Lincolnshire
COUNTY COUNCIL
Working for a better future

Lincolnshire Rail Infrastructure Strategy

Strategy Overview

This work assesses rail infrastructure across the Lincolnshire with the aim to identify capacity constraints and potential locations for rail infrastructure enhancements to enable an uplift in rail service frequency both for passengers and freight.

The Lincolnshire Rail Infrastructure Study (LRIS) is closely aligned to the Passenger Rail Strategy and sits alongside similar strategies for cycling, walking, freight and bus to inform LTP 5.5

The LRIS recommendations have been developed with reference to the six emerging LTP themes including:

- Economic growth;
- Greening of transport and climate change;
- Creating a thriving environment;
- Supporting safety, security and a healthy lifestyle;
- Promoting high aspirations; and,
- Quality of life.

Lincolnshire Rail Infrastructure Strategy

Introducing the strategy

The Lincolnshire Passenger Rail Strategy (LPRS) outlines an aspiration for increased passenger services across the Greater Lincolnshire network within the LTP period, and it presents the challenges and opportunities for rail, identifying four objectives for passenger rail around the six emerging LTP themes for rail,

- Improve the quality and usability of the rail environment to ensure it is safe, affordable and inclusive for all;
- Make travel by train a genuine travel option for our residents living and working in the larger communities, in doing so contribute to reducing the environmental impact of travel and improving physical wellbeing alongside other modal strategies;
- Enhance rail to support Lincolnshire's economy, people's access to jobs and training and support the growth of the leisure and tourism industry; and,
- Make rail more attractive than the car and improve access to the local stations by bus, bike and on foot, and for more remote communities by car, and the use of stations so that stations and the railway become part of the community.

The Lincolnshire Rail Infrastructure Study builds on this, through an assessment of rail infrastructure with the aim to identify capacity constraints and locations for rail infrastructure enhancements to enable an uplift in rail service frequency, to improve access to employment, education and leisure opportunities by rail and increase rail mode share.

The assessment of rail infrastructure has incorporated engagement with rail industry stakeholders to understand interfacing schemes planned by the rail industry and agree an aspirational indicative train service specification for Greater Lincolnshire up to 2034 which considers the feasibility of expanding the frequency of our services on routes across the region.

A timetabling exercise has been undertaken with the aim to accommodate the agreed train service specification onto existing rail infrastructure using industry recognised timetable software in order to identify locations where the service specification cannot be accommodated.

Thereafter, a series of rail line constraints and potential infrastructure enhancements have been developed through stakeholder engagement.

Interventions have been shortlisted to create a series of recommendations for inclusion in LTP 5

In addition to the assessment of rail infrastructure, an evidence-based assessment of proposed new station sites throughout Lincolnshire has been undertaken based on five areas identified by Lincolnshire County Council and stakeholder groups, as follows:

- Donington;
- Littleworth, Deeping St Nicholas;
- Washingborough/Heighington;
- Canwick Hill; and,
- Cherry Willingham.

In order to identify a preferred site and recommendations for inclusion in LTP 55, multi-criteria assessment has been undertaken, structured around:

- Accessibility to the proposed station site by all modes including public transport, passengers on foot, passengers in a motor vehicle and passengers travelling by bicycle;
- Assessment of station catchment including population within 1km walking and existing routes which may be suitable for development for highway access to the station;
- Availability of land for parking/disabled parking, mobility hub, additional bus provision and/or drop off;
- Qualitative assessment of rail constraints, cost, buildability and delivery timescales;
- Political constraints;
- Environmental constraints; and,
- A review of planning constraints.

This document is supported by a technical report which has been developed through consultation with rail industry partners, regional transport bodies, local districts across Greater Lincolnshire and community rail partnerships.

Vision

Whilst the LPRS was produced prior to the LRIS, both form part of a wider connected rail piece, and therefore this document should be read in conjunction with the LRIS technical report and the LPRS.

The LPRS sets out the following vision for rail in general and which should be adopted by the LRIS:

Our vision is to make Lincolnshire a place where catching a train is a natural choice for people when making journeys to work, education and for leisure for those larger communities living alongside or close to the rail network. To achieve this rail must be accessible, convenient, inclusive, and attractive to all, especially when compared to the alternatives, such as the car.

Challenges and opportunities

Rail network

The Lincolnshire rail network was developed by five different railway companies (principally the Great Northern Railway and Great Eastern Railway but also Midland Railway, Lancashire, Derbyshire and East Coast Railway and Great Central Railway) often leading to route choice between major towns only.

By the late 19th century, eight principal rail lines had been established, providing good coverage across the county.

The principal rail lines are as follows:

- Barton-Upon-Humber - Habrough - Cleethorpes;
- Cleethorpes - Scunthorpe - Doncaster - Sheffield;
- Lincoln - Gainsborough - Sheffield (and Leeds);
- Grimsby (Cleethorpes) - Market Rasen - Lincoln - Nottingham – Leicester;
- Lincoln - Newark North Gate;
- Skegness - Boston - Sleaford - Grantham - Nottingham;
- Doncaster - Lincoln - Sleaford - Spalding - Peterborough; and,
- Peterborough - Stamford - Melton Mowbray - Birmingham.

Reflecting the geography of the area, the rail network serves the main urban areas of Lincoln, Gainsborough, Sleaford, Spalding, Stamford and Skegness and offers onward connections to major hubs outside Lincolnshire including Nottingham, Leicester, Sheffield and Leeds while connections to Doncaster, Peterborough, London and York are possible via the East Coast Mainline (ECML) which passes through the south west of Lincolnshire between Peterborough and Grantham.

Direct connections in under an hour are possible to Doncaster and Nottingham from Lincoln, while Peterborough and Cambridge are easily accessible from Stamford. For commuters to Sheffield there is a direct service from Lincoln in 82 minutes, which then carries on to Leeds.

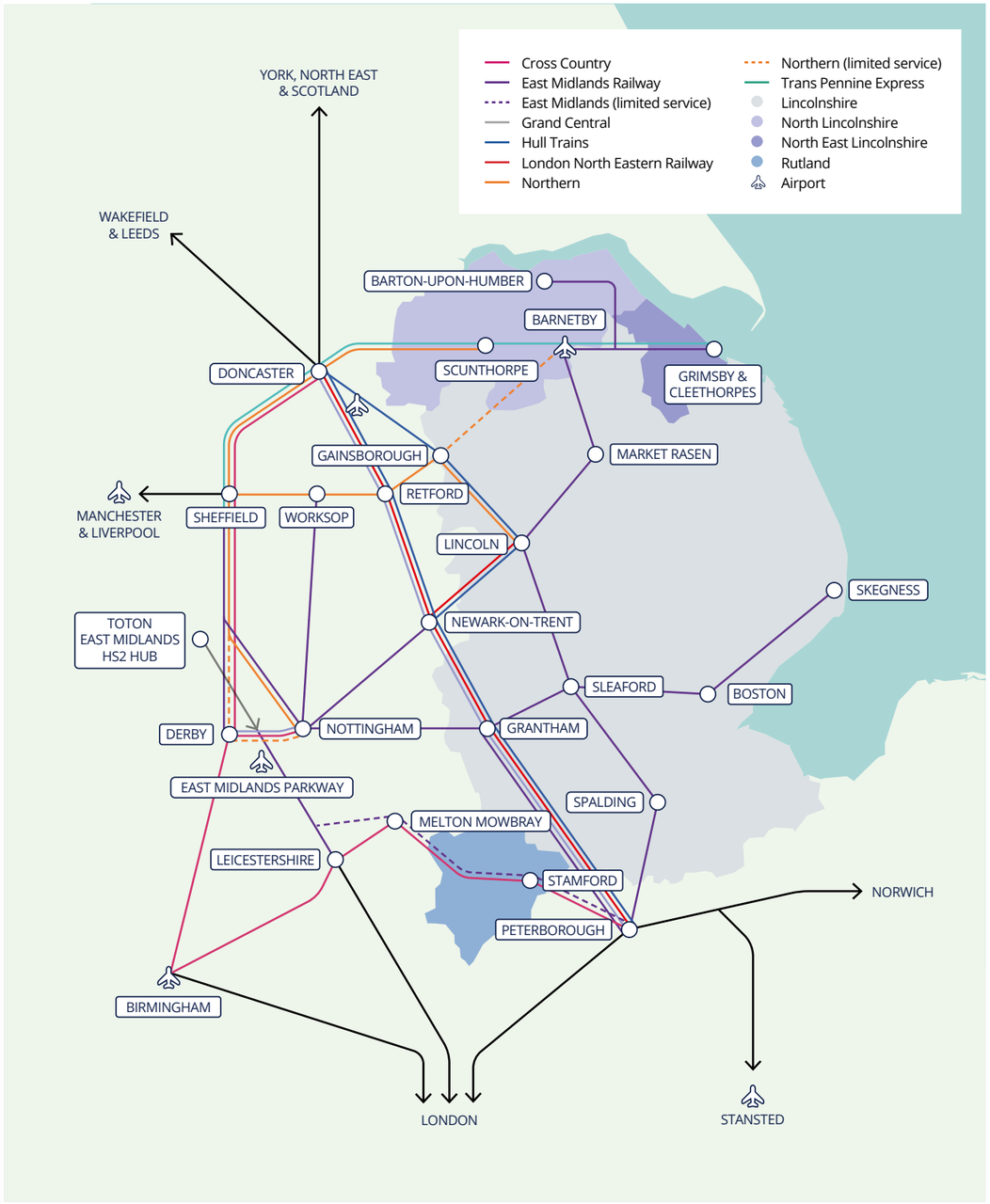
The Freight Strategy shows that, in addition to passenger operations, freight is of great significance to rail in Greater Lincolnshire and there are significant constraints to movement.

