetitive with driving journey times, or passengers may not travel at all.

2.93 There are some specific examples of long interchange times in the East Midlands, including:

- Interchanging between Lincoln – Peterborough and Nottingham – Skegness services at Sleaford can have a lengthy wait, depending on the precise arrival times (which vary throughout the day)
- Arriving at Nottingham on Worksop services there can be a long wait for services in the direction of Lincoln (approximately 45 minutes), and the interchange time on to Norwich – Liverpool and Nottingham – Skegness service is long (up to 60 minutes)
- Arriving at Nottingham on services from Lincoln, there can we long wait for MML 'semi-fast' services heading south (up to 45 minutes).

2.94 In terms of specific flows, the table below shows the 13 intra-East Midlands flows with at least 5,000 annual journeys that require an interchange. It also shows the average interchange time departing at the first available opportunity after 14:00 on a standard weekday.

Table 2.27: Interchange times for major intra-regional flows

Flow	Annual journeys (000s)	First train arrives	Second train departs	Gap
Corby - Leicester	20	14:14	14:22	00:08
Derby - Skegness	12	14:36	14:46	00:10
Narborough - Nottingham	11	14:51	15:17	00:26
Leicester - Skegness	11	15:07	15:45	00:38
Lincoln - Derby	8	15:26	15:41	00:15
Derby - Lincoln	8	15:18	15:34	00:16
Hinckley - Nottingham	8	14:51	15:17	00:26
Lincoln - Boston	7	15:03	15:54	00:51
Leicester - Corby	7	14:35	14:46	00:11
Belper - Leicester	7	14:48	15:09	00:21
Kettering - Derby	6	14:46	15:06	00:20
Oakham - Nottingham	5	14:49	15:17	00:28
Market Harborough - Derby	5	14:17	14:37	00:20

2.95 This shows the long interchange times faced by passengers on journeys between some of the major towns and cities in the East Midlands. The interchange time of around 40 minutes at Nottingham to travel between Leicester and Skegness, the 50 minutes at Sleaford (Lincoln – Boston), and 30 minutes at Leicester (Oakham – Nottingham) stand out as particularly long interchanges.

New stations assessment

2.96 This section covers an initial assessment of the case for a number of new stations across the East Midlands. A high-level analysis of potential new stations that have been identified by Steer and TfEM officers has been undertaken using a combination of GIS and model data.

2.97 At this stage the analysis is not based on detailed costings or engineering assessment but on an initial assessment of the potential demand and mode shift that could be achieved by each of the proposed new stations. The list of potential stations has been sourced through multiple channels, and include stations that are part of a number Restoring Your Railways (RYR) Fund bids. The full list of new stations included in the assessment is:

- Ashby-de-la-Zouch
- Brackley
- Breadsall
- Castle Donington
- Castle Gresley
- Clay Cross
- Coalville
- Desborough
- Donington
- Drakelow
- Earl Shilton
- East Hunsbury
- Eckington
- Edwinstowe
- Ellistown
- Irchester
- Kibworth
- Killamarsh
- Leicester South
- Lenton
- Louth
- Meynell's Gorse
- Moira
- Ollerton
- Pinxton
- Southwell
- Staveley
- Stenson Fields
- Toton
- Towcester
- Washingborough
- Weedon Bec
- Whittington
- Wollaton

East Midlands Airport Station

2.98 The list above includes a proposed new station at Castle Donington, approximately three kilometres away from East Midlands Airport. Potential options for a new rail connection have

been assessed by Nottingham City Council as a part of their East Midlands Gateway Study. The option investigated in the study involved a new spur with the Midland Main Line near Kingston on Soar, a new station at the airport, and a further new route between the Airport and Derby via the South Derby growth Zone. The new rail links and station were included in a wider package of interventions shown to generate significant transport benefits. An assessment of a new connection and station has not been duplicated as a part of this study.

