Lincolnshire County Council

# NORTH HYKEHAM RELIEF ROAD

## Options Appraisal Report


70038233
SEPTEMBER 2018

CONFIDENTIAL

Lincolnshire County Council

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## Lincolnshire County Council

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## Options Appraisal Report

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# 1. EXECUTIVE SUMMARY

Lincolnshire County Council (LCC) is seeking funding to develop and construct the North Hykeham Relief Road (NHRR) scheme. The proposed NHRR scheme will provide a new link through a predominantly rural area situated to the south of the Lincoln urban area (including Lincoln and North Hykeham) and will link the existing Western Relief Road (A46) in the west to the Lincoln Eastern Bypass (LEB) currently under construction, in the east.

This report summarises the options assessment process completed for the NHRR including a summary of the key existing and future problems and issues, the options considered to date and the outcome of the options assessment.

### 1.1.1. Key Problems & Issues

Lincoln currently suffers from high levels of congestion from local and strategic traffic movements which impacts on the quality of life for local residents, acts as a constraint on the economy and reduces the attractiveness of the city for visitors and investors.

The existing road network in Lincoln consists of a number of regionally important routes through and around the city, as well as major routes into the city centre and local roads.

The main orbital and strategic routes include the A46 Western Relief Road/Northern Relief Road which forms part of the Highways England (HE) network, the A57 Saxilby Road/Carholme Road on the western side of Lincoln which provides a key east-west route into the City, the A15 which provides a major north-south route through Lincoln and provides a link to the Humber Ports and the A1434 which again provides a route into the city from the south west and passes through several residential areas including North Hykeham.

However, the existing principal road network currently has a number of limitations. There are few major and strategic routes through and around Lincoln and these are further constrained by the location of the rivers, watercourses and rail infrastructure within and around the city.

Lincoln is bisected by the River Witham and Fossdyke Navigation which cut through the city in both east-west and north-south direction. These act as a significant constraint to the transport network as there are limited crossing opportunities of the both the river and the Fossdyke Navigation in the centre of the city and very few in the south of Lincoln. In the south of the city the crossings are limited to a number of relatively minor routes which are particularly unsuited to strategic traffic.

In addition the railway lines also bisect the city. These run east-west through the centre of Lincoln and in a north-south direction through North Hykeham. There are again limited opportunities to cross the rail infrastructure and the location and number of level crossings also has a further constraining effect on the network for both strategic and local movements across Lincoln.

This results in a limited route choice for traffic wishing to travel north-south and east-west, especially in the south of the Lincoln urban area, with traffic forced to use either the A46 or A1434 and A15 to pass by or through the city.

These network limitations cause several problems.

It results in significant volumes of traffic having to use a limited number of strategic and major routes or unsuitable routes through residential areas. East-west traffic in the south of Lincoln is forced to using minor rural routes to the south of Lincoln;

On the Strategic and Major Road Network there are a several links that are currently carrying significant volumes of traffic. The highest current traffic flows and the largest recent increases have been on Lincoln's orbital and major routes (A46, A15 and A1434) and the expectation is that they will continue to increase putting the network under further pressure.

On the local network, several routes in the North Hykeham area experience relatively high traffic volumes for their design standard, this can be attributed to the lack of east-west and north-south connectivity. Key points include:

- Moor Lane, Mill Lane and Station Road carry circa 10,000 vehicles/day. Critically these routes pass through residential areas, often with housing immediately adjacent to the highway; and
- Meadow Lane currently forms an important east-west link between radial routes to the south of Lincoln and is the only crossing point of the River Witham to the south of Lincoln. Without another viable alternative Meadow Lane will continue to carry significant volumes of traffic compared to its design standard.

The lack of route choice and high levels of traffic on the limited number of strategic and major routes also results in rat running through residential areas, particularly in the North Hykeham area and the villages to the south of Lincoln. These routes are unsuitable for the volumes of traffic that they currently carry and result in a high level of severance in local communties.

There is also a poor level of network resilience and this is a key problem on the Strategic and Major Route Network. The poor network resilience has a wide impact and affects movement of strategic and local traffic across the Lincoln network. The lack of alternatives to the existing orbital ring road and major routes through the city mean that that traffic is diverted through urban and residential areas which are unsuited to the additional volumes of traffic.

Several important sections of the existing network are also operating either at capacity or would be expected to reach capacity in the short to medium term. This includes the A46, the A15 and the A1434, with congestion resulting in poor average speeds, variable journey times and delay in both peak periods and to some extent also in off peak conditions.

### 1.1.2. Future Problems & Issues

Future land-use policies identify significant levels of planned growth up to 2036. This includes the development of the four Sustainable Urban Extensions which will contribute to a 50% increase in dwellings in Lincoln by 2036.

The LEB, which is currently under construction, will provide welcome and much needed mitigation for the traffic and transport problems affecting Lincoln but once open several residual issues will remain.

In particular the lack of east-west connectivity will remain a significant problem which will exacerbate the existing congestion problems on radial routes and routes into Lincoln.

Travel demands are also forecast to increase substantially over the next 20 years. Increases in traffic of approximately 20% by 2036 are forecast and will result in a deterioration of conditions on key areas of the network particularly on the western side of Lincoln including the A46 Western Relief Road (WRR), A1434 Newark Road and sections of the A15.

The forecast impact of the future level of travel demand on infrastructure illustrated by link capacity, junction capacity and average speed indicates issues of congestion and poor speeds on the key route network including A46 WRR and A1434 Newark Road and on local routes in the South of Lincoln and North Hykeham area. This includes the Meadow Lane and Brant Road – the current main east west crossing of the River Witham in the south of Lincoln.

Without a suitable transport intervention traffic conditions in the future will deteriorate and the road network will struggle to:

- Accommodate forecast growth;
- Support the delivery of Sustainable Urban Extensions;
- Support the delivery of the Central Lincolnshire Local Plan;
- Support the Major Road Network development;

- Accommodate the increase travel demand;
- Improve resilience and reliability; and
- Provide adaequate network capacity and route choice.

If a suitable transport intervention is not implemented existing and future conditions will result in:

- **A lack of strategic connectivity:** the A46/A15 currently provide strategic connectivity to wider economic areas such as the Humber ports. Congestion which will be exacerbated in the future which will inhibit efficient movement on this route and therefore wider strategic connectivity;
- **Constrained economic growth:** the transport network is forecast to face increasing congestion which may impact on the areas ability to deliver sustainable economic growth;
- **An impact on housing targets:** the ability to deliver housing targets will be compromised; and
- **An impact on the emerging Major Road Network:** existing and future congestion on the A15 and A46 may hinder the potential of these routes to operate as part of the MRN.

## 1.2. NHRR OPTIONS

This OAR has focussed on the options relating to the standard of carriageway and follows on from the earlier work completed by LCC which established the key requirements of the scheme and the route corridor. Three primary options for a NHRR between the A46 (A46/A1434 Pennell's Roundabout) to the A15 (A15 Lincoln Eastern Bypass/Sleaford Road Roundabout) have been considered; these being:

- A single carriageway;
- A dual carriageway; and
- A single carriageway with future-proofed junctions and structure which will allow for dualling of the scheme at a future date.

Further options for shorter schemes have also been considered:

- A46 to South Hykeham Road – single carriageway;
- A46 to South Hykeham Road – dual carriageway;
- A46 to Brant Road – single carriageway; and
- A46 to Brant Road – dual carriageway.

## 1.3. OPTIONS ASSESSMENT

The seven options have been taken through a robust WebTAG compliant assessment process including analysis of the current and future conditions, confirming the need for a scheme, objective setting, concept design, initial economic appraisal, stakeholder and public engagement. This work has been supported by the 2015 Greater Lincoln Transport Model and has included the following stages:

- **Initial Sift:** An initial sift of options was completed to identify any significant problems and issues which are likely to prevent an option progressing.
- **Early Assessment & Sifting Tool:** The Early Assessment and Sifting Tool (EAST) has been utilised. This was developed by the DfT as a decision support tool to develop, quickly summarise and present evidence on options in a clear manner which is consistent with the DfT's five case transport business structure.
- **Traffic Impacts:** The traffic impacts of each option have been assessed on the Strategic and Major Road Network as well as on the local roads and routes.

### 1.3.1. Intial Sift

The shorter options (A46 to South Hykeham Road and the A46 to Brant Road) were discounted at this stage due to:

- Scoring poorly against scheme objectives;

- Not deemed deliverable on the grounds that they do not align with long term policy aspirations of a relief road to the south of Lincoln as stated within the Lincoln Integrated Transport Strategy, Lincolnshire 4th Local Transport Plan and the Central Lincolnshire Local Plan; and
- Not deemed feasible as the options are not technically appropriate when considering future demand.

### 1.3.2. EAST Assessment

The EAST Assessment identified the dual carriageway as being the best performing option in relation to the objectives and overall impact. In the main this is due to the slightly higher level of traffic relief expected to result from its implementation. However, each option is likely to deliver high value for money (in line with DfT's criteria).