As a result of ongoing capacity issues on the ECML, following the upgrade to the Great Northern/Great Eastern (GNGE) joint line this has become the primary route for daytime north-south freight traffic, with freight services passing directly through Lincoln and Gainsborough. In addition, there is a focus of freight activity at the South Humber Bank at the Port of Immingham and the Port of Boston has two rail terminals which handle approximately 200-230 tonnes per day.

Railway infrastructure

Prior to developing a train service specification for 2034, it is essential to review previous studies to identify known infrastructure constraints for each principal rail line.

The existing rail network across Greater Lincolnshire and adjoining areas is as follows.



Line	Known infrastructure constraints
Barton-upon-Humber - Habrough - Cleethorpes	• Much of the line is single track; • Non-electrified line; • Maximum line speed of 60mph; • Limited service frequencies: two hourly intervals between services. No Sunday services in winter and limited in summer restricted by signal box hours (10:15-19:45 summer; closed in winter); • Volume of freight services into Immingham; • Connectivity is restricted towards Grimsby and Cleethorpes, unless making interchange at Habrough; • No passenger trains currently run on the short spur of line between Ulceby Station and Brocklesby.
Cleethorpes - Scunthorpe –– Doncaster - Sheffield	• Much of the line is single track (with limited section of two track between Grimsby Town and Sheffield); • The track-speed east of Grimsby Town is only 40mph; • The line is not electrified; • Limited Sunday services.
Lincoln (Saturday only Cleethorpes) - Gainsborough - Sheffield (and Leeds)	• Some sections of single track, maximum two track; • Line is not electrified; • The Sunday services are restricted by the existing hours the signal boxes are staffed; • Limited platforms at Sheffield.
Grimsby (Cleethorpes) - Market Rasen - Lincoln - Nottingham - Leicester	• Some sections of single track; • Major constraint where the line crosses the East Coast Mainline at Newark Flat Crossing. This is currently limited to two train paths per hour crossing the mainline, one of which is a freight path; • Inconsistent line speeds; some slow sections (40mph Cleethorpes to Grimsby); • Line is not electrified; • Limited weekend services and inconsistent calling patterns at local stations (Leicester to Lincoln).

Line	Known infrastructure constraints
Lincoln - Newark North Gate	• Max two track; • Line is not electrified; • Inconsistent eastbound/westbound services (East Midlands Railway); • Limited Sunday service travelling westbound.
Skegness - Boston - Sleaford - Grantham - Nottingham	• Mixture of single and two track along full route; • Line is not electrified; • Limited Sunday services; inconsistent calling at smaller stations on East Midlands Railway Services from Nottingham to Skegness; • Relatively slow line speeds; • Long signal sections.
Doncaster - Lincoln - Sleaford - Spalding - Peterborough	• Two track along full route; • Line is not electrified; • Long signalling sections between Lincoln and Peterborough; • No East Midlands Railway Sunday service; • Limited opportunities to regulate freight south of Lincoln.
Peterborough - Stamford - Melton Mowbray - Birmingham	• Leicester Station currently at capacity; • Existence of absolute block signalling on route contributes to capacity constraints; • Two track along full route; • Line is not electrified; • Limited Sunday service due to signal box opening hours.

Strategy approach

To develop the strategy, the approach has been to look at the evidence base and any interventions that are currently proposed and then assess the network capacity before arriving at potential further solutions and developing the Indicative train service specification (ITSS) that would form the backbone of the Rail infrastructure Strategy.

Interfacing studies and committed enhancements

During the development of an indicative train service specification for 2034, engagement was undertaken with rail industry stakeholders including Network Rail, East Midlands Railway, Midlands Connect and Transport for the North, to understand parallel initiatives and committed enhancements that interface with the rail network in Greater Lincolnshire.

This process allows the strategy to evolve from a knowledge of rail infrastructure capacity, the proposal of a timetable specification and its subsequent appraisal.

Infrastructure capacity

Prior to the development of an enhanced train service specification for 2034, the rail capacity across the county was assessed using a pre–COVID-19 2020 timetable in order to identify areas of capacity constraint.

When constructing a timetable for a complete railway system using an agreed ITSS the complexity and/or amount of flexibility and viability of the timetable, can depend on several factors including:

- The available line capacity;
- Nature of the traffic on the route – if all trains are following the same pattern, then a much higher number of trains can be accommodated; and,
- Number of routes that feed into the main route, and whether junctions are flat or grade separated;

For the purposes of strategy development, when weighing together these factors, the routes and stations around Lincolnshire and surrounding areas can be classified into the following four categories:

- **Green Routes:** Have few capacity constraints and can accommodate the ITSS with flexibility for a timetable solution;
- **Amber Routes:** Have the capacity to accommodate the ITSS but have limited flexibility. They may require suboptimal journey times or frequency of services;
- **Pink Routes:** The line is very close to maximum capacity, while it is able to support the ITSS this is likely to be the maximum level of service the infrastructure can support; and,
- **Red Routes:** The line/station is very constrained. It may not be able to fully support the ITSS and/or require a specific timetable solution.

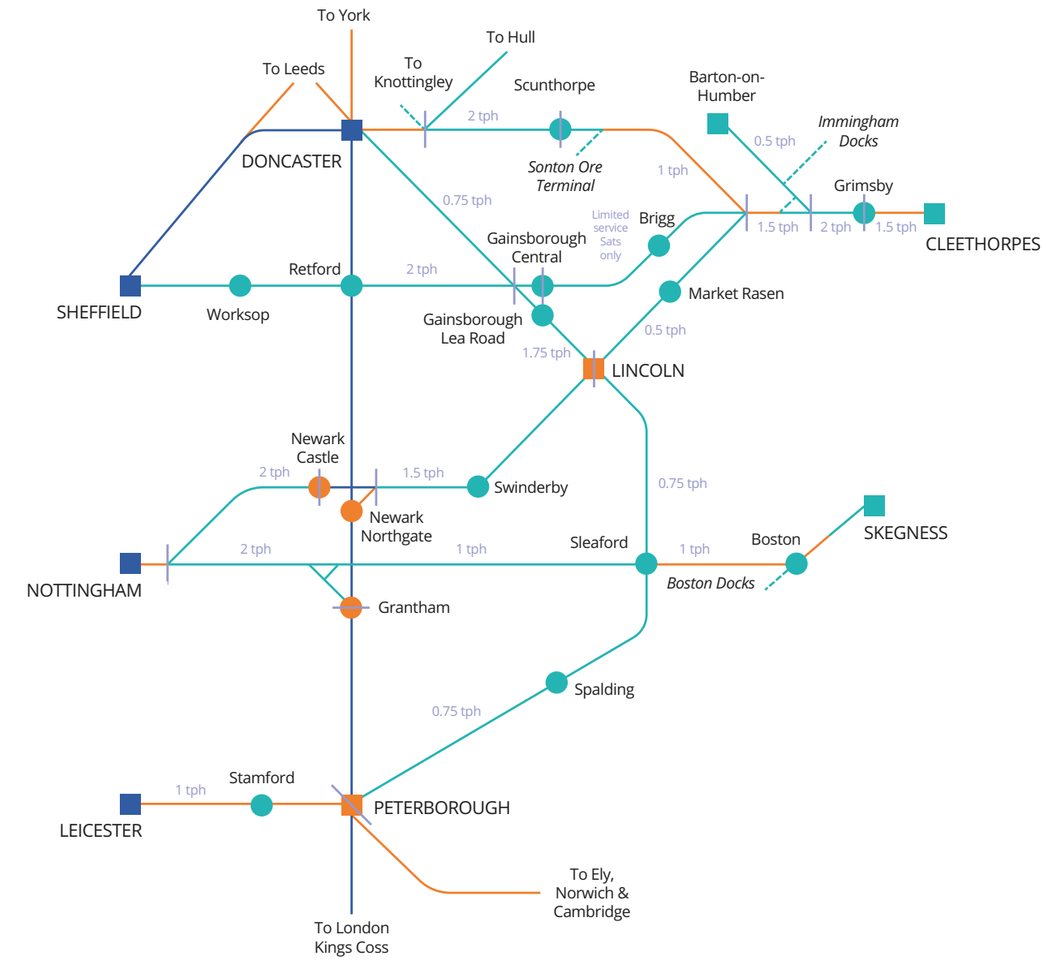
Having one red route on the system is not generally a major issue, assuming the timetable is able to be constructed around these requirements.