Methodology

2.99 The methodology followed to produce the assessments is summarised in Figure 2.15.

Figure 2.15: New stations assessment methodology summary

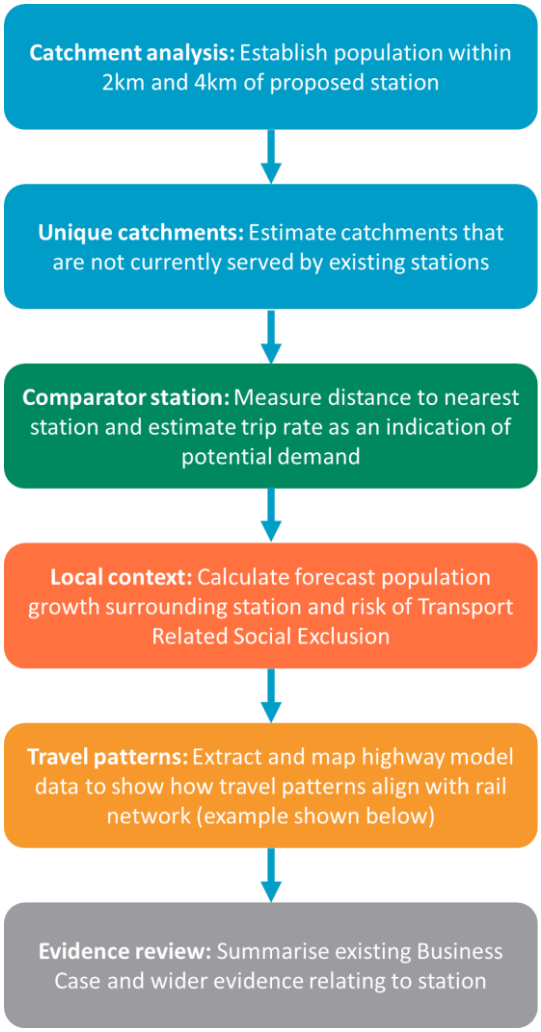
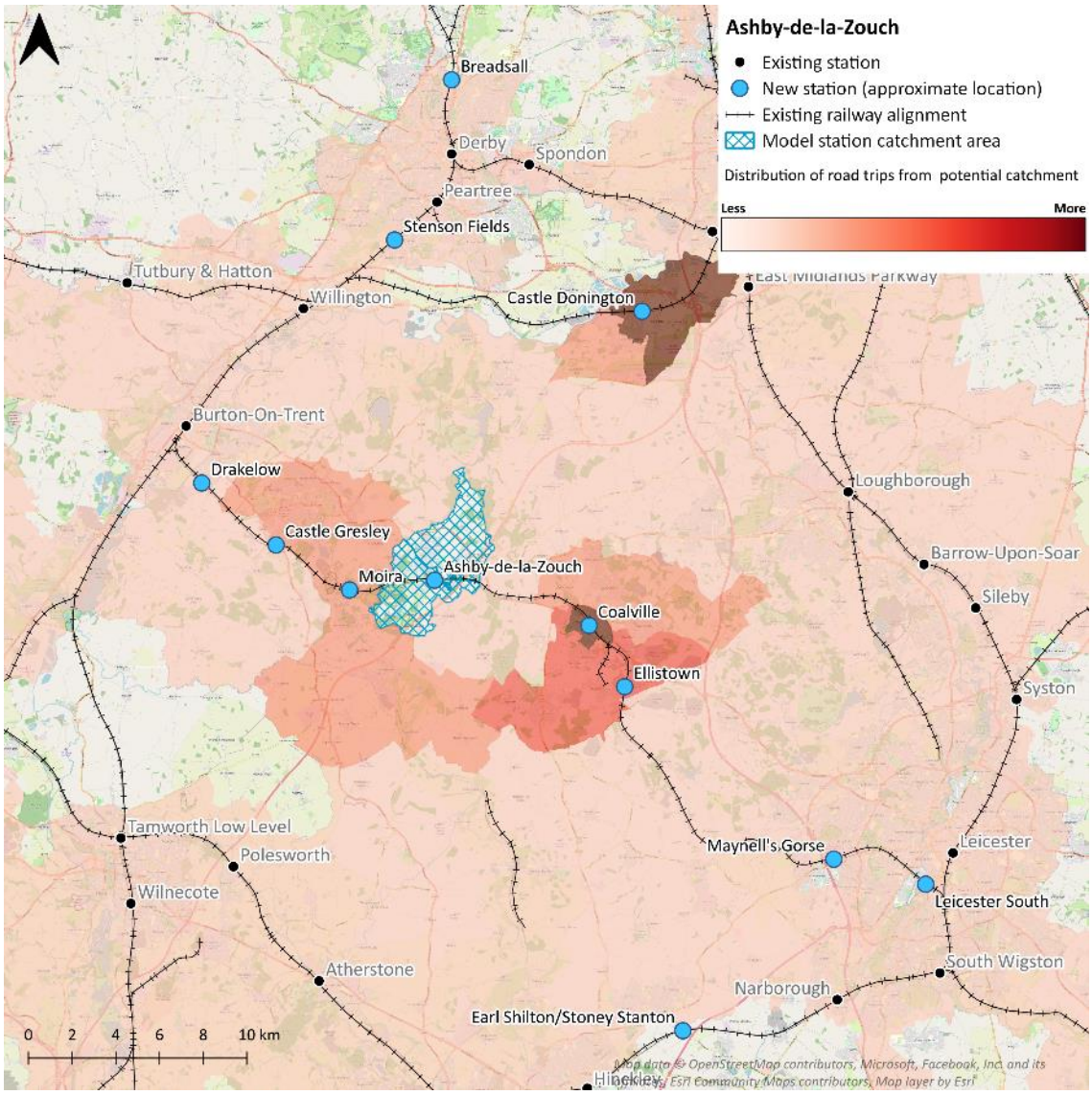