### 1.3.3. Traffic Impacts

The following summarises the traffic impacts and issues for the three shortlisted options:

- Across all three options, the opening year traffic flows for the NHRR are consistent with those acceptable for a dual 2 lane all-purpose carriageway as set out in guidance contained within the Design Manual for Roads and Bridges (DMRB);
- The journey times along the dual carriageway option are over a minute quicker than the single carriageway and future proofed options in the peak periods both in 2026 and 2036. The average speeds are also forecast to be significantly quicker (approximately 10mph) in the dual carriageway option;
- Analysis indicates that the single carriageway links, particularly at the western end of the NHRR, may operate close to capacity by the end of the Local Plan period (2036) or at the design year (2041) whilst the dual carriageway option should remain well within capacity in these timescales;
- The LEB is being constructed as a single carriageway with future proofed junctions and features. There remains an aspiration to upgrade this to a dual carriageway at some point in the future. Progressing the NHRR as a standard single carriageway could be seen as being inconsistent with the overall design approach to the LEB;
- As dependent development the South West Quadrant has not been taken into account in the 'with NHRR' scenario. This will place further development pressures on the network;
- All three options will improve the resilience of the transport network through the expansion of the orbital network and increases in capacity. However, a dual carriageway option would further improve resilience as it will have the capacity to better deal with incidents and the impact of maintenance works.
- The dual carriageway option is forecast to provide the greatest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road on the sections between Skellingthorpe Road and Riseholme Road.
- All three options will provide significant traffic relief across a number of routes both within central Lincoln and in the south of the city; and
- The dual carriageway option provides the greatest level of relief although for many routes this is a marginal difference.

### 1.3.4. Costs

The initial outturn scheme cost estimates range from £100m for the single carriageway option to £148m for the dual carriageway.

| Option | Single Carriageway | Single Carriageway Future Proofed | Dual Carriageway |
|---|---|---|---|
| Base Costs* | £60,620,560 | £72,168,966 | £91,040,330 |
| *Risk Allowance* | *£17,900,000* | *£20,324,000* | £25,440,000 |
| Inflation | £21,508,792 | £25,339,031 | £32,043,039 |
| **Total** | **£100,029,352** | **£117,831,997** | **£148,523,369** |

**Does not include any sunk costs*

### 1.3.5. Benefits & Benefit Cost Ratio

The outcome of the indicative value for money assessment is set out in the table below. This summarises the forecast transport user and accident benefits for each option, the present value of costs and the benefit to cost ratio (BCR). It shows that the single carriageway and future proofed options are likely to produce a similar level of benefit and the dual carriageway is forecast to provide the greatest level of benefit (£321m over 60 years). However, the given the relatively modest difference in benefits between the three options and the lower scheme costs, the single carriageway would be expected to result in a higher BCR. It should also be noted that the BCRs for all options fall in the high value for money category (BCR between 2 and 4) as defined by DfT[1].

| Indicative Value for Money Assessment | Option | | |
|---|---|---|---|
| | Single Carriageway | Single Carriageway Future Proofed | Dual Carriageway |
| Present Value of Benefits (PVB)** | **£277,600,000** | **£277,763,000** | **£321,800,000** |
| Present Value of Costs (PVC)** | £75,580,170 | £89,046,233 | £112,227,573 |
| Net Present Value (NPV)** | £202,019,830 | £188,716,767 | £209,572,427 |
| **Indicative BCR** | **3.67** | **3.12** | **2.87** |

**The operating costs have not been calculated. This will be completed for the OBC.*

*** 2010 prices and values*

## 1.4. ENGAGEMENT OUTCOME

Stakeholder and public engagement was undertaken in June 2018. The engagement process included two stakeholder workshops and four public drop-in exhibitions. In parallel a questionnaire was also released, of which 1,023 were completed. Some 73% of respondents strongly supported the scheme and 89% either supported or strongly supported the scheme. Only 8% of respondents opposed or strongly opposed the scheme with 2% either not knowing/having no opinion. In addition, 87% of respondents preferred a scheme between the A46 and the A15 with 75% of respondents preferring the dual carriageway option. Only 1% of

[1] DfT Value for Money Framework 2015

respondents preferred any version of the A46 to South Hykeham Road option with 8% preferring the A46 to Brant Road option.

### 1.4.1. Outcome

The OAR has assessed a number of options for NHRR including three different carriageway standards and three different lengths. Through initial sifting the two shorter versions of the NHRR were discounted and more detailed assessment and appraisal has been undertaken for the options of three different standards of the full A46 to A15 route. In summary:

### 1.4.2. Single Carriageway

- The single carriageway option will deliver the scheme objectives. It will improve the east-west connectivity in the south of Lincoln, help to reduce traffic levels on local urban and rural roads, support the delivery of the Sustainable Urban Extensions and help improve the resilience of the orbital and key route network through and around Lincoln;
- It will provide significant traffic relief across a number of local routes both within central Lincoln and in the south of the city;
- The forecast flows on the single carriageway exceed the opening year flow range for a single carriageway as defined by DMRB. This identifies that a dual carriageway standard is likely to be more economically and operationally acceptable. Congestion Reference Flow analysis also indicates that some sections of a single carriageway scheme may be operating close to capacity at the end of the plan period in 2036 or at the design year in 2041;
- It will produce acceptable levels of benefits albeit these will be lower than the dual carriageway option;
- The standard single carriageway is the lowest cost option and the outturn costs are expected to be in the region of £48m lower than the dual carriageway;
- This option will produce a BCR that is within the high value for money category, as defined by DfT. However, due to the lower costs, and relatively similar levels of benefits, the single carriageway option is predicted to provide the best value for money with the dual carriageway option notably lower; and
- Progressing the NHRR as a standard single carriageway could be seen as not being consistent with the overall design approach to the LEB. This is being developed as a future proofed single carriageway and there is a clear aspiration to upgrade the route at a later date.

### 1.4.3. Single Carriageway + Future Proofing

- The future proofed option is expected to have a similar level of performance to the standard single carriageway and it will deliver the scheme objectives;
- It will provide similar level of traffic relief to the standard single carriageway across a number of local routes both within central Lincoln and in the south of the city;
- The forecast flows on the scheme are again similar to single carriageway and exceed the opening year flow range for a single carriageway as defined by DMRB;
- It will also produce acceptable levels of benefits albeit these will be lower than the dual carriageway option;
- This is the second lowest cost option. The outturn costs for the option with future proofing are expected to be in the region of £30m lower than the dual carriageway;
- This option will produce a BCR that is within the high value for money category, as defined by DfT. Due to the higher costs, and relatively similar levels of benefits, the BCR for this option is lower than that of the single carriageway, but higher than for the dual carriageway option; and

- The design standard will be consistent with the overall design approach to the LEB. However, there are risks in adopting this approach as it requires land not immediately required for the scheme making the case for compulsorily purchasing some elements of land more difficult to justify.

**Dual Carriageway**

- All three carriageway standard options of the full route deliver the scheme objectives, however, due the greater capacity of the dual carriageway option, it is likely to do so more robustly;
- An analysis of opening year daily traffic flows compared to DMRB guidance for carriageway standards indicates that a dual carriageway standard is most likely to be economically and operationally acceptable;
- The recent stakeholder and public engagement exercise has shown that a very significant majority of people (75%) support the dual carriageway option for the full A46 to A15 NHRR;
- The dual carriageway option is forecast to provide the highest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road. The dual carriageway option is also forecast to result in more traffic reassigning to use the eastern bypass with the southern section to the B1188 Lincoln Road expected to see the most significant increases;
- The dual carriageway option will provide the highest level of benefits, although not significantly higher than the other two options in proportion to the relative costs;
- The dual carriageway is significantly more expensive than the other two options and has an outturn cost of approximately £148m;
- This option has the lowest BCR of all three options; and
- If taken forward to the OBC stage, further work will need to be undertaken to demonstrate that the dual-carriageway option will provide sufficient value for money, wider economic benefits and strategic fit for the DfT to consider funding.

# 2. INTRODUCTION

## 2.1. OVERVIEW

Lincolnshire County Council (LCC) is seeking funding to develop and construct the North Hykeham Relief Road (NHRR) scheme.

The proposed NHRR scheme will provide a new link through a predominantly rural area situated to the south of the Lincoln urban area (including Lincoln and North Hykeham). The NHRR will link the existing Western Relief Road (A46) in the west to the A15 Lincoln Eastern Bypass (LEB) currently under construction, in the east. The preferred route alignment of NHRR is shown in Figure 1.