However, should the number of red routes exceed one, to ensure there is enough flexibility to link these constrained areas together, at least some of routes which link these together would need to be on green routes.

When a system consists of purely red or amber routes with no, or very limited sections of green routes, this suggests a very constrained, inflexible, and potentially unworkable, timetable solution that, at best, is going to provide significant operational challenges to operate.

The assessment of the rail capacity within Greater Lincolnshire 2020 (pre-COVID-19) is summarised graphically as follows.

Lincolnshire rail capacity 2020
Not to scale, not all lines and stations shown



Line/station very constrained. May not be able to support full ITSS and/or require specific timetable solution. Dashed line represents a freight only route.

Line/station constrained. Can support ITSS but limited flexibility. May require suboptimal journey times or frequency of services. Dashed line represents a freight only route.

Line/station unconstrained. Can support ITSS with flexibility for timetable solution. Dashed line represents a freight only route.

2.5 tph — Number of (passenger) trains per hour (tph) in typical standard hour.

Location at which there is a change in quantum of passenger services per hour.

In general, the routes within Lincolnshire currently have sufficient capacity, and in many areas, significant spare capacity.

However, in some areas, such as Boston and Grimsby to Cleethorpes, single lines constrain the timetable; as does the Newark Flat Crossing. Lincoln station is also close to capacity, but, it is noted that all routes from Lincolnshire feed to into very congested areas, such as Doncaster, Sheffield, Nottingham and Leicester and so the existing spare capacity is often required to provide sufficient flexibility to build and operate the timetable

Indicative Train Service Specification (ITSS)

Collaboration between the county council, Network Rail, Midlands Connect, East Midlands Rail and Transport for the North, has enabled an aspirational ITSS for Greater Lincolnshire to be developed, initially for 2034.

The development of the ITSS considers the feasibility of expanding the frequency of services on many routes across the region, with the aim of enhancing connectivity by rail for employment, education and leisure opportunities and ultimately make rail a more attractive proposition, encouraging modal shift and an increase in the use of sustainable travel.

The ITSS is bounded by the timetabling geography of Peterborough, Leicester, Sheffield and Doncaster stations.

However, it is recognised that the rail network outside of Lincolnshire may constrain capacity in Greater Lincolnshire as a result of existing capacity constraints elsewhere (Sheffield and Nottingham) noting High Speed 2 (HS2), Northern Powerhouse Rail (NPR) and Midlands Connect service enhancement aspirations.

From the interfacing schemes that have been discussed with rail industry stakeholders, it is clear that only committed enhancement schemes should be incorporated into the ITSS.

The ITSS for 2034 presents an enhanced service frequency from the May 2020 service level on most routes as follows:

- In Northeast Lincolnshire, while the Cleethorpes – Manchester Airport and Doncaster – Scunthorpe service would remain hourly;
- The main service increases would be an increase to hourly (from two-hourly in May 2020) on the Barton-on-Humber branch; and,
- An hourly service between Grimsby and Lincoln (assumed to be extended to Newark Northgate every hour to maximise London connectivity and simplify arrangements at Lincoln). A trade-off for this would be to not extend the London Kings Cross – Lincoln service to Grimsby and Cleethorpes in this ITSS.

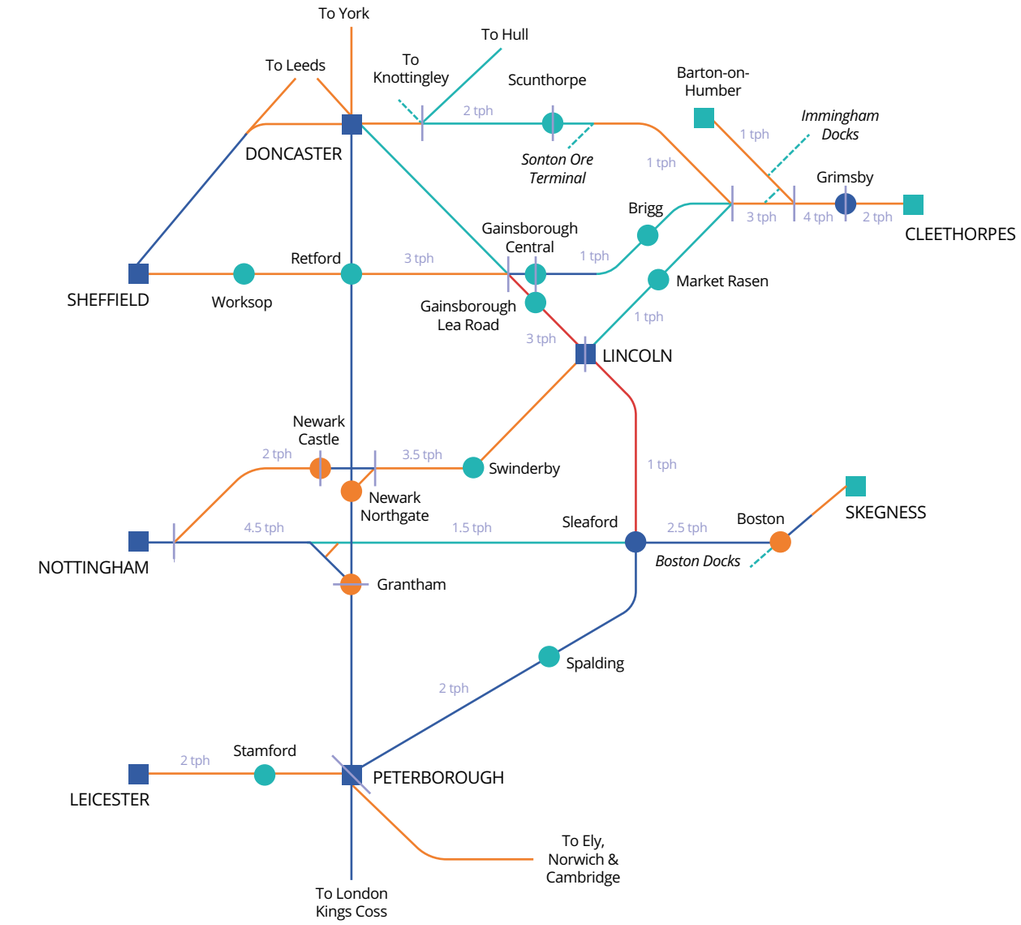
Other major service enhancement in this area of Lincolnshire would be a regular hourly service through Brigg, by extending the current Sheffield – Gainsborough Central service through to Grimsby.

Through Lincoln, the service between Doncaster and Peterborough would increase from an irregular service to hourly; with the aspiration for two trains an hour between Sheffield and Lincoln, and potentially Nottingham and Lincoln over the currently hourly service on both routes.

Between Nottingham, Grantham and Skegness, a substantial increase in service is aspired to, with an extra train from Nottingham to East Anglia. This is in addition to making the stopping service between Nottingham and Grantham hourly, and an extra two hourly stopping service between Nottingham and Skegness. Skegness would also see an hourly service from Peterborough (reversing at Sleaford), which would improve London connectivity to Boston and Skegness.

Between Leicester and Peterborough, the aspiration is for a second train an hour to serve Stamford; this is assumed to be an extension of the existing Birmingham New Street – Leicester stopping service.

Lincolnshire rail capacity 2034 before interventions
Not to scale, not all lines and stations shown



Line/station very constrained. May not be able to support full ITSS and/or require specific timetable solution. Dashed line represents a freight only route.

Line/station constrained. Can support ITSS but limited flexibility. May require suboptimal journey times or frequency of services. Dashed line represents a freight only route.

Line/station unconstrained. Can support ITSS with flexibility for timetable solution. Dashed line represents a freight only route.

Line/station close to maximum capacity. While able to support modelled ITSS this is likely to be the maximum level of service this infrastructure can support.

2.5 tph — Number of (passenger) trains per hour (tph) in typical standard hour.

Location at which there is a change in quantum of passenger services per hour.