Figure 2.16: Example of new station existing trips mapping



Other considerations

2.100 As well as the quantitative analysis and mapping described above, any relevant existing evidence or key considerations regarding the potential station, the services that would call at it, and the alignment it would be on, have been included.

Conclusions

2.101 The headline conclusions for each of the proposed new station sites is summarised in Table 2.28.

Table 2.28: Headline conclusions from new stations assessment

Station	Headline conclusion
Eckington	Barrow Hill line stations all have high potential for modal shift and relatively large and unique 2km population catchments. RYR bid is progressing past SOBC stage.
Killamarsh	
Staveley	
Whittington	
Ashby-de-la-Zouch	Ivanhoe Line potential stations have a consistent pattern of travel to other places on the line, suggesting high potential for modal shift. Catchments are relatively unique and not currently served by existing stations. Meynell's Gorse, Coalville, Leicester South, Drakelow, Ashby, and Castle Gresley in particular have large immediate catchments. Ivanhoe Line reopening was included in Network North Announcement.
Castle Gresley	
Coalville	
Drakelow	
Ellistown	
Leicester South	
Meynell's Gorse	
Moira	
Pinxton	Pinxton has a relatively large 2km population catchment and travel patterns that in-part could be catered for by a new rail service. Maid Marian Line RYR bid is not progressing to delivery.
Edwinstowe	Both Robin Hood Line extension stations have relatively high risk of TRSE in their catchment areas and both have 2km and 4km catchments that are not already served by the rail network, suggesting good potential for mode shift. The Robin Hood Line extension was included in the IRP.
Ollerton	
Brackley	Both stations are on part of the Northern Arc as proposed by England's Economic Heartland. The existing road trip analysis shows that some existing trips (predominantly to Banbury and towards Northampton) could be served by rail.
Towcester	
Breadsall	Breadsall has a large 2km catchment (seventh largest of all new station sites) and the biggest destination for existing road trips is Derby, suggesting high potential for modal shift.
Castle Donington	Relationship with wider connectivity of East Midlands Airport is key for the potential Castle Donington station. The existing trip data from Castle Donington itself shows the most trips are to towns on the proposed Ivanhoe Line route, which would not obviously be directly connected to a new station at Castle Donington.
Clay Cross	Plans for new station have progressed to SOBC production. Analysis included in this assessment shows that existing travel patterns are well-suited to the rail network (mainly to Chesterfield and beyond to West Yorkshire). 2km population catchment is around average of the station sites included. The town itself is on top of a MML tunnel so exact connectivity between town and new station will be an important consideration.
Desborough	Population catchment is relatively low compared to other sites considered. Existing trips are mainly to nearby Market Harborough (suitable for abstraction by any new rail service). Also high level of trips to areas not served by rail and Corby (which would require interchange based on existing services.
Donington	Population in immediate catchment is extremely low relative to other sites and trip rates of surrounding existing stations are low. Some trips to