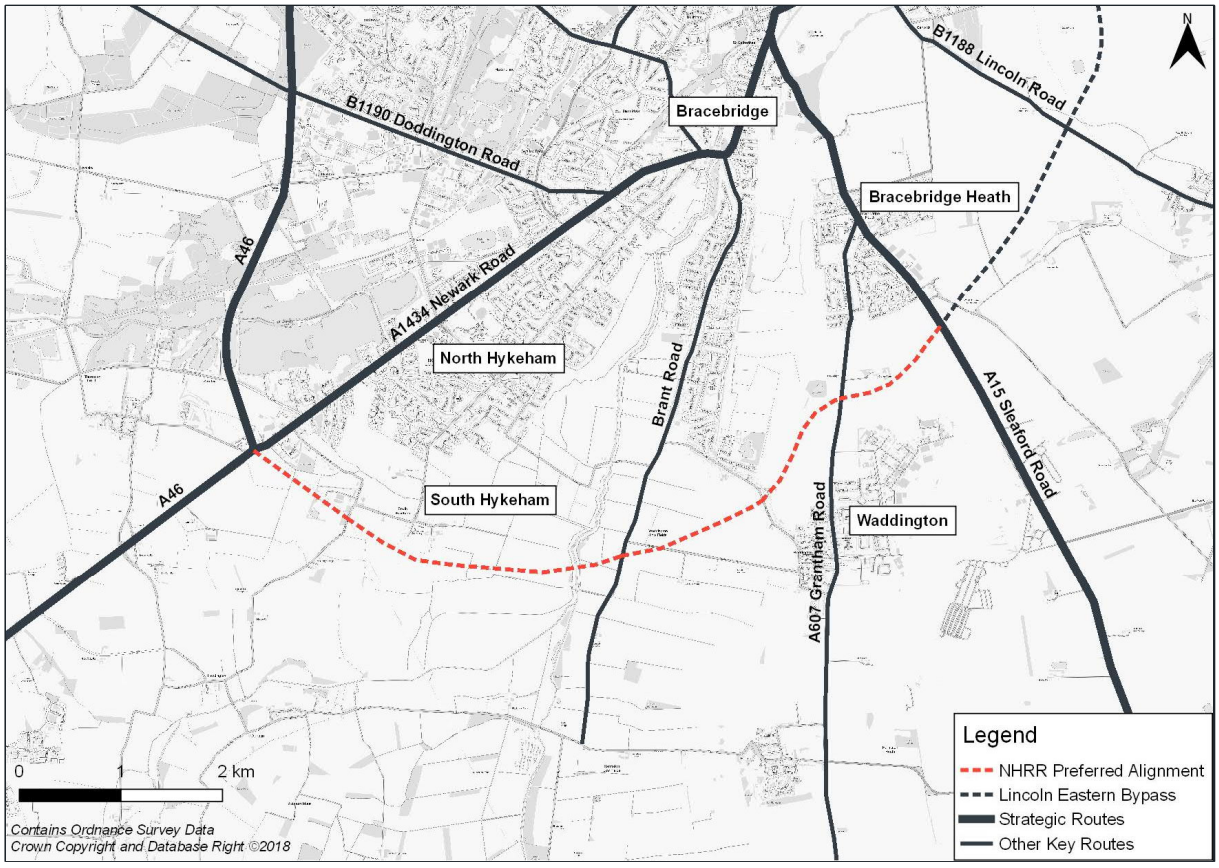



**Figure 1 – Preferred North Hykeham Relief Road Alignment**

The NHRR will provide a much needed link to complete the orbital ring road around the Lincoln urban area and will be a key piece of infrastructure that forms part of the Lincoln Transport Strategy and supports the delivery of the Central Lincolnshire Local Plan.

Proposals for NHRR have been in development for a significant number of years and previously the scheme was known as Lincoln Southern Bypass (LSB). NHRR and LSB are essentially the same scheme and any references here or in other documents to LSB or, indeed, a southern bypass of Lincoln, should be considered as now refering to NHRR.

## 2.2. AREA CONTEXT

Lincoln is a cathedral city and the county town of Lincolnshire in the East Midlands. Lincoln is a central service centre for the wider hinterland and a number of outlying settlements and has been targeted for significant housing and economic development as set out in the Central Lincolnshire Local Plan.

The city is on the Strategic Road Network (SRN), with the A46 which forms the City's Western Relief Road being managed by Highways England up to its junction with the A57. The A46 links Lincoln to the wider SRN at Newark where it connects into the A1, a major national north-south route. The local highway network provides further links to the SRN including via the A15 which provides a route north towards the Humber Ports and north-west to the M180. It also links into the A57 which provides a connection west to the A1(M) and the M1 beyond.

The A46 is also the key orbital route which skirts the western and northern boundaries of the urban area (formed by the Lincoln Western and Northern Relief Roads) and as well as providing the link to Newark and A1 to the south also connects to Market Rasen to the north. The A15 on the other hand provides the main route through the city centre, providing an alternative north-south route and along with the A46 providing the major links across the River Witham. The A57 provides an east-west route into the city centre where it meets the A15.

The A158 begins outside Lincoln as part of the Lincoln Northern Relief Road at the A46 roundabout with Nettleham Road (B1182) and provides a link to the town of Horncastle to the east where it intersects the A16 as well as Skegness on the Lincolnshire coast.

## 2.3. STUDY AREA

The area under study is in the semi-rural south of Lincoln encompassing the south west section of the A46 and the key radial routes of the A1434 Newark Road, Brant Road, Grantham Road and the A15 Sleaford Road, and is illustrated in Figure 1. The study area includes settlements in the southern extent of the Lincoln urban area including North Hykeham, South Hykeham, Swallow Beck and Bracebridge, and also smaller rural settlements in their entirety consisting of Waddington and Bracebridge Heath. As can be seen in Figure 1, east-west connectivity is limited in the study area, with the network resembling spokes of a wheel.

## 2.4. PREVIOUS STUDIES

Significant work has been undertaken in developing the scheme proposal to date, this includes:

- Option Assessment Report (September 2003): Examined historic options;
- Stakeholder workshop (April 2004): Emerging route corridors were identified;
- Route Assessment Report (March 2005): Resulted in the production of five routes within three corridors;
- Public Consultation (October 2005): Three routes were presented;
- Route Corridor Appraisal (September 2006): The outcome of the report confirmed route 2C as the preferred route;
- Chief Executive for Highways decision that the preferred route was to be developed and agreed for consultation (April 2006);
- Public Consultation (October 2006): Emerging preferred route was presented;
- Preferred Route developed;
- County Council Executive Committee endorsement of Preferred Route option (November 2008);
- Regional Transport Board Submission (November 2008); and
- Large Local Majors Funding Application (July 2016).

## 2.5. STRUCTURE OF THE OPTION ASSESSMENT REPORT

This Option Assessment Report (OAR) documents the process of identifying the need for intervention (based on the current and future issues), the process of option development and sifting, and finally the options assessment results and next steps. Following on from this introductory chapter, the remainder of the document is structured as follows:

- **Chapter 2** outlines the **current situation** in the study area in terms of current transport (and other) policy, the transport network and levels of service, existing travel demands and the impact of these existing transport demands;
- **Chapter 3** sets out the **future situation**, taking into account future land-use policies, changes to the transport system and levels of service, and travel demands;
- **Chapter 4** establishes the **need for intervention**, based on the current and future transport-related problems in the area and the underlying causes of these problems;
- **Chapter 5** presents a clear set of **intervention-specific objectives**;
- **Chapter 6** establishes the **geographical area of impact** to be addressed by an intervention, based on the extent of current and future transport problems;
- **Chapter 7** outlines the **option generation** process;
- **Chapter 8** discusses the process of how the **options were appraised and sifted** to identify preferred options; and
- **Chapter 9 summarises the findings** of the OAR, sets out the preferred option and outlines the next steps for the scheme.

# 3. UNDERSTANDING THE CURRENT SITUATION

## 3.1. OVERVIEW

This chapter examines the **current situation** within and surrounding the Lincoln urban area and is structured as follows:

- **2.2 Policy & Strategy Review –** Discusses relevant national, regional and local policy.
- **2.3 Existing Road Network and level of service** – Presents the current provision of transport infrastructure and services.
- **2.4 Existing Travel Demand** – Assesses the existing level of demand for the infrastructure and services.
- **2.5 Existing Travel Demand Impact** – Presents the impact of the existing level of demand on the current infrastructure network and services.
- **2.6 Existing Public Transport** – Sets out the existing bus and rail network and services.
- **2.7 Existing Non-Motorised User Provision** – Presents Public Rights of Way and cycle infrastructure.
- **2.8 Existing Constraints** – Reviews environmental, land ownership and geotechnical constraints.

A review of current national, regional and local policy objectives relating to transport is discussed in this section, providing a framework for determining the future required performance of the strategic network in Lincoln. In addition, levels of current travel demand and service are reviewed along with the issues and opportunities relating to the transport network in Greater Lincoln.