Level of service and performance

To assess the likely impact of the Greater Lincolnshire timetable service specification for 2034 and identify locations where the service level may not be able to be accommodated on existing infrastructure, the industry standard timetabling tool ATTUne has been used. To allow a comparison between the 2020 pre-COVID-19 scenario, the lines and stations are categorised according to green routes, amber routes, pink routes and red Routes, as before.

From timetabling, the main constraints in the 2034 ITSS are:

- Grimsby station – Not enough flexibility to accommodate additional services terminating here;
- Gainsborough Central – Constraints on the single line section;
- Lincoln station – Not enough flexibility to accommodate additional services terminating here;
- Newark Flat Crossing – Limits paths to two tph in each direction over ECML;
- Nottingham – Grantham – Signalling headway;
- Grantham station – Not enough capacity to accommodate all services;
- Sleaford – Not enough capacity to accommodate all services;
- Peterborough – Sleaford – Signalling headway;
- Sleaford – Sibsey Junction – Constraints on the single line; and,
- Leicester – Not enough capacity to robustly operate more trains north of the station.

The findings for each Northeast Lincolnshire and Lincolnshire rail line can be summarised, outlining key observations from the timetabling exercise and highlighting any areas of capacity constraint.

Northeast Lincolnshire

Doncaster – Scunthorpe – Wrawby Junction

Essentially, the ITSS for 2034 mirrors the current level of service on this route but runs in a more regular pattern. On the assumption that the timetable structure will not significantly change on this route, the 2034 ITSS can be accommodated on the current infrastructure.

Wrawby Junction – Cleethorpes

Generally, the existing infrastructure will be able to support the 2034 ITSS, but the addition of an hourly service on the Brigg line will create some congestion at Grimsby, occupying a platform at the same time as the Grimsby - Lincoln (Newark Northgate service). With only one of the two through platform bi-directional and one bay platform, it is not possible to pass a train from Cleethorpes through Grimsby, while two trains are turning back in the station at the same time. To deliver the ITSS it is likely to require an additional crossover at the west end and platform 1 being made bi-directional to support this resolve this operational issue and deliver the ITSS.

Barton-on-Humber branch

The Barton-on-Humber branch leaving the main line at Habrough is mostly single track, although there is a substantial double track section between Ulceby North Junction and Oxmarsh for approximately five miles. However, if increasing the service to hourly and only wishing to utilise two units on the service, the trains would naturally pass on the single-line section between Habrough and Ulecby. With short turnarounds at Barton-on-Humber and Cleethorpes there would not be the flexibility to re-time the services to pass on a double track section of line, either east of Habrough or north of Ulceby. Enhancements are proposed to operate an hourly service on the existing infrastructure.

Wrawby Junction – Lincoln

There would be sufficient capacity on the route to accommodate the expected 2034 ITSS, noting that the study recommends a potential reduction in freight traffic on this corridor to ease constraints at Lincoln and the Newark Flat Crossing.

Wrawby junction - Gainsborough Trent junction – via Brigg

As a result of existing constraints around Sheffield, the existing Sheffield – Gainsborough Central service is likely to need to run in a very fixed path in and out of Sheffield and for the purposes of this study, it is assumed to continue in its May 2020 path. To extend this beyond Gainsborough Central means the westbound and eastbound services naturally cross on the single-line section between Gainsborough and Northorpe Loop. While it would be possible to timetable the service on the existing infrastructure, it would lead to lengthy journey time extensions of approximately 10-15 minutes for the eastbound service at Gainsborough Central, while waiting for the single line section to clear. Enhancements are proposed to accommodate the 2034 ITSS.

Doncaster – Peterborough via Lincoln

Generally, there is sufficient capacity to permit the Doncaster to Peterborough service to run hourly and accommodate expected freight paths. However, it must be noted that with additional services on the Brigg line and potentially additional Sheffield to Lincoln services, together with freight diverted away from Lincoln, the Gainsborough Trent junction will see a significant increase in the number of conflicting movements. While this can be timetabled, the junction and line into Lincoln would be running close to its natural maximum capacity and could prove to be a performance risk; it would also not be able to accommodate any increase in freight traffic beyond that modelled in the 2034 ITSS. Lincoln station is challenging when trying to accommodate the ITSS, as a result of additional terminating services from Nottingham and Sheffield. Enhancements are proposed to accommodate the ITSS at this location. With the additional services on the Skegness line, Sleaford station starts to become a constraint, with one service reversing in Sleaford station and line running to Peterborough. To accommodate the ITSS, enhancements are proposed at Sleaford.

Sheffield – Lincoln

Sheffield station is a major constraint, with limited platforms and the congested two track section between Sheffield Midland station and Nunnery Main Line Junction. This takes all traffic from Sheffield to Barnsley, Huddersfield, Leeds and Doncaster, with services to Lincoln then having a conflicting move at Nunnery Main Line Junction. There is no realistic infrastructure solution to widen this corridor and beyond upgraded signalling to make lines bi-directional and slightly reduce headway, there is little prospect of significantly increasing capacity on this corridor – noting competing NPR and HS2 aspirations for increasing service levels through Sheffield around the 2034 time frame.

It is likely that the maximum quantum of trains from Sheffield Midland towards Worksop and Lincoln will not be able to increase from the current service level of two tph, and that any additional services between Sheffield and Lincoln may need an alternative method of serving Sheffield. Beyond Sheffield, there are few constraints, however
any stopping service would need careful planning between a semi-fast service and to be cognisant of the constraints outlined at Sheffield and Lincoln. There may also be a requirement for some additional freight traffic on this corridor to reduce pressure on the Newark Flat crossing and Lincoln station.

Nottingham – Lincoln

Nottingham station has not been considered in detail because of its relative remoteness from the county, but the station is already close to capacity and similar to Sheffield, HS2 and Midlands Connect have aspirations to increase the number of services using the station around the 2034 time frame. There is a significant risk that the aspired increase in services proposed in the ITSS 2034 would not be able to be accommodated at Nottingham station. The ITSS is likely to require, as a minimum at least a second eastern facing bay platform at Nottingham and potentially another through platform. The other major constraint on this route is Newark Flat Crossing. This limits the maximum number of paths east of Newark Castle to two tph (currently one freight and one passenger) fitting into limited gaps in the ECML timetable. To run two passenger trains an hour beyond between Newark Castle and Lincoln will require diversion of freight paths. The freight traffic using this route is generally bulk traffic such as oil trains between Kingsbury and Immingham. These are currently running at 3400T when loaded from Immingham and Kingsbury and are among the heaviest trains operating in the UK.

Nottingham – Skegness

The 2034 ITSS forecasts a significant increase in services between Nottingham and Grantham, as well as on the Skegness route, with the addition of the hourly Peterborough – Skegness service. This leads to a number of constraints on this route that will require infrastructure interventions to accommodate the 2034 ITSS. Noting the issues around Nottingham station, the main constraint is signalling headway between Nottingham and Grantham. When the route was re-signalled, signals were only installed at locations of former signal boxes, so the route is still planned on absolute block[1] principles. The headway between Nottingham and Netherfield Junction (where the Newark line diverges) is also not suitable for this level of service. At Netherfield Junction, services from Lincoln and Newark have very fixed paths due to Newark Flat Crossing. With an increased level of service, the junction is constrained and is likely to require reasonably significant amounts of pathing time (therefore increasing journey times) to provide a compliant solution. Grantham station, only having one through and one bay platform for services to and from Nottingham and Skegness, will not be able to accommodate the ITSS. It is likely to require, as a minimum an extra through platform and potentially an extra bay platform (or one alternative to this additional bay platform maybe planning the all station stopping Skegness service to avoid Grantham in some hours). Paths on the East Coast Main Line (ECML) south of Grantham have also not been examined, as it is unclear what the 2034 service level and timetable would be on the ECML. However, there is a risk, even if capacity is available that services will have to dwell at Grantham for longer than desired matching paths between Nottingham and Grantham and between Grantham and Peterborough, which further strengthens the need for an additional through platform. Between Allington Junction and Sleaford there are no capacity problems, as it is double track and the existing absolute block sections are short enough so as to not create a capacity constraint. Sleaford station will require infrastructure interventions as stated in the Doncaster – Peterborough section. East of Sleaford, the route becomes single track with passing loops through Boston, before reverting to double track from Sibsey Junction. These single-line sections create a major constraint with up to three trains an hour in each direction. With trains flighted close together in the same direction a movement in the opposing direction has to wait for 15-20 minutes for the single line section to clear, by which time there is another service in that direction trapped behind it. Infrastructure enhancements are proposed here to accommodate the 2034 ITSS. Beyond Sibsey to Skegness there are no capacity concerns with accommodating the ITSS based on existing infrastructure and block sections.