	Spalding that could be suitable for rail but rural surroundings will make competitive journey times competitive. Case could be helped by nearby road connections which feature in Lincolnshire Country Council proposals for the station.
Earl Shilton	Relatively low 2km catchment and 25% of wider catchment overlaps with existing stations. Existing road trips are focussed on Hinkley which could be suitable for rail.
East Hunsbury	2km catchment is large, but partially overlaps with Northampton's catchment. Trips are focussed on Northampton but also to the area immediately to the east which is not served by rail, and also to the north east areas of Northampton.
Irchester	2km catchment is around average compared to other new station sites. Trips are focussed on Wellingborough which is very close. Also a high number of trips to wider area west and north of Wellingborough which would not be possible by rail.
Kibworth	Relatively small 2km and 4km catchments, none of which is served by rail currently. High number of trips to Market Harborough which would be served by rail. Also a high number of trips to wider surrounding area which would not be served by rail. Low level of trips to central Leicester which otherwise would have been a possible attractor rail trips.
Lenton	Very high 2km population catchment, approximately half of which is served by existing stations. High number of short-distance trips to central Nottingham, Beeston and other parts of the city which could be suitable for abstraction to rail.
Wollaton	Similar to Lenton, although none of large 2km catchment is served by existing rail stations. Large number of trips to central Nottingham, Beeston, and rest of the city. Station would require reopening of Trowell curve to passenger services which has been considered as a part of previous HS2-related studies.
Louth	Existing trip data shows that by far the biggest destination of road trips is Cleethorpes/Grimsby. Mablethrope and Firsby RYR bid would include a Louth station that is connected to the south (Skegness/Boston) rather than the north. Previous work has shown reinstating the previous through station is challenging.
Southwell	Relatively small 2km and 4km catchment. Large number of trips to Newark which could be served by rail, but also large number of trips to the south east of Southwell (Calverton/Oxton area), which would not be served by rail. It is challenging to see how the station would fit with the existing Nottingham – Newark alignment.
Stenson Fields	Already a large 2km catchment and high number of trips to Derby which would be well-suited to rail abstraction, plus the area is a priority growth site for Derby.
Toton	Toton was previously central to HS2 plans which were being developed alongside local growth ambitions. Those growth ambitions remain, and trips to Long Eaton/Beeston/Lenton could be suitable for abstraction to a conventional rail station.
Washingborough	Relatively small 2km and the wider 4km catchment is largely served by Lincoln station already. High number of trips into central Lincoln which could be served well by rail.

Weedon Bec	Small population in 2km and 4km catchments, although station is being considered as a parkway-style station to serve Daventry and M1 corridor more generally.

Recommendations for next steps on new stations

2.102 Other than the stations that are part of RYR schemes, and the two stations included in England's Economic Heartlands Northern Arc proposals, the stations below are the recommended priorities for any further development/exploration of new stations in the region:

2.103 Of the stations assessed, the routes which have been subject to RYR bids appear to have strong cases for further exploration and development. They have the advantage of the investment costs in (re)opening alignments effectively being 'shared' across a number of new stations, as opposed to proposed stations like Louth and Southwell which would require a new alignment as well as a new station.