## 3.2. POLICY & STRATEGY REVIEW

Table 1 highlights the specific organisations and documents, at the national, regional and local level which set the policy and strategy for the provision, management and use of the transport network within and surrounding the Lincoln urban area. The following section presents the key points from the documents highlighted below and a more in-depth review of the policies and strategies is provided within Appendix A.

**Table 1 – Organisations and reviewed policies and strategies**

| | Organisation | Reviewed policies and strategies |
|---|---|---|
| **National** | ▪ Department for Transport (DfT); &<br>▪ Highways England | ▪ National Planning & Policy Framework (2012);<br>▪ Building our Industrial Strategy, Green Paper (January 2017);<br>▪ Transport Investment Strategy (July 2017);<br>▪ Action for Road – A Network for the 21st Century (July 2013);<br>▪ Creating Growth, Cutting Carbon: Making Sustainable Transport Happen;<br>▪ Highways England Delivery Plan 2015 – 2020;<br>▪ Road Investment Strategy: for the 2015/16 – 2019/20 Road Period;<br>▪ Transport Resilience Review (July 2014); and<br>▪ National Infrastructure Delivery Plan. |

| | Organisation | Reviewed policies and strategies |
|---|---|---|
| **Regional** | ▪ Midlands Connect<br>▪ Greater; Lincolnshire Local Enterprise Partnership (GLLEP); &<br>▪ Central Lincolnshire. | ▪ Greater Lincolnshire Strategic Economic Plan 2014 – 2030 (Spring 2016);<br>▪ Central Lincolnshire Local Plan 2012-2036;<br>▪ Greater Lincolnshire Strategic Infrastructure Delivery Plan;<br>▪ Midlands Engine Strategy (Mach 2017);<br>▪ Midlands Connect Strategy: Powering the Midlands engine (March 2017); and<br>▪ Highways England North and East Midlands Route Strategy, April 2015 and Evidence Report. |
| **Local** | ▪ Lincolnshire County Council (LCC);<br>▪ City of Lincoln Council (CoLC);<br>▪ North Kesteven District Council (NKDC);<br>▪ West Lindsey District Council (WLDC); &<br>▪ Neighbourhood Plan areas. | ▪ Lincolnshire Local Transport Plan 4 (2013);<br>▪ City of Lincoln Council Strategic Plan Vision 2020;<br>▪ Lincoln Integrated Transport Strategy (2004);<br>▪ Lincoln Integrated Transport Strategy Update Revision 1 (2008);<br>▪ A Transport Strategy for the Lincoln Area (2013);<br>▪ North Kesteven Strategic Plan;<br>▪ Hykeham Neighbourhood Plan, 2016-2036; and<br>▪ Surrounding neighbourhood plans. |

### 3.2.1. National Policy Context

The issues and objectives highlighted below are common points found across the reviewed national policies and strategies. The key themes detailed within the policies and strategies are identified below and these will need to inform the development and the basis of any proposals.

*Issues:*

- UK's economic performance has been poor compared to other developed countries and businesses;
- Critical need to upgrade and improve the Strategic Road Network which has suffered from inconsistent and inadequate investment;
- There is a need for a less congested and better connected network in order to build a more balanced economy, enhance global competitiveness and to support the creation of housing;
- Forecast quantum of housing development will place increased pressure on the existing transport network; and
- A lack of network resilience when an incident occurs has a negative impact on businesses.

*Objectives:*

- Provide capacity and connectivity to support national and local economic activity;
- Delivering high quality homes and create sustainable communities;
- Improve connections between individual towns and cities;
- There should be consideration of the need for funding to ensure the resilience of the transport network supports local businesses; and
- Support growth, create jobs and attract inward investment.

*Opportunities:*

- Provide capacity and improve connectivity to join communities together and promote economic growth;
- Provide additional highway capacity to support the need for housing; and.
- Review the resilience of the road network with the view to improve resilience and therefore have a positive impact on communities and businesses.

### 3.2.2. Regional Policy Context

At a regional level the key strategies including the Greater Lincolnshire Strategic Economic Plan (SEP) and Central Lincolnshire Local Plan (CLLP) identify that Lincoln, is a major centre for Lincolnshire's strongest economic sectors including manufacturing and the visitor economy. It is home to global manufacturing businesses as well as important visitor attractions such as Lincoln Castle and Cathedral. The SEP identifies that improving Lincolnshire's connectivity and transport infrastructure is vital to achieving growth and the economic aims and objectives outlined in the SEP.

It sets out a number of challenges:

- Poor road connections to priority national markets;
- Demand for the movement of people and goods will continue to grow across Greater Lincolnshire, putting increased stress on existing transport network; and
- Over four million lorry loads of goods per year add to pinch points in traffic congestion and poor access will weaken the future sustainability of the economy.

The SEP also identifies the A46 as a key corridor around Lincoln and emphasises that priority must be given to additional network improvements to contribute to growth in housing and improved connectivity to sectors and markets both nationally and internationally.

The CLLP sets out an aspiration that between 2012 and 2036, Central Lincolnshire will grow by 36,960 new homes, meeting the housing needs of all communities. The Plan also sets out the location of several Sustainable Urban Extensions (SUEs), along with what is expected to be delivered for each. In the Greater Lincoln area, these are:

- **Lincoln Western Growth Corridor (WGC):** Includes the delivery of approximately 3,200 dwellings and 20ha of employment and leisure land;
- **Lincoln South East Quadrant (SEQ):** Includes the delivery of approximately 6000 homes (3,600 in the plan period up to 2036) and 7hs of employment land;
- **Lincoln North East Quadrant (NEQ):** Approximately 1,400 homes and 5ha of employment land; and
- **Lincoln South West Quadrant (SWQ):** Approximately 2,000 homes and 5ha of employment land.

It is stated that growth in homes and jobs should be closely linked "with new infrastructure such as schools, roads, health facilities and open space provision planned and provided at the same time as the new buildings."

The Greater Lincolnshire Strategic Infrastructure Delivery Plan also identifies that that whilst Greater Lincolnshire has a comprehensive road network, it faces a number of key challenges, including:

- Tackling rising congestion in town centres and at key pinch points across the region;
- Accommodating housing growth through investment in urban distributor roads and associated infrastructure; and

- Increasing accessibility across Greater Lincolnshire to areas that are currently inaccessible for employment and freight journeys.

Included amongst the medium-term road schemes listed within the delivery plan is the NHRR. The plan identifies the need for the provision of a bypass around Lincoln's southern quadrant to address existing congestion as well as enable the development of housing around the area. Further to this, the plan emphasises how a new link will:

- Support agricultural businesses in and around Lincoln;
- Support business growth through improved connectivity;
- Improve air quality within the urban area; and
- Unlock proposed South West Quadrant with around 2,000 homes.

In addition:

- **Midlands Engine Strategy:** The Midlands Engine Strategy looks at the challenges the area faces, ensuring investments and interventions are targeted effectively. The strategy focuses on five key objectives:
  - Improving connectivity in order to raise productivity;
  - Strengthening skills in order to make the Midlands a more attractive location for businesses;
  - Supporting enterprise and innovation in order to foster a more dynamic regional economy;
  - Promoting the Midlands nationally and internationally in order to maximise trade and investment in the region;
  - Enhancing quality of life in order to attract and retain skilled workers, as well as to foster the local tourist economy.
- **Midlands Connect Strategy:** There is a recognition that the SRN is not performing at the required level to support the economy with the A46 being highlighted as an area for improvement to drive economic growth. Furthermore the document highlights connectivity between Lincoln and the Humber Ports as an 'intensive growth corridor' which provides an opportunity for a transport intervention to contribute to the improvement of this corridor.

In summary the key regional strategy and policy documents identify:

***Issues:***

- There are poor road connections to priority national markets;
- Demand for the movement of people and goods will continue to grow across Greater Lincolnshire, putting increased stress on the existing transport network;
- A need to improve journey times and network resilience;
- A need to modernise and maintain the network to support growth; and
- A need to improve the network to support housing growth and attract businesses.

***Objectives:***

- To promote Greater Lincolnshire as a place for sustainable growth through improved transport infrastructure to enhance connectivity with national and international markets;
- To recognise the need for new housing for the existing local population and potential movers to the area, and support balanced housing and economic development through promoting the area's capacity to deliver high-quality growth;

- Tackling rising congestion in town centres and at key pinch points across the region;
- Improving connectivity in order to raise productivity; and
- Support the development of a bypass to the south of Lincoln.

*Opportunities:*

- Delivering the NHRR will support existing strategic movement on the A46 and future growth on this corridor.

### 3.2.3. Local Policy Context

The key local policy and strategy documents include the Lincolnshire Local Transport Plan 4 (2013), City of Lincoln Council Strategic Plan Vision 2020, the Lincoln Integrated Transport Strategy and the neighbourhood plans.