Leicester - Peterborough

The Leicester station area is at capacity today. In order to robustly operate any more services north of Leicester, it will require, at the very minimum, four track reinstating between Leicester and Syston. Signalling on the route between Leicester and Peterborough, being predominantly absolute block, is also a potential constraint. However, the number of signal boxes between Melton Mowbray and Manton Junction means the overall signalling headway is not a major issue on this section. Nonetheless, between Melton Mowbray and Syston, and between Manton Junction and Helpston, block sections are longer, so this can act as constraint. Signalling enhancements are proposed on this route, set out in the recommendations section.

Conclusion arising from the ITSS

Timetable analysis of the proposed 2034 ITSS which incorporates an uplifted service frequency across the county has highlighted a number of capacity constraints and locations where an infrastructure improvement is recommended in order to accommodate the uplifted service frequency.

The following Table summarises timetabling constraints, their impact and it outlines the services that would be affected.

Line	Location	Constraint	Impact of constraint	Services which would be impacted
Barton-Upon-Humber - Habrough - Cleethorpes	Habrough - Ulecby	Trains requiring to pass on single with two unit resourcing plan.	Risk of not being able to accommodate the iTSS and extended journey times or additional unit resource needed to operate service.	Cleethorpes - Barton-on-Humber
Cleethorpes - Scunthorpe - Doncaster - Sheffield	No infrastructure issues.			
Lincoln (Saturday only Cleethorpes) - Gainsborough - Sheffield (and Leeds)	Gainsborough - Northorpe	Trains naturally passing on single line.	Substantially increased journey times and no capacity for freight.	Sheffield - Grimsby via Brigg
Lincoln (Saturday only Cleethorpes) - Gainsborough - Sheffield (and Leeds)	Grimsby	Not enough bi-directional platforms to turn back service in.	Not possible to accommodate service.	Sheffield - Grimsby via Brigg
Lincoln (Saturday only Cleethorpes) - Gainsborough - Sheffield (and Leeds)	Sheffield	Capacity issues at Nunnery Main Line Jn and Sheffield station, noting NPR and HS2 aspirations.	Risk of not being able to accommodate the iTSS and extended journey times.	Sheffield - Grimsby via Brigg Sheffield - Lincoln
Grimsby (Cleethorpes) - Market Rasen - Lincoln - Nottingham - Leicester	Newark Flat Crossing	Flat crossing with ECML, limits paths and timetable options on Nottingham - Lincoln line.	Risk of not being able to accommodate the iTSS and extended journey times.	Nottingham - Lincoln
Lincoln - Newark North Gate	No infrastructure issues.			
Lincoln area	Lincoln station	Limited platforms and volume of services passing through the station as well as turning back.	Risk of not being able to accommodate the iTSS and extended journey times.	Doncaster - Lincoln - Peterborough Grimsby - Newark Northgate Nottingham - Lincoln Sheffield - Lincoln
Skegness - Boston - Sleaford - Grantham - Nottingham	Sibsey - Sleaford	Single track sections between Sibsey and Sleaford.	Risk of not being able to accommodate the iTSS and extended journey times.	Peterborough - Skegness Nottingham - Skegness

Line	Location	Constraint	Impact of constraint	Services which would be impacted
Skegness - Boston - Sleaford - Grantham - Nottingham	Sleaford	Single track at eastern end for both Skegness and Peterborough services and not all platforms bi-di.	Risk of not being able to accommodate the iTSS and extended journey times.	Peterborough - Skegness - Nottingham - Skegness
Skegness - Boston - Sleaford - Grantham - Nottingham	Grantham	Only one through platform from Notts to ECML and one bay for reversing. TSS have significant increase in services using Grantham.	Risk of not being able to accommodate the iTSS and extended journey times.	Nottingham - Grantham Nottingham - East Anglia Nottingham - Skegness
Skegness - Boston - Sleaford - Grantham - Nottingham	Netherfield Junction - Grantham	Long signalling headways.	Risk of not being able to accommodate the iTSS and extended journey times.	Nottingham - Grantham Nottingham - East Anglia Nottingham - Skegness
Skegness - Boston - Sleaford - Grantham - Nottingham	Netherfield Junction - Nottingham	Long signalling headways & flat junction.	Risk of not being able to accommodate the iTSS and extended journey times.	Nottingham - Grantham Nottingham - East Anglia Nottingham - Skegness Nottingham - Lincoln
Doncaster - Lincoln - Sleaford - Spalding - Peterborough	Peterborough - Sleaford - Lincoln	Long signalling headways.	Risk of not being able to accommodate the iTSS and extended journey times.	Peterborough - Skegne Peterborough - Lincoln - Doncaster
Peterborough - Stamford - Melton Mowbray - Birmingham	Leicester	3 track section of line between Leicester and Syston at capacity.	Not able to accommodate the iTSS.	Leicester - Peterborough
Peterborough - Stamford - Melton Mowbray - Birmingham	Syston - Helpston	Absolute block signalling system.	Risk of not being able to accommodate the iTSS and extended journey times.	Leicester - Peterborough

Developing infrastructure options

Engagement

In light of the ITSS constraints, a long-list of potential interventions for the rail network have been developed. These have been shared with stakeholders and their feedback was used to further develop the long-list of potential solutions.

Engagement with stakeholders formed a key component of the development of the Greater Lincolnshire Rail Infrastructure Strategy Development.

To gather feedback on the proposed enhancements to address the identified timetabling constraints, as well as establishing more broader aspirations for our rail network, a number of stakeholder workshops were held with local districts and community rail partnership groups.

Whilst not all feedback received throughout the process was relevant for incorporation into the long list of rail infrastructure enhancements, all comments have been considered in order to gauge the wider ambitions for rail within Lincolnshire.

The feedback is summarised in a technical report and the general consensus indicated,

- A number of opportunities were highlighted for the Lincoln - Sleaford Line, including:
  - Service upgrades on the Sleaford - Lincoln route and the Sleaford- Grantham route to make them more attractive to commuters and the general population.
  - Improved services from Sleaford to Lincoln and through to Nottingham; particularly given the forecast growth in Sleaford which is set to see an additional 4,435 homes housing around 10,000 people.
  - Introduction of additional services on the Lincoln - Sleaford line. The previous restriction of no signalling service after a certain time no longer applies due to the line upgrade providing 24/7 signalling.
  - The service between Lincoln and Sleaford requires later running trains during the week and the introduction of a Sunday service.
  - A proposal to re-open the Louth – Firsby line was outlined which is understood to have the support of Matt Warman MP, Victoria Atkins MP, Tom Ashton, Councillor at East Lindsey District Council, and Louth Town Council.

Sleaford – Grantham Line:

  - It was recommended that better connections out of Sleaford may be needed as the area continues to expand. The line provides a key connection to Nottingham from the south of the district, as well as connections to London via Grantham. Frequency upgrades should be considered to enable commuting along the route, including to London.
  - Feedback from both South Holland District Council and North Kesteven recommended the introduction of a direct Lincoln – London service, via Sleaford, Spalding and Peterborough. While this wouldn't be as fast as the existing service via Newark, it could be provided without the need to change trains throughout the day. North Kesteven highlighted that the service had been previously considered several years ago and could be explored again.

- South Holland District Council made several recommendations for freight within Lincolnshire, including:
  - Emphasis was placed on a need to shift from road to rail freight. The national shortage of HGV drivers, coupled with the forthcoming and eventual ban on the use of internal combustion engines, each hasten the requirement to move more products by rail. Feedback suggested that a rail-based solution to freight will solve many of the challenges currently faced.
  - One of the options proposed was to provide a rail freight interchange south of Spalding. If delivered, this would not have a huge effect on rail traffic north of Spalding (and from there onto Sleaford and Lincoln, where the main concern around congestion sits) as the majority of incoming product would come in from the south, and finished product would (predominantly) return to the south.
  - Given the large numbers of HGV's moving in and out of Spalding and the surrounding area on a daily basis, and given the work being done around the viability of 'piggybacking' by Midlands Connect; Spalding, the RFI, and the GNGE Joint line with its connections to Felixstowe, may be a consideration.

The report produced in response to the Midlands Connect Transport Strategy Refresh Spring 2021, by South Holland District Council and Boston Borough Council, set out a number of priority projects for Lincolnshire's rail network. Many of these were centred around the expansion of rail freight to enable the food chain (and other cargoes) to be moved by rail; this would reduce lorry movements and facilitate the UK's largest food processing and logistics cluster to lead the transition towards low-carbon transport options. Priority projects set out in the report include developing a delivery plan for a South Lincolnshire rail freight hub. This will maximise rail freight opportunities for national and international distribution, by creating a state-of-the-art hub to integrate road and rail connectivity.

Infrastructure interventions

Sifting

Analysis and engagement has resulted in a long-list of infrastructure options, along with a series of criteria to enable option sifting through multi criteria analysis in order to discount those options which do not represent realistic or deliverable solutions.