2.104 Potential new stations at Toton, Lenton, and Wollaton also all appear to have a reasonable initial case for further exploration. This is due to their proximity to Nottingham and Derby, densely populated catchments, and existing travel patterns that would appear to suit rail. These stations were previously part of and related to work on HS2, with the reinstatement of the Trowell curve a key part of plans in the Nottingham area. The new stations are unlikely to justify investment in the curve on their own, plus facilitating new services and station calls alongside existing capacity constraints at Trent Junction and Nottingham is a key issue for these sites.

2.105 Of the rest of the sites assessed, a new station in the Stenson Fields area would appear to have a strong case, in large part of its potential support of major planned development in that part of the city. One challenge with that site will be Peartree station, which is approximately three kilometres closer to Derby, and is only served by a limited service in the morning and evening peak. It also has extremely low usage, with just over 4,000 entries/exits in the most recent ORR station usage statistics. How a new station would sit alongside an already underserved and underused question would be a key challenge for Stenson Fields.

Prioritisation analysis

Developing prioritisation tool

2.106 As a part of producing this chapter of the technical annex a 'prioritisation tool' has been developed. This tool allows simple tests of improvements to intra-East Midlands rail services (measured as generalised journey times (GJT)), and allow the user to see on which flows the biggest demand response would be expected, as well as which urban areas in the region are most likely to benefit from agglomeration/wider economic benefits.

2.107 There are three elements of the tool:

- GJT calculator – allows tests of improving journey times, service frequencies, and number of interchanges required. This is a simplified version of the calculations that would typically be done in MOIRA as a part of testing entire timetables. The outputs of the tool are the change in demand (both in absolute and percentage terms) by origin-destination. The tool also identifies on which flows the test that has been specified results in a GJT

change that is too large for the traditional elasticity-based approach to be used in forecasting demand[17].

- Benchmarking tool – this part of the tool allows the user to select an origin – destination in the East Midlands and the tool will return a list of similar flows elsewhere in the UK. The idea of this tool is it can show how levels of service and patronage in the East Midlands compare with national benchmarks, and show the approximate level of patronage that can be generated, in part, through a specific service level. The definition of similar is decided by the user, with the three criteria being:
    - Distance between stations
    - The population within 1km of each station
    - DfT station categories[18]
- Agglomeration/gravity calculation – this final part of the tool follows TAG Unit A2-3 guidance to estimate the potential wider economic benefits/agglomeration impacts of improving rail connectivity in the East Midlands. The theory behind this analysis is that improving connectivity between two urban areas increases their 'effective densities' (or the concentration of economic activity in a specific areas). Increasing effective density increases economic productivity, which combined with base levels of jobs and productivity can be used to estimate an overall change in economic output for each Local Authority District in the region.

2.108 The sections below present some example results from the prioritisation tool.

Improving journey times

2.109 The first test that has been run is a uniform 10% reduction in in-vehicle times for all East Midlands flows included in the analysis. The in-vehicle time is one part of GJT, and represents the time spent on board the train(s) travelling from the origin to the destination. In terms of the biggest beneficiaries of this test, unsurprisingly the biggest changes in demand are seen on some of the biggest existing flows, many of which are to/from Nottingham. The table below shows the biggest changes in percentage terms.

Table 2.29: Absolute change in demand for 10% reduction in in-vehicle times, top ten biggest flows

Origin-destination	Existing demand	Demand growth	Percentage growth
Leicester-Nottingham	348,812	26,719	7.7%
Nottingham-Leicester	320,489	22,455	7.0%
Newark-Nottingham	241,594	16,086	6.7%
Grantham-Nottingham	174,975	13,894	7.9%
Lincoln-Nottingham	139,046	12,135	8.7%
Derby-Nottingham	167,726	11,011	6.6%

[17] The Passenger Demand Forecasting Handbook (PDFH) says that for changes in GJT greater than 30% the journey time elasticities may not be the appropriate modelling framework to forecast changes in demand. This is particularly relevant for a large portion of rail journeys in the East Midlands where existing services are often indirect and/or limited in terms of service frequencies.