The Lincolnshire Local Transport Plan 4 echoes national policy by highlighting the need for transport investment to support sustainable economic growth and improving accessibility to jobs and services. The plan specifically mentions NHRR and how it will provide a missing link to create a full orbital road around the city. It identifies a number of issues including the following:

- Supporting growth and the local economy - Population growth in Lincolnshire has been substantially above that recorded both regionally and nationally. Increasing development to accommodate this growth will put further pressures on existing transport networks across the county;
- Improving access to employment, training and key services – 12% of Lincolnshire's population live within the 20% most deprived areas of England;
- Contributing to a healthier community – The proportion of obese adults and children in Lincolnshire is higher than the national average; and
- Improving road safety – Since 2008, KSI casualties have increased in the county, reaching 483 in 2011.
- The environmental impact of transport - A city-wide AQMA was declared in Lincoln in February 2008 following assessment of fine particulates (PM10) at key junctions across the city.

LTP4 goes on to set out detailed objectives and policies to address to issues highlighted above:

- To assist the sustainable economic growth of Lincolnshire, and the wider region, through improvements to the transport network;
- To improve access to employment and key services by widening travel choices, especially for those without access to a car;
- To make travel for all modes safer and, in particular, reduce the number and severity of road casualties;
- To maintain the transport system to standards which allow safe and efficient movement of people and goods;
- To protect and enhance the built and natural environment of the county by reducing the adverse impacts of traffic, including HGVs;
- To improve the quality of public spaces for residents, workers and visitors by creating a safe, attractive and accessible environment;
- To improve the quality of life and health of residents and visitors by encouraging active travel and tackling air quality and noise problems; and
- To minimise carbon emissions from transport across the county.

In addition the City of Lincoln Council Strategic Plan Vision 2020 sets out the following issues:

- Increased rail traffic through the city centre results in longer waiting times for road traffic at the two rail crossings;
- The need to improve connectivity between Lincoln, Central Lincolnshire and the Humber area, which is experiencing significant growth;
- There are two air quality management areas (AQMAs) in the city, which can have an impact on the health of the population with traffic accounting for around 13% of Lincoln's CO2 emissions;
- Inequality of access to services and opportunities; and
- Over 2,000 households on the affordable housing waiting list in Lincoln.

The Strategic Plan calls for further development in transport infrastructure to improve regional and national connectivity as well as the need to support economic growth and the delivery of quality homes. It cites a southern relief road bypass as being key to facilitating growth and opening up employment opportunities in addition to being pivotal in completing the ring-road around the city.

The Lincoln Integrated Transport Strategy (LITS) also recognises the need for investment in transport infrastructure and has highlighted the NHRR as a key established intervention. It identifies that delivery of the LITS and the identified schemes including the NHRR will result in:

- City centre benefits brought through the reallocation of road space following the removal of unnecessary traffic;
- Accessibility benefits for all transport users associated with providing more options to travel throughout the Lincoln Area;
- Environmental benefits for the Lincoln area such as improved air quality and improved public realm;
- Safety benefits resulting from the transfer of traffic onto more appropriate routes and reducing conflict with cyclists and pedestrians; and
- Economic and regeneration benefits through supporting existing land uses and proposed developments.

At the local level the Hykeham Neighbourhood Plan states that the area is car centric and is not conducive to more sustainable forms of travel. It also states that North Hykeham suffers from considerable traffic congestion particularly at peak times and the South Hyekham village is subject to 'rat running'. The plan highlights that a bypass would address many of these concerns and has been identified as a priority.

In summary:

***Issues:***

- Population growth has been substantially above the regional and national forecasts;
- Over 2,000 households are on the affordable housing waiting list;
- Delays to buses resulting from congestion have continued to increase;
- The delivery of the sub-regional strategy is behind expectation which includes delivery of the NHRR; and
- North Hykeham suffers from considerable traffic congestion including:
    - At peak times around key junctions along Newark Road, Moor Lane, Chapel Lane, Meadow Lane and on Statin Road when the railway crossing is closed
    - Long Lane running through South Hykeham village is also being used as a 'rat run'.

***Objectives:***

- To assist the sustainable economic growth of Lincolnshire, and the wider region, through improvements to the transport network;
- Developing transport infrastructure to ensure Lincoln is connected both regionally and nationally;
- To reduce the negative impacts of through traffic, particularly heavy goods vehicles, in the centre of Lincoln;
- To deliver quality housing with an aim to achieve 2,000 new units (including the SWQ) by 2020; and
- Deliver the NHRR by 2026.

***Opportunities:***

- Delivery of the NHRR has been cited as an opportunity to create a full orbital road around the city.

### 3.2.4. Policy and Strategy Summary

In general national and regional policy documents state a need to address the following common themes:

- Improve strategic connectivity;
- Improve route capacity;
- Enable economic growth; and
- Deliver housing.

At the local level the key policies and strategies also align with the above themes while also highlighting more local issues such as 'rat running'. It also cites that NHRR will help address these issues.

## 3.3. EXISTING TRANSPORT AND TRAFFIC SITUATION

### 3.3.1. OVERVIEW AND CONTEXT

Lincoln's city centre currently suffers from high levels of congestion from local and strategic traffic movements which impacts on the quality of life for local residents, acts as a constraint on the economy and reduces the attractiveness of the city for visitors and investors. There are a number of longstanding transport and travel problems including the lack of alternative river crossings, a lack of route choice means that strategic traffic, including large numbers of long distance HGVs, use a limited number of routes to travel through and around Lincoln. This intrusion of strategic traffic in the city centre has been identified as a key constraint on Lincoln's continued success and a key driver for the promotion of the LITS.

The delivery of the LEB which is currently under construction will have a significant impact on transport and travel in Lincoln. It will improve north-south route choice through providing a new bypass around the eastern side of the city and reduce congestion and traffic within the centre of Lincoln – particularly along the existing A15. However, there will be a number of residual issues and constraints that are identified by LITS, that are likely to require further intervention to resolve.

***Greater Lincoln Area – Overview of Existing Traffic Problems***

The key traffic-related problems in the Lincoln area outlined in LITS are set out below:

- A lack of route choice has long been identified as a severe problem for north-south and east-west movements in the Lincoln area.
- The lack of route choice results in poor network resilience when incidents occur, exacerbating congestion problems.
- A number of key sub-regional strategic north-south routes converge on Lincoln city centre and with no viable alternatives this results in significant levels of strategic through traffic, including HGVs, being forced to route through the constrained historic centre of Lincoln.
- East-west movements, particularly in the southern Lincoln area are limited restricting

***North Hykeham Relief Road Locality – Overview of Existing Traffic Problems***

LITS also identified a number of network-specific problems in the locality of the proposed NHRR. Despite the delivery of the LEB these issues are expected to act as a constraint and affect Lincoln, they are as follows:

- The main east-west route to the immediate south of Lincoln city centre presently runs through the residential area of North Hykeham. This situation is unpopular amongst people living here. Traffic signal changes have improved safety at many junctions but have increased congestion.
- The Western Relief Road does not provide a suitable connection to the A15 to the south of the Lincoln urban area, causing traffic on the A607 Grantham Road and A15 Sleaford Road to pass through Lincoln or to travel on unsuitable local roads to the south of urban area. The combination of locally generated and through traffic has led to congestion, delays and severance with negative environmental and social impacts.

## 3.4. EXISTING ROAD NETWORK AND LEVEL OF SERVICE

### 3.4.1. Network Function

The existing road network in Lincoln consists of a number of regionally important routes through and around the city, as well as major routes into the city centre and local roads.

The main orbital and strategic routes include the A46 Western Relief Road/Northern Relief Road which forms part of the Highways England (HE) network, the A57 Saxilby Road/Carholme Road on the western side of Lincoln which provides a key east – west route into the city, the A15 which provides a major north south route through Lincoln and provides a link to the Humber Ports and the A1434 which again provides a route into the city from the south west and passes through several residential areas including North Hykeham.

There are also a number of other major routes which provide links to the city centre and the surrounding towns and villages. These include the A607 Grantham Road this also provides access to RAF Waddington, B1190 Doddington Road and B1378 Skellingthorpe Road which provide radial routes into Lincoln on the western side of the city and B1308 Greetwell Road, B1190 Washingborough Road and B1188 Lincoln Road which provide radial routes into Lincoln on the eastern side of the city.

The network to the south of Lincoln consists of several rural and local routes which connect the villages to the major routes and roads in the area. These include Blackmoor Road / Station Road, a rural east west route through the villages of Auborn and Harmston and Brant Road which provides a north south route into Lincoln.

Figure 2 provides an overview of the major routes and the network within the area and Appendix B presents the key strategic, regional and local functions for each route.