Each options was scored using a seven-point scale (-3 to +3) against the following objectives and critical success factors using the MCAT:

- ITSS 2034 – To facilitate an increased passenger service frequency through enabling the accommodation of the proposed 2034 ITSS;
- Alignment with transport objectives – Measure of the extent to which the proposed intervention aligns with our wider transport objectives including aspiration to increase rail mode share;
- Stakeholder acceptability – Measure of the level of stakeholder acceptability including districts, political, public and businesses;
- Economy of scale – Measure of the extent to which the proposed intervention can offer economies of scale. For example, will the intervention impact more than one line on the Greater Lincolnshire rail network;
- Minimum Viable Product – Measure of the extent to which it is possible to deliver a low value, reduced programme option of the intervention;
- Service frequency to housing and employment developments – Measure of the extent to which the intervention facilitates increased service frequency to areas of housing and employment development; and
- Service frequency to deprived areas – Measure of the extent to which the intervention facilitates increased service frequency to our deprived areas and communities in Greater Lincolnshire.

The long-list of options has also been assessed against the following CSFs:

- Cost of intervention;
- Engineering Complexity; and,
- Dependency on other projects.

Recommendations

From the option sifting, the infrastructure interventions were developed where they offered sufficient flexibility within the Greater Lincolnshire rail network to operate the 2034 ITSS.

Note, that this may however likely require further intervention within the Nottingham and Sheffield area in connection with HS2, NPR and Midlands Connect aspirations.

Northeast Lincolnshire

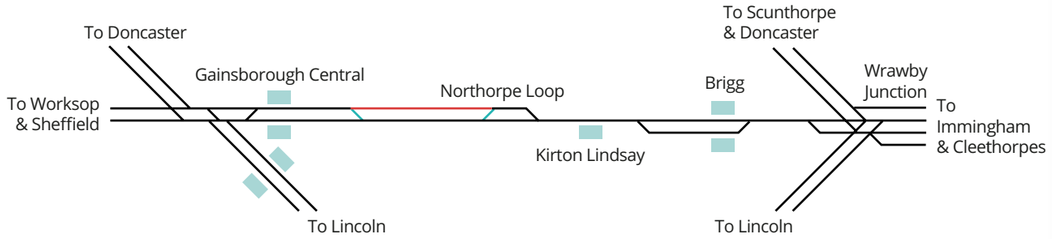
Barton-on-Humber branch

To operate an hourly service on the existing infrastructure would require three units, with units passing between Habrough and Grimsby and between Ulceby and Oxmarsh. This would require lengthy turnarounds at Barton-on-Humber and Cleethorpes and the additional OPEX costs of this would need considering against any business case and the costs of doubling the line between Habrough and Ulecby.

Wrawby Junction - Gainsborough Trent Junction – via Brigg

If the section between Gainsborough and Northorpe was re-doubled, then the timetabling constraint between Gainsborough and Northorpe loop would be removed.

There would then be sufficient capacity on the route to permit an hourly passenger service in both directions and a freight service every two hours, i.e. in each timetable hour a freight path would be available either heading towards Immingham or away from Immingham. A high conceptual schematic of re-doubling the section between Gainsborough and Northorpe Loop is shown below.



Doncaster – Peterborough via Lincoln

As a result of an increase in terminating services and an increase in the level of freight services passing through Lincoln station, it is challenging the accommodate the service frequency uplift in 2034.

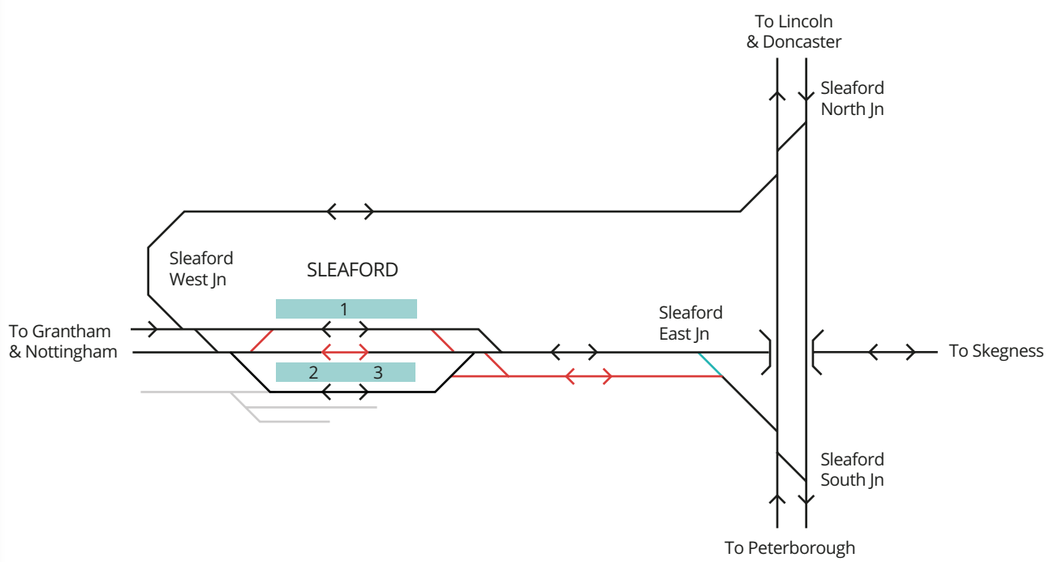
Part of the key to making Lincoln work is to have a consistent ITSS and maximising the use of through trains. To simplify arrangements at Lincoln, there would be value in having a standard hourly service from Grimsby to Newark Northgate. However, this is not possible for a number of services from Sheffield and Nottingham with only three through platforms and no straightforward infrastructure solution to increase this, it is likely some form of turnback siding may be required. This could potential be achieved by using and upgrading the existing Lincoln Terrace Carriage Sidings. The feasibility of a new western facing bay platform is also recommended to be explored.

Reducing the amount of freight passing through Lincoln would also assist in the station operation, noting that the GN-GE Joint Line from Doncaster to Peterborough is the only practical alternative to the congested ECML so is likely to also have a high and increasing demand for freight. Some potential alternative routes available for freight from the West Midlands to Northeast Lincolnshire, are outlined in the Nottingham - Lincoln section.

South of Lincoln, there are few issues until Sleaford, although there would be some operational benefit to reducing the lengthy signalling headway on this route, to provide a bit more flexibility in how trains are timed and enable more bunching up of trains through Lincoln. The level of freight traffic on the route is likely to be the key driver behind this infrastructure upgrade.

Sleaford station starts to become a constraint with additional services on the Skegness line, with one of these reversing in Sleaford station and running to Peterborough and re-modelling work here is recommended to provide to separate single lines (one to Skegness and one to Peterborough) between Sleaford station and Sleaford East Junction as set out below. With some additional switches and crossing and signalling changes, all platforms could be made fully bi-directional which would provide additional flexibility and enable the 2034 ITSS to be timetabled.

South of Sleaford with the additional Peterborough – Skegness train, reducing the signalling headway becomes more critical and it is recommended that a four-minute signalling headway would be required to robustly operate the 2034 ITSS south of Sleaford.



Although Peterborough platforming hasn't been considered in detail, the Werrington dive-under provides opportunities for services from Doncaster and Skegness to use platforms 5, 6 and 7 and potentially one option that the industry could consider is linking the Ipswich - Peterborough service with a Peterborough - Skegness service to assist Peterborough platforming.

Nottingham - Lincoln

As outlined previously, a major constraint on this route is Newark Flat Crossing which limits the maximum number of paths east of Newark Castle to two tph (currently one freight and one passenger) fitting into limited gaps in the ECML timetable. To run two passenger trains an hour beyond between Newark Castle and Lincoln will require the diversion of freight paths.