[18] The DfT/Network Rail have categorised every rail station in Great Britain into one of six categories from A to F depending on the stations size and usage. For example, Nottingham is a category B or "regional interchange" station, Grantham is a category C "important feeder" station, and Swinderby is a category F2 "small unstaffed" station.

Derby-Leicester	144,065	9,741	6.8%
Newark-Lincoln	151,662	9,718	6.4%
Loughborough-Leicester	227,170	9,632	4.2%
Nottingham-Derby	130,693	9,096	7.0%

Table 2.30: Percentage change in demand for 10% reduction in in-vehicle times, top ten biggest flows

Origin-destination	Existing demand	Demand growth	Percentage growth
Nottingham-Skegness	63,636	6,831	10.7%
Skegness-Nottingham	23,009	2,428	10.6%
Lincoln-Leicester	15,299	1,555	10.2%
Leicester-Lincoln	13,639	1,363	10.0%
Boston-Nottingham	26,656	2,651	9.9%
Nottingham-Boston	13,267	1,315	9.9%
Grantham-Skegness	9,676	944	9.8%
Loughborough-Lincoln	5,581	542	9.7%
Skegness-Grantham	4,013	387	9.6%
Lincoln-Loughborough	4,221	406	9.6%

2.110 Using the benchmarking tools for some of the flows shown above, it is possible to see which flows the revised journey times would be similar to. For example, prior to the hypothetical journey time improvement Derby – Nottingham is midranking amongst similar flows nationally by number of journeys. It carries substantially fewer journeys (approximately 170,000) compared to much bigger flows such as Huddersfield – Leeds (650,000) and Didcot – Reading (360,000). Both the examples here have a much lower GJT than Nottingham – Derby (33 and 30 minutes, respectively compared to 46 minutes). Reducing in-vehicle times by 10% would bring Nottingham – Derby closer to similar flows such as these.

2.111 The tool also allows comparison of rail and car journey times, before and after any improvement to the rail service is applied. The table below shows the flows for which the ratio of rail to car journey time changes the most when a more ambitious 25% reduction in rail journey times is applied.

2.112 Worksop to both Nottingham and Mansfield is shown as a possible priority in the results below, with these being flows only served by one train every hour. Reducing the journey time on that train would help bridge the gap between car and rail journey times. Otherwise, the results below focus on cross-regional flows between Lincolnshire and the rest of the region, which currently often have slow rail journey times relative to car.

Table 2.31: Ten biggest reductions in rail/car journey time[19]

Flow	Journeys	Rail GJT/average car journey time	
		Before test	After test
Worksop-Nottingham	32,101	1.4	1.1

[19] This table shows the rail generalised journey time divided by the car journey time, before and after the journey time reduction is applied. The higher the number, the slower the rail journey is relative to car. Only flows with existing patronage of over 10,000 are shown for this example.

Boston-Nottingham	26,656	1.3	1.1
Boston-Skegness	26,212	1.6	1.4
Syston-Nottingham	21,187	1.8	1.5
Worksop-Mansfield	21,114	1.8	1.5
Wainfleet-Skegness	18,076	3.4	3.1
Sleaford-Nottingham	16,666	1.3	1.1
Lincoln-Leicester	15,299	1.5	1.2
Nottingham-Matlock	15,125	1.6	1.3
Boston-Lincoln	15,027	2.0	1.7

Improving service frequencies and removing interchange

2.113 The tool also allows the test to include improving service frequencies and removing the requirement to interchange between trains. The first test run has been to add one additional train per hour to every flow that is included in the analysis. The tables below shows the flows that experience the biggest absolute and percentage increase in demand, alongside their base demand and trains per hour.