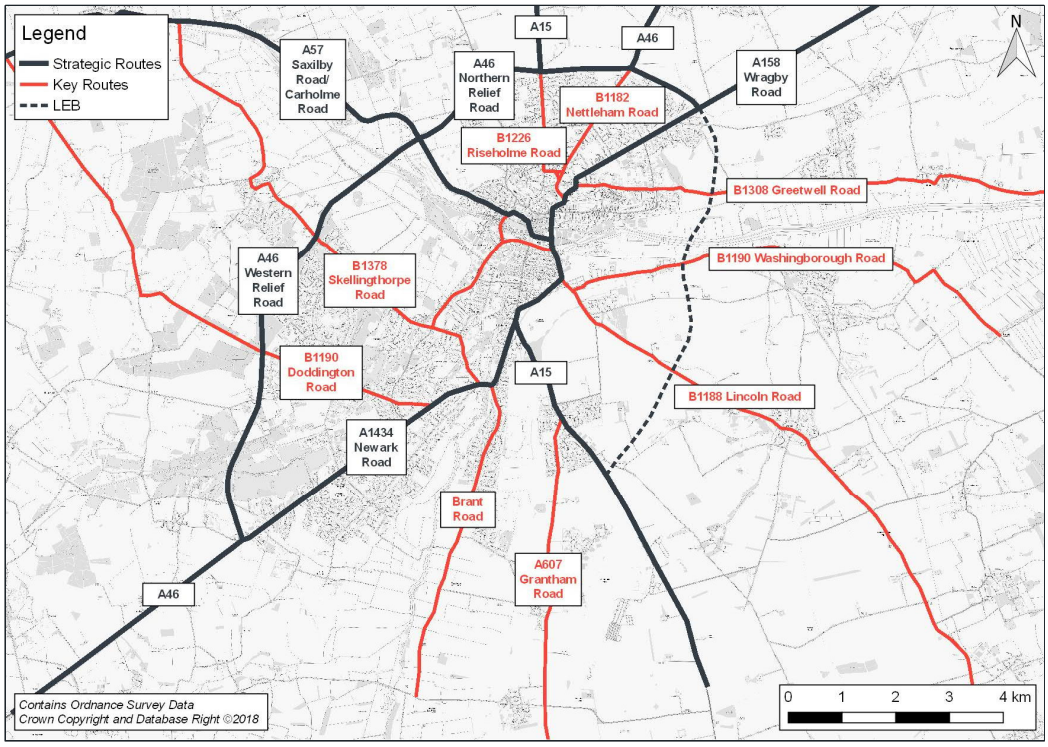



**Figure 2 - Strategic and key routes**

### 3.4.2. Highway Standard

As described in the previous section there a number of important strategic and local routes which cross and converge on Lincoln. The existing capacity of these routes has an impact on the performance of the network. Figure 3 and Table 2 summarise the capacities and characterics of these routes and highlights the limited nature of the current provision.

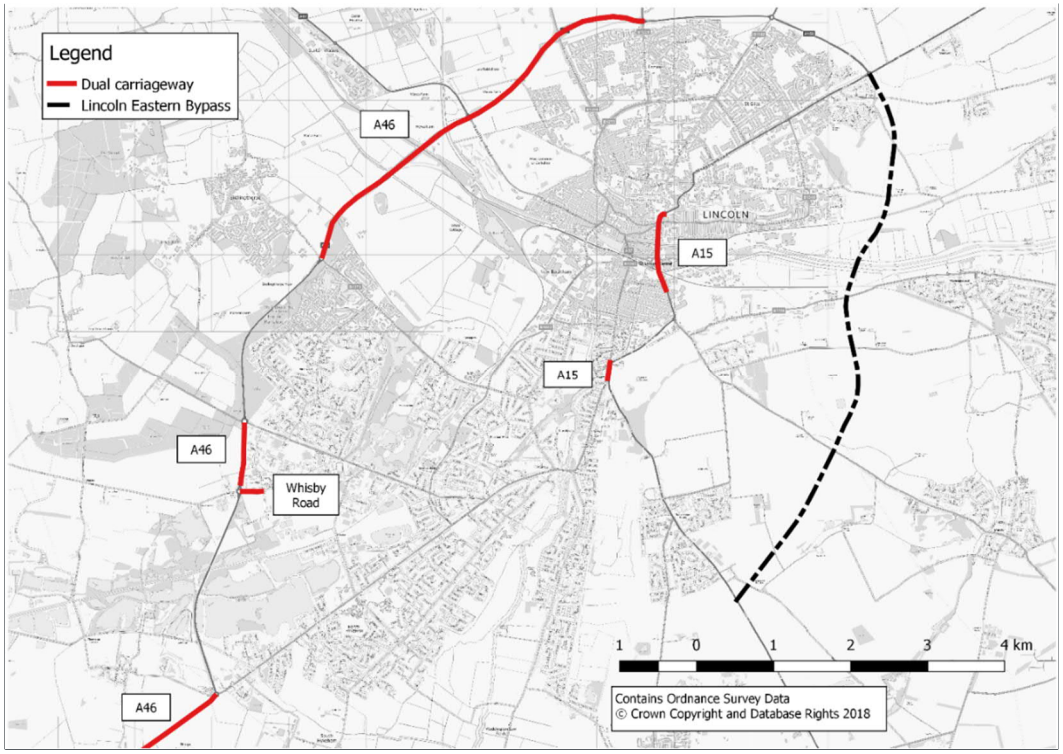



**Figure 3 – Dual carriageway sections of existing network**

**Table 2 - Network Standards**

| Function | Route | Road Type | Overview & Summary |
|---|---|---|---|
| Strategic Route Network | A46 | Dual / Single Carriageway | - Dual carriageway on approach to Pennell's Roundabout<br>- Mixture of single and dual carriageway sections on the western and northern relief road.<br>- Southern sections bounded by Nature Park and drainage features |
| Major Road Network | A57 Saxilby Road / Carholme Road | Single Carriageway | - Mixture of rural and urban single carriageway |
| | A15 | Dual / Single Carriageway | - Rural / urban single carriageway on approach to Lincoln from both the north and south.<br>- Urban dual carriageway through central Lincoln |
| | A1434 Newark Road | Single Carriageway | - Urban single carriageway route<br>- Properties front onto the carriageway |
| | A158 | Single Carriageway | - Rural single carriageway |
| | A607 Grantham Road | Single Carriageway | - Rural single carriageway on approach to Waddington<br>- Properties front onto the carriageway through Waddington and Lincoln |

| Function | Route | Road Type | Overview & Summary |
|---|---|---|---|
| Local Road Network – Key Routes | B1190 Doddington Road | Single Carriageway | - Rural single carriageway east of junction with A46<br>- Urban single west of junction with A46 |
| | Whisby Road | Dual / Single carriageway | - Short dual carriageway section on approach to Teal Park<br>- Single carriageway to the east and west of Teal Park |
| | B1378 Skellingthorpe Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | B1398 Burton Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | B1226 Riseholme Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | B1182 Nettleham Road | Single Carriageway | - Urban single carriageway |
| | B1188 Lincoln Road | Single Carriageway | - Rural single carriageway sections |
| | B1190 Washingborough Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | B1308 Greetwell Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | Brant Road | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | Meadow Lane | Single Carriageway | - Mixture of rural and urban single carriageway sections |
| | Blackmoor Road / Station Road | Single Carriageway | - Rural single carriageway |

There are a number of physical constraints and features which have an impact on the transport network within Lincoln. The most significant relate to the location of the rivers, watercourses and rail infrastructure.

Lincoln is bisected by the River Witham and Fossdyke Navigation which cut through the city in both east-west and north-south direction (see Figure 4).

These act as a significant constraint to transport network as there are limited crossing opportunities of the both the river and the Fossdyke Navigation. In the centre of the city this is limited to the B1272 Brayford Way, A57 Wigford Way and the A15 Broadgate / Melville Street and the LEB, once complete. There are however even fewer opportunities to cross the river in the south of Lincoln and these include a number of relatively minor routes that are particularly unsuited to strategic traffic. They include the B1003 Rope Walk to the south of the city centre, Boultham Avenue and the B1360 Dixon Street - both minor residential roads, the A1434 Newark Road and Meadow Lane – a minor rural road in North Hykeham.

In addition the railway lines also bisect the city (see Figure 4). These run east-west through the centre of Lincoln and in a north-south direction through Hykeham. The road network crosses the railways via a series of overbridges (A46, B1273 Brayford Way, A15 Cabwick Road, Greetwell Road) and level crossings (Brayford Wharf East and High Street in the centre of Lincoln and B1738 Skellingthorpe Road, B1190 Doddington Road, Station Road and Thorpe Road to the south of the city centre).

There are again limited opportunities to cross the rail infrastructure and the location and number of level crossings also has a further constraining effect on the network for both strategic and local movements across Lincoln.