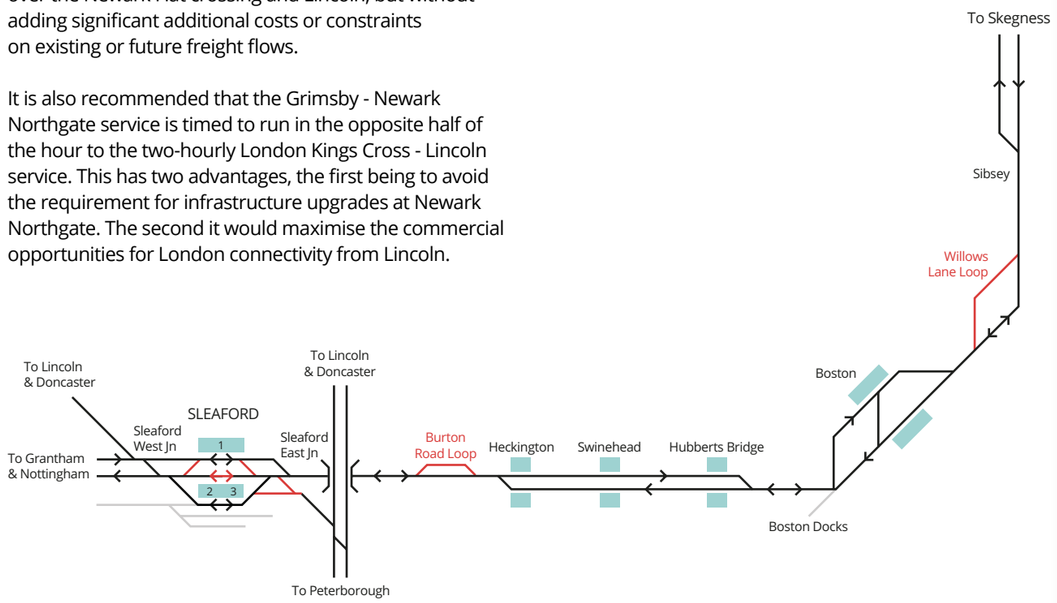
Alternative routes will have to be able to accommodate heavy oil trains which when loaded are running at circa 3,400 tonnes and further work is required to examine the practicalities of this. One alternative route may include operating via Brigg, Worksop, Mansfield, Pinxton and Toton, however the gradients in the Mansfield area may require additional locomotive resources to operate loaded oil trains.

It is recommended further work is undertaken to look at freight routing strategy, with the objective of significantly reducing the number of freight trains over the Newark Flat crossing and Lincoln, but without adding significant additional costs or constraints on existing or future freight flows.

It is also recommended that the Grimsby - Newark Northgate service is timed to run in the opposite half of the hour to the two-hourly London Kings Cross - Lincoln service. This has two advantages, the first being to avoid the requirement for infrastructure upgrades at Newark Northgate. The second it would maximise the commercial opportunities for London connectivity from Lincoln.

Nottingham – Skegness

As outlined previously, the single-track section between Sleaford and Boston creates a major constraint on this line, with up to three trains an hour in each direction. As there is a high volume of level crossings and constrains in the built-up area around Boston full doubling of the line (although the operationally best solution) is not likely to be viable. However, an additional loop between Sleaford and Heckington, as well as north of Boston to break up the single-line sections is recommended, as this would provide sufficient flexibility and additional capacity to accommodate the ITSS. These loops should be as long as possible to ideally create a dynamic loop where trains can pass without one or both being stationary. The loops are recommended to be in the area of Burton Road between Heckington and Sleaford and Willows Lane, between Sibsey and Boston as outlined in Figure 7.



Leicester – Peterborough

This route has a number of constraints including capacity at Leicester Station and signalling on the route between Leicester and Peterborough. As this is a key freight route between Felixstowe and the Midlands which has aspirations for substantial growth in traffic by 2034, it is proposed to fully re-signal the route to enable a standard headway. However, the provision of some extra intermediate block signals between Syston and Melton Mowbray, as well as between Manton Junction and Helpston Junction may also be considered.

Assessment of proposed station sites

The station sites

Having looked at regional infrastructure priorities, the final part of the strategy is to identify a similar long-list of rail station improvements. An evidence-based assessment of proposed new station sites throughout Lincolnshire has been reviewed based on areas identified by the county council at,

- Donington;
- Littleworth, Deeping St Nicholas;
- Washingborough/Heighington;
- Canwick Hill; and,
- Cherry Willingham.

A long-list of possible locations in these areas was generated from an initial desktop study.

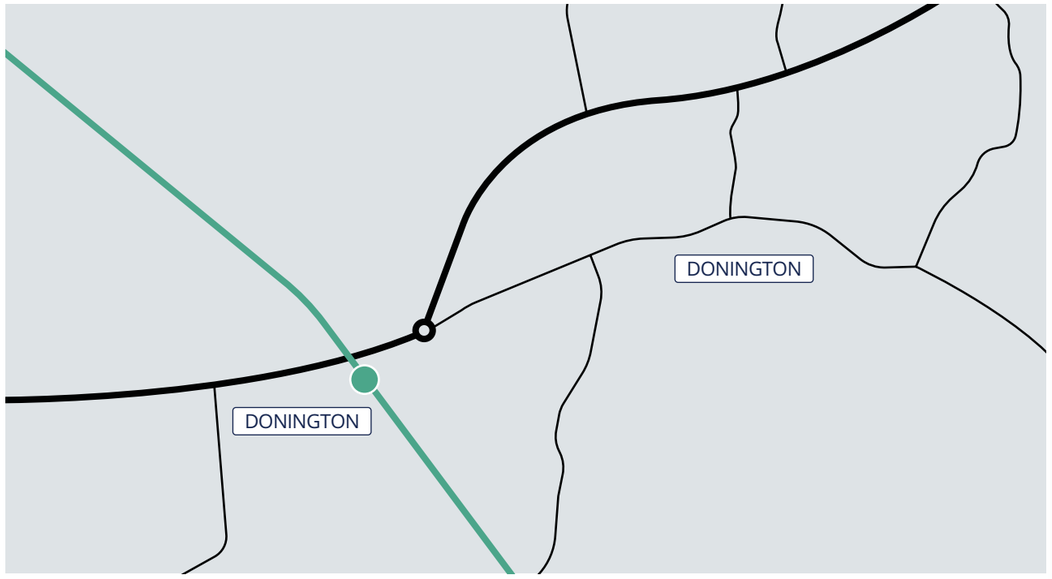
No site visit or analysis of land ownership has so far been undertaken but from the long-list of potential station locations, five proposed station locations were looked at a high-level based on likely catchment and access links. One proposed station location within each area has been taken forward, based on a judgement of land availability and maximising walk catchment whilst balancing the need for highway access within the locality.

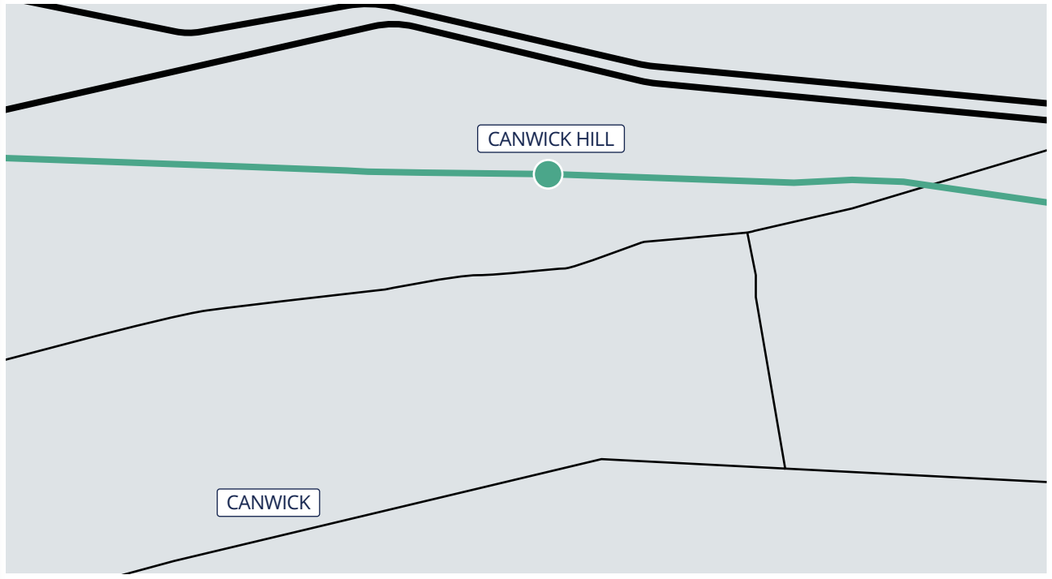
Littleworth looks to be the preferred solution based on its location as described in previous studies[2].