Table 2.32: Absolute change in demand for additional train per hour test, top ten biggest flows

Flow	Existing demand	Demand growth	Percentage growth	Base tph[20]
Nottingham-Leicester	320,489	35,633	11.1%	1.9
Leicester-Nottingham	348,812	35,217	10.1%	1.7
Loughborough-Leicester	227,170	33,263	14.6%	2.4
Newark-Nottingham	241,594	22,908	9.5%	1.8
Long Eaton-Nottingham	164,525	19,861	12.1%	2.4
Melton Mowbray-Leicester	109,569	19,540	17.8%	1.0
Market Harborough-Leicester	141,929	19,525	13.8%	1.8
Leicester-Loughborough	117,925	19,498	16.5%	1.9
Derby-Leicester	144,065	17,178	11.9%	1.8
Market Rasen-Lincoln	32,629	16,759	51.4%	0.4

[20] This base train per hour figure is sourced from the DfT's RUDD dataset which reports an average gap between services across the full day timetable, which when converted into trains per hour will often not produce a whole number.

Table 2.33: Percentage change in demand for additional train per hour test, top ten biggest flows

Flow	Existing demand	Demand growth	Percentage growth	Base tph[21]
Lincoln-Market Rasen	10,988	6,231	56.7%	0.4
Market Rasen-Lincoln	32,629	16,759	51.4%	0.4
Lincoln-Spalding	3,288	1,290	39.2%	0.2
Spalding-Lincoln	9,055	2,746	30.3%	0.4
Ruskington-Sleaford	16,421	4,494	27.4%	0.8
Bottesford-Nottingham	29,429	7,908	26.9%	0.6
Heckington-Sleaford	18,320	4,906	26.8%	0.9
Aslockton-Nottingham	15,668	4,153	26.5%	0.7
Grantham-Newark	17,072	4,434	26.0%	0.8
Kettering-Corby	10,999	2,735	24.9%	0.9

2.114 By this measure the biggest beneficiaries are not always the biggest existing flows, and as shown above the four biggest beneficiaries are all reasonable sized flows to/from Lincoln, suggesting that addressing service frequencies in that part of the region could be a possible priority for future improvements.

2.115 Again, referring to the benchmarking part of the tool, and the Market Rasen – Lincoln flow specifically, it shows stark differences in the level of service on that flow compared to similar flows nationally. The table below shows the patronage and average gap between services for similar flows, which are all flows from relatively small DfT category F' stations to local/regional centre DfT category C stations. Market Rasen – Lincoln is one of a number of flows that suffers from big gaps between services on the Grimsby – Leicester services currently.

Table 2.34: Market Rasen – Lincoln compared to similar flows using benchmarking tool

Flow	Base gap between services (minutes)	Base number of journeys
Leominster-Hereford	55	131,873
Lydney-Gloucester	56	62,312
Welshpool-Shrewsbury	82	55,045
Treherbert-Pontypridd	34	55,023

[21] This base train per hour figure is sourced from the DfT's RUDD dataset which reports an average gap between services across the full day timetable, which when converted into trains per hour will often not produce a whole number.

Nailsea & Backwell-Bath Spa	38	52,128
Wem-Shrewsbury	92	51,118
Pembrey & Burry Port-Swansea	41	45,522
Steeton & Silsden-Bradford	30	40,500
Ruskington-Lincoln	63	38,046
Frodsham-Chester	60	34,371
Market Rasen-Lincoln	**137**	**32,629**
Ruabon-Chester	64	24,036
Whitchurch (Salop)-Shrewsbury	85	22,994
Cam & Dursley-Gloucester	71	22,063
Craven Arms-Shrewsbury	48	21,089

2.116 A further test has been run to show the impact of removing an interchange where one is currently required. The table below shows the 12 major East Midlands flows where an interchange is required to travel on rail between two places that are less than 40km apart, and the impact that the test has on demand on those flows. The results here show that generally, the potential demand response from removing interchange is smaller than that of the other journey time and service frequency tests described above.