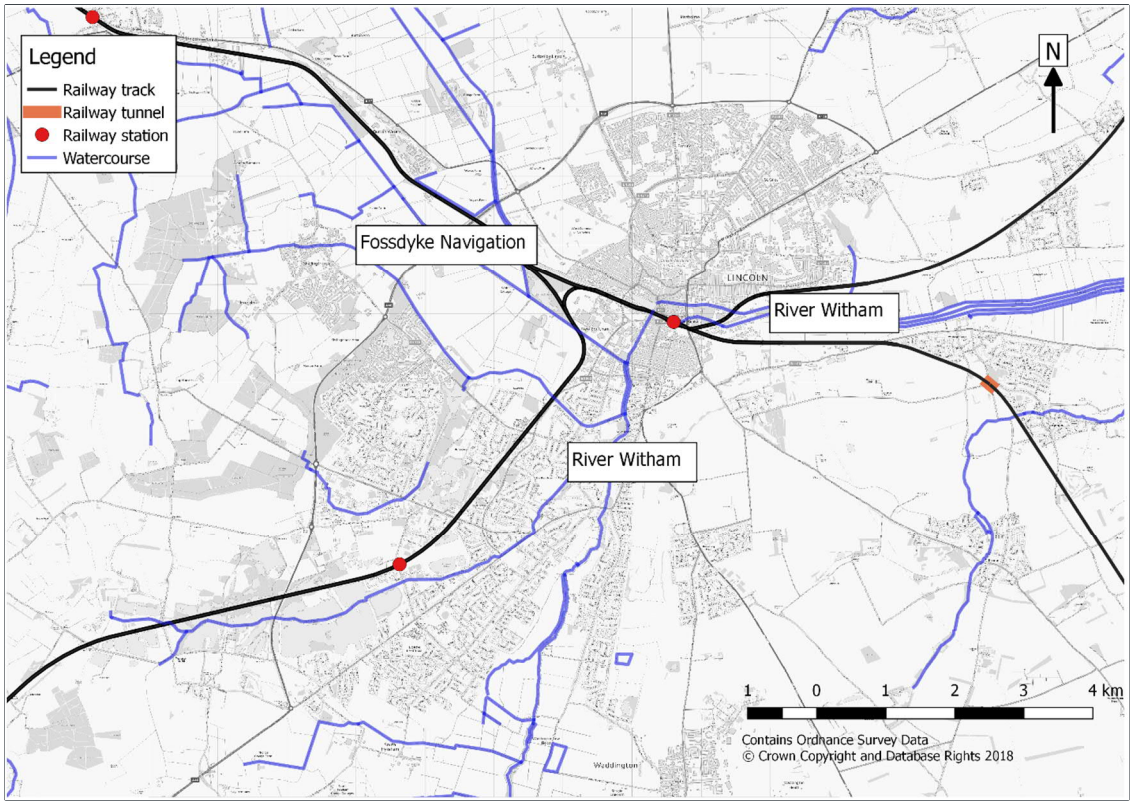



**Figure 4 – Constraints and features impacting on the transport network**

### 3.4.3. Route Choice

The existing principal road network as illustrated in Figure 2 currently has a number of limitations. North-south traffic has limited route choice, especially in the south of the Lincoln Urban Area, with traffic forced to use either the A46 or A1434 and A15 to pass by or through the city.

The introduction of the LEB will significantly improve the north-south connectivity and help to remove north-south traffic from the centre of Lincoln. However even with the introduction of the eastern bypass there will continue to be a lack of east-west connectivity in the south of Lincoln. Traffic travelling from the south west of Lincoln will still be required to use either to A46 or A4134 to travel through or around the city.

The A46 / A15 is also key alternative route from the A1 north through to the nationally important Humber Ports of Grimsby, Immingham and Hull. The A1 / A1M / M180 is a longer route to the ports

and although more direct the A46 / A15 is constrained by existing congestion at key junctions and links around Lincoln.

There are also limited crossing opportunities of the River Witham and the Fossdyke Navigation in Lincoln. In the centre of the city this is limited to the B1272 Brayford Way, A57 Wigford Way and the A15 Broadgate / Melville Street and the LEB, once completed. There are however even fewer opportunities to cross the river in the south of Lincoln and these include a number of relatively minor routes that are particularly unsuited to strategic traffic. They include the B1003 Rope Walk to the south of the city centre, Boultham Avenue and the B1360 Dixon Street - both minor residential roads, the A1434 Newark Road  and Meadow Lane – a minor rural road in North Hykeham.

These factors result in:

- significant volumes of traffic having to use unsuitable city centre routes; and
- East-west traffic using minor rural routes to the south of Lincoln.

This impacts on the City's historic core and the existing communities and residential areas located to the south of Lincoln. The routes are generally unsuitable for the heavy volumes of strategic traffic which is further exacerbated in that a relatively high proportion of strategic traffic consists of heavy goods vehicles.

Again although the introduction of the LEB will provide an additional crossing of the River Witham there will still be a limited number of crossings over the river. In addition the limited connectivity from the south west to the eastern side of the city will mean that some north-south traffic will still need to use the centre of Lincoln to cross the River Witham.

The combination of strategic through traffic coupled with locally generated trips has resulted in congestion and severance particularly south of the city centre. The lack of a strategic orbital connection from A46 Western Relief Road to the A15 results in traffic being forced to use overly complicated and protracted routes along unsuitable local roads, leading to relatively slow speeds and longer journey times, and impacts on rural and residential communities.

**There is limited route choice for north-south and east-west strategic traffic;**

**Once complete the LEB will significantly improve north-south connectivity, however there will continue to be limited route choice for east-west movements particularly in the south of the city;**

**This exacerbated by the limited number of crossings of the River Witham which results in strategic traffic being forced to use unsuitable routes and high levels of traffic travelling through existing residential areas.**

### 3.4.4. Resilience

The flow of traffic can be disrupted when incidents occur on the road network in the Lincoln area, particularly on the major routes, resulting in rerouting, longer journey times and associated congestion throughout the area.

The poor network resilience has a wide impact and affects movement of strategic and local traffic across the Lincoln network. The lack of alternatives to the existing orbital ring road and major routes through the city mean that that traffic is diverted through urban and residential areas which are unsuited to the additional volumes of traffic. This exacerbates the existing congestion problems

already affecting the major routes through the city. Figure 5 shows the official diversion routes during closures along sections of the A46 Lincoln Western Relief Road, the following should be noted:

- Closures between the Hykeham and Doddington Roundabouts causes the diversion of traffic on to the A1434 Newark Road which has many local accesses therefore creating numerous pinch points along the route. Traffic is then directed back towards the A46 along the B1003 Tritton Road and then on to the B1190 Doddington Road, both of which are narrow single carriageways and are not equipped to deal with large amounts of strategic traffic from the A46.
- If a closure occurs further north along the A46 between the Doddington and Skellingthorpe roundabouts, traffic is diverted either along the same section of the B1190 Doddington Road and on to the B1003 Tritton Road before heading back towards the A46 via the B1378 Skellingthorpe Road, or traffic is diverted along Birchwood Avenue which is a local access road. The former is a 7km diversion route which is likely to have a significant negative impact on journey times.
- Network resilience is heavily dependent on where the closure occurs, what time of day it occurs and the volume of traffic on the route at the time. Local traffic usually finds its way via local routes whereas strategic traffic is directed along the respective official diversion route provided.

There are high levels of seasonal traffic east-west which utilise Lincoln's road network to access the Lincolnshire Coast (predominantly the A46 / A15 / A158). In the event of an incident or closure on these routes there is little choise of suitable alterantives creating severe disruption. In addition, on the eastern side, in the event of a closure along the A15 between Bracebridge Heath and Coleby Heath, traffic is diverted on to sections of smaller local roads, including Heath Road, that are not suited to accommodate strategic traffic. A road closure here is also likely to have an adverse impact on the residents of Coleby where the diversion route merges on to the A607 passing through the village of Harmston and Waddington.

Closures elsewhere on the network also have the potential to impact on Lincoln. Incidents on the A1 also results in strategic traffic being diverted past Lincoln. This adds to the existing volumes of traffic and congestion problems and which is further exacerbated by the limited number of major routes in the area.