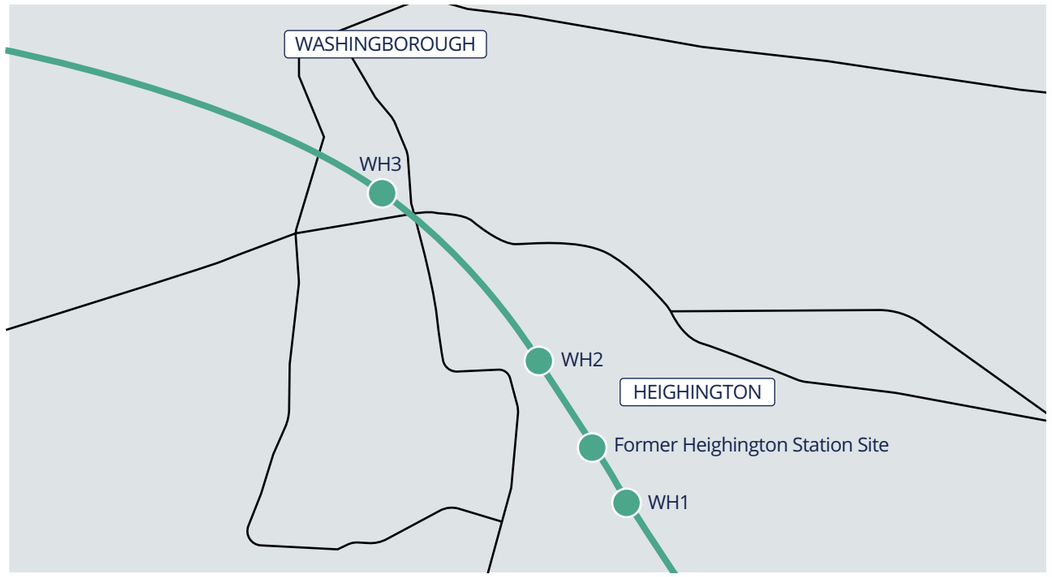
Within Cherry Willingham, three possible sites for a station were identified based on identifying areas of unbuilt up land adjacent to the railway. The furthest east was constrained with no existing highway access and is already proposed for development within the Local Plan. As such this site has been discounted. A site towards the west of the area seemed to give the best highway and catchment options and was therefore taken forward for high level analysis. As the Lincoln Eastern Bypass has recently been built close to the area of Canwick Hill, future development and access plans are known but still in early stages of planning. A representative, relatively central possible location has therefore been considered in the high-level analysis.

Equally, within Donington, one particular location where the road crosses the railway gives an obvious choice for high level evaluation.

Once general locations for any proposed station had been chosen through this process, further work is essential to ascertain the preferred option, or an alternative, to be taken forward to development and design stages.
The site locations at Donington, Washingborough/Heighington, Canwick Hill, Cherry Willingham are as follows,







Evaluation of possible station sites

In order to identify a preferred site, multi-criteria assessment was been undertaken, structured around:

- Accessibility to the proposed station site by all modes including public transport, passengers on foot, passengers in a motor vehicle and passengers travelling by bicycle;
- Assessment of station catchment including population within 1km walking and existing routes which may be suitable for development for highway access to the station;
- Availability of land for parking/disabled parking, mobility hub, additional bus provision and/or drop off;
- Qualitative assessment of rail constraints, cost, buildability and delivery timescales;
- Political constraints;
- Environmental constraints; and,
- A review of planning constraints.

From these categories, 14 criteria were used and all sites were assessed against criteria scores from 0 to 2, on their own merits and not ranked against the other sites. The assessment criteria are;

	Criterion	Description
1	Level of pedestrian links to the proposed station site.	The extent to which the proposed station location is accessible to passengers on foot considering existing infrastructure.
2	Level of public transport provision to the site including bus and other first/last mile options.	The extent to which the proposed station location is accessible to passengers travelling by bus, considering existing infrastructure. Other first to last mile options to be assessed if applicable.
3	Cycling routes.	The extent to which the proposed station location is accessible to cyclists travelling on existing cycle routes and inclusive cycling infrastructure to the station could be provided.
4	Drive up catchment.	An assessment of the extent to which the proposed station location will attract those driving to the station, with the catchment weighted by distance from the proposed station.
5	Population within 1km walking catchment.	Isochrones have been developed to assess the population within 1km walking catchment of each of the proposed station locations. The isochrones are set out overleaf.
6	Land availability for station car park, disabled parking and drop off.	An assessment of land availability for car parking, disabled parking and drop off.
7	Level of highway access to the site.	The extent to which the proposed station location is accessible to motor vehicles considering existing infrastructure.
8	Land availability for provision of a mobility hub	An assessment of land availability for a mobility hub. Consideration is given to the availability of land relative to the number of non-motorised parking spaces which could be provided.
9	Cost	A qualitative assessment of the expected magnitude of cost relative to a reference station.
10	Political Acceptance	A qualitative assessment of any local concerns raised by our residents or other key stakeholders
11	Ability to provide a regular and economically viable service.	An assessment of the extent to which the proposed station service plan can provide a regular service which is economically viable.
12	Environmental Constraints.	This criterion considers statutory risks and the extent to which environmental constraints, including local heritage and conservation areas, flooding, designated environmental sites, may impact the delivery of a station at the proposed location.
13	Planning Constraints.	Consideration is given to the proposed station location relative to greenbelt land.
14	Interfacing development proposals.	Consideration is given to development proposals which may interface with a station at each of the proposed location and the known extent to which these would impact on station development.

Whilst some analysis remains to be finalised, particularly at the Littleworth site, the new station location assessment findings are,

- Provision of new stations in a rural area is challenging due to the low rail uptake and small local catchments leading to low rail service frequencies. However, increasing the rail take up needs to start somewhere.
- None of the station locations had "showstopper" constraints which means all of them would be possible to deliver.
- The difficulty is not in the possibility of delivery, but in the building of the benefits to show a business case. In this regard, those stations in more populated areas, with a higher potential number of users and/ or more frequent rail service patterns will be more favourable.
- This economic analysis is likely to favour those stations closer to Lincoln with Heighington station currently scoring the highest with Canwick Hill and Cherry Willingham close behind.
- The case for Littleworth and Donington is harder at present to support, but this does not make them less worthwhile schemes if appropriate approaches can be found.

These are initial, high-level analyses which may change as a result of further consultation with stakeholders and design detail.

References

1. A railway line under absolute block working is divided into block sections. A train approaching a section is offered by a signalman to his counterpart at the next signal box. If the section is clear, the latter accepts the train, and the first signalman may clear his signals to give permission for the train to enter the section.
2. Littleworth Station Feasibility Study, March 2013, MVA consultancy and Proposal to Reopen Littleworth Station Business Case Review, Mouchel, October 2014.

Glossary

CRP	Community Rail Partnership. A group of local people, mostly volunteers, who promote and undertake small scale works at local stations of lines.
DfT	Department for Transport – the Government body who buy most train services and fund Network Rail.
ECML	East Coast Mainline, line accommodating fast services between the north and London passing through Doncaster and terminating at London Kings Cross.
EMR	East Midlands Railways – local and regional services across the East Midlands and Long-distance high s peed services to London along the Midland Mainline.
GBR	Great British Railway – the proposed future organisation to run England Railway, taking over from Network Rail, DfT and TOC's. See Rail White Paper.
LCC	Lincolnshire County Council.
LNER	London North Eastern Railway. Operate Long-distance high-speed services to London along the East Coast Mainline.
LTP 5	The Lincolnshire County Council's 5th Local Transport Plans (lasting 5 years to 2028/29).
MML	Midland Mainline, line accommodating fast services between Yorkshire and London, starting at Sheffield and Nottingham/Lincoln and travelling to London St. Pancras via Leicester.
Northern	Northern Trains – local and regional train company operating services across the north of England.
ORR	Office of Rail Regulation who oversee Network Rail's performance and report back to DfT.
RTB's	Regional Transport Bodies, including Transport for East Midlands/East Midlands Councils (TfEM/EMC), Midlands Connect, Transport for the North (TftN).
TOC	Train Operating Company.
TPD	Trains per day.
TPX	Transpennine Express – inter-regional train company operating services across the north of England and into Scotland.
XC	Cross Country – a train operator serving long-distance routes excluding London.
COVID-19	Coronavirus pandemic of 2019/20.
LTB	Local Transport Boards.
RAP	Route Action Plan.
HIAMP	Highways Infrastructure Asset Management Plan.
SEA	Strategic Environmental Assessment.
SA	Sustainability Appraisal .
GVA	Gross Value Added.
TfL	Transport for London.
LENNON	Latest Earnings Networked Nationally Overnight.
ATC	Automatic Traffic Count.
EV	Electric Vehicle.
DECC	Department of Energy and Climate Change.
SUEs	Sustainable Urban Extensions.
UKCRF	UK Community Renewal Fund.
UKSPF	UK Shared Prosperity Fund.
LUF	Levelling Up Fund.
LATS	Local Area Transport Strategies.
LCWIP	Local Cycling and Walking Infrastructure Plan.
ROWIP	Rights of Way Improvement Plan.
PRoW	Public Rights of Way.
CPO	Chargepoint Operator.
EVCP	Electric Vehicle Charhepoint.
BAME	Black, Asian and Minority Ethnic groups.
NTS	National Travel Survey.
CBSSG	COVID-19 Bus Services Support Grant.
JSNA	The Joint Strategic Needs Assessment.
DLUHC	The Department for Levelling Up, Housing and Communities.
SIDP 21	Strategic Infrastructure Delivery Plan 2021.

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