Table 2.35: Change in demand on flows as a result of removing need to interchange

Flow	Existing demand	Additional demand from removing interchange	Percentage change
Corby-Leicester	19,736	6,387	32.4%
Boston-Lincoln	15,027	3,566	23.7%
Narborough-Nottingham	11,327	2,431	21.5%
Lincoln-Boston	7,228	1,685	23.3%
Leicester-Corby	7,088	1,803	25.4%
Belper-Leicester	6,771	1,438	21.2%
Grantham-Lincoln	5,788	1,217	21.0%
Grantham-Derby	4,170	926	22.2%
Lincoln-Grantham	3,973	883	22.2%
Alfreton-Leicester	3,429	750	21.9%
Retford-Nottingham	2,454	508	20.7%
Hinckley-Melton Mowbray	322	66	20.5%

Estimating agglomeration impacts

2.117 The final part of the tool provides a high-level estimation of the potential agglomeration benefits of improving rail connectivity in the East Midlands. The tool follows TAG guidance on calculating effective densities and applying the change in it to different sectors. As per TAG guidance the tool works at a Local Authority District level and for the purpose of this analysis the largest station (by usage) in each district has been taken as the representative station.

2.118 The methodology prescribed in the guidance means that places with the following characteristics are most likely to benefit from agglomeration benefits:

- Places that are closer to each other
- Places with more employment (across all industries)
- Places with employment in sectors that are most sensitive to improvement connectivity, with the list ordered in descending order of agglomeration sensitivity:
  - Producer services
  - Construction
  - Consumer services
  - Manufacturing

2.119 For the purposes of this analysis a test has been run in which rail GJTs have been reduced by 5%, and the results in terms of annual GVA increases for each district/station are shown below.

Table 2.36: Annual agglomeration benefits for 5% reduction in rail generalised journey times

LAD	Station	Annual agglomeration benefits (£m)
Nottingham	Nottingham	25.8
Leicester	Leicester	20.5
Northampton	Northampton	16.6
Derby	Derby	15.4
Charnwood	Loughborough	9.4
Amber Valley	Alfreton	6.9
Chesterfield	Chesterfield	6.8
Blaby	Narborough	6.6
Harborough	Market Harborough	6.5
South Kesteven	Grantham	6.1
Hinckley and Bosworth	Hinckley	5.9
Newark and Sherwood	Newark stations	5.7
Rushcliffe	East Midlands Parkway	5.6
Bassetlaw	Retford	5.6
Daventry	Long Buckby	5.4
Lincoln	Lincoln	5.3
East Lindsey	Skegness	5.2
Wellingborough	Wellingborough	5.0
Kettering	Kettering	5.0
Broxtowe	Beeston	5.0
North Kesteven	Sleaford	4.7
Ashfield	Sutton Parkway	4.7
Erewash	Long Eaton	4.4
South Derbyshire	Tutbury & Hatton	4.2
Mansfield	Mansfield	3.9
Derbyshire Dales	Matlock	3.7
Corby	Corby	3.7
North East Derbyshire	Dronfield	3.6

Boston	Boston	3.5
West Lindsey	Gainsborough stations	3.3
Melton	Melton Mowbray	2.6
Gedling	Carlton	1.9
Rutland	Oakham	1.9
Oadby and Wigston	South Wigston	1.4

2.120 The estimation of wider economic benefits is one of the more uncertain estimates of transport appraisal, and as such the results above are more useful in interpreting the relative benefits for each geography, rather than for estimating an absolute value of economic output. Unsurprisingly they show that the biggest, both in terms of population and economic activity, cities of the region stand to benefit the most from improvements in rail connectivity by this measure.

2.121 The results above do not consider the feasibility of improving rail connectivity from each geography, which is an important consideration for Northampton for example. Whilst it is an important economic centre the feasibility of improving rail connectivity from it to the rest of the places in the East Midlands listed above is limited, due to its position on the rail network.

Overview of the regional rail network in the East Midlands

2.122 The analysis of various aspects of the East Midlands rail network presented above shows some stark findings:

The network is sparse

2.123 The region has the smallest proportion of its population who can access a station within 5 mins drive in all of England. For the most part the difference to other regions is also very large.

The network offers a poor level of service to communities

2.124 Around 75% of stations in the region are served by just one train per hour or fewer.

The network is unreliable

2.125 All of the main train operating companies serving the East Midlands all have lower levels of reliability than the national average.

The network is poorly used

2.126 The region has the lowest rail usage per head of population in England.

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