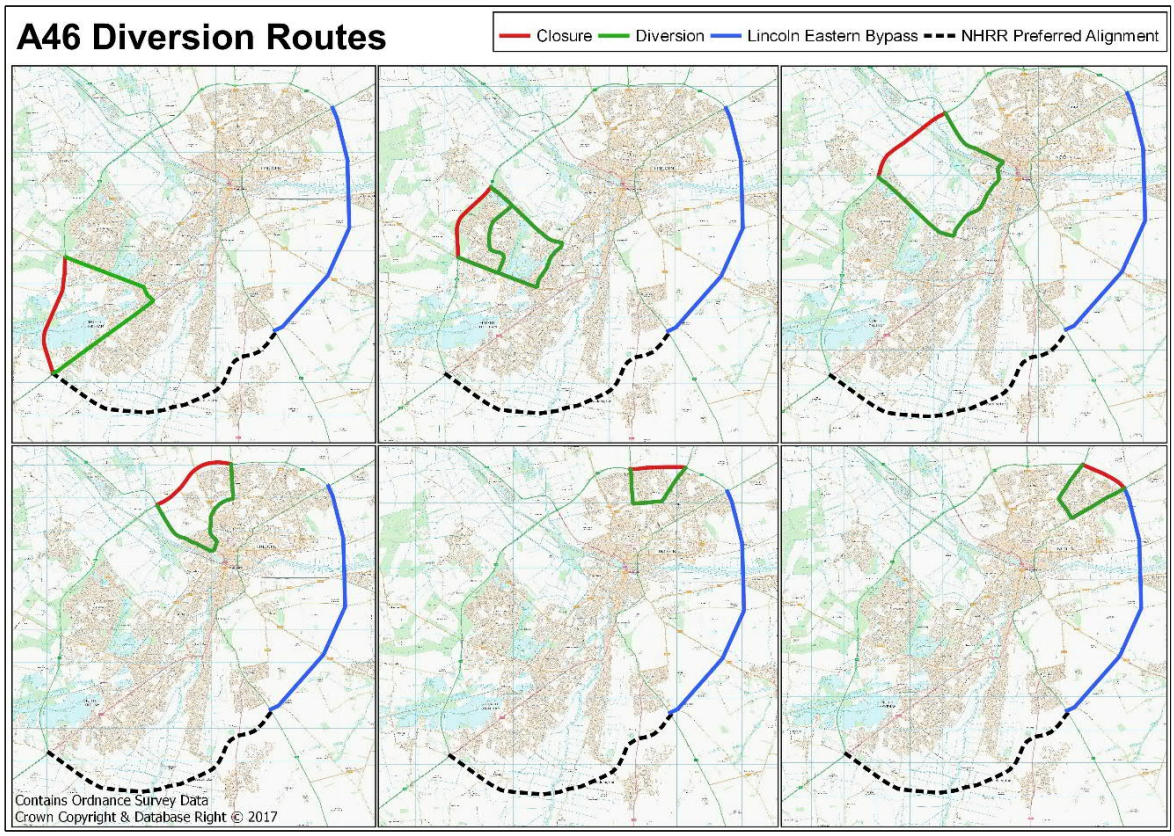



**Figure 5 – Diversion routes along A46 Lincoln Western Relief Road during closures**

**The network resilience of the A46 and A15 principal routes is poor, in that in the event of road closure there is no option but to divert strategic traffic via lower standard, unsuitable local routes adjacent to residential areas.**

### 3.4.5. Existing Public Transport Provision

In this section, the existing public transport provision in the south of Lincoln and wider Greater Lincoln area is described and discussed in terms of the network and services.

#### Local Bus Network & Services

The city of Lincoln is served by a comprehensive bus network that provides a broadly frequent service to a number of surrounding conurbations.

#### *Routes and Frequency*

There are a total of 19 bus services through Lincoln and and the NHRR study area. The routes are summarised in

Table 3 below, along with their respective weekday frequency. Many of these services operate along the major radial routes including the A15, A1435 Newark Road, A46 Lincoln Road, A158, A607 Grantham Road and B1378 Skellingthorpe Road as well as key local routes including Brant Road and Meadow Lane. These route currently experience significant congestion during peak periods.

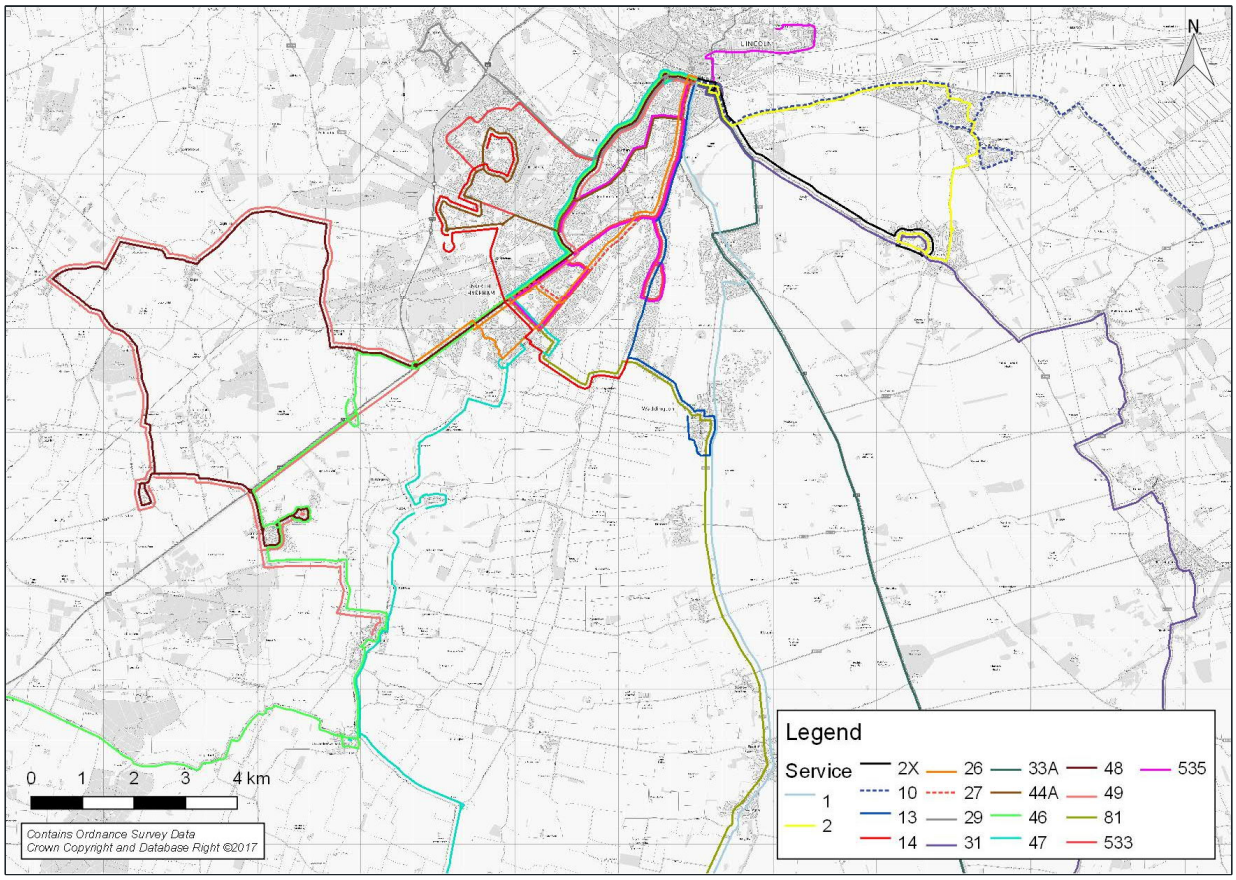



**Figure 6 – Lincoln Bus Routes**

**Table 3 – Lincoln Bus Routes**

| Service number | Route | Weekday frequency |
|---|---|---|
| 1 | Grantham – Lincoln (Stagecoach) | 30 minutes |
| 2 | Branston – Lincoln (Stagecoach) | 20 minutes |
| 2X | Branston – Lincoln (Stagecoach) | Daily |
| 10 | Lincoln – Horncastle | 2 hours |
| 13 | Lincoln – Waddington (Stagecoach) | 30 minutes |
| 14 | Lincoln – North Hykeham (Stagecoach) | 30 minutes |
| 26 | Lincoln – North Hykeham (Stagecoach) | 20 minutes |
| 27 | Lincoln – North Hykeham (Stagecoach) | 20 minutes |
| 29 | Lincoln – Skellingthorpe (Stagecoach) | 60 minutes |
| 31 | Lincoln – Sleaford (Stagecoach) | 2 hours |
| 33A | Lincoln – Sleaford (Centrebus) | Two journeys on Tuesday; One journey on Friday |
| 44/44A | Birchwood – Lincoln (Stagecoach) | 30 minutes |
| 46 | Lincoln – Newark (Stagecoach) | Two journeys each weekday |
| 47 | Lincoln – Newark (PC Coaches) | 3 hours |
| 48 | Lincoln – Witham St Hughes (PC Coaches) | 2 hours |
| 49 | Bassingham – Lincoln (PC Coaches) | 2 hours |
| 81 | N. Hykeham – Welbourn (Brylaine Travel) | One journey on schooldays only |
| 533 | Lincoln South Circular (Stagecoach) | One journey each weekday |
| 535 | Lincoln South Circular (Stagecoach) | One journey each weekday |

Although it can be seen from Table 3 that there are frequent bus services throughout the study area, it should be noted that services are heavily reduced on Sundays and during the evenings.

***Patronage***

The number of bus passenger journeys in Lincolnshire grew by almost 27% between 2005/06 and 2009/10 from 13.5 million to 17.1 million passengers. This growth was for a number of reasons including new routes introduced within this period (e.g. Louth to Grimsby, Lincoln to Scunthorpe via Gainsborough and Peterborough to Spalding corridors), the provision of improved bus information and improved public transport infrastructure delivered during the 2nd LTP period, to name a few. The growth in England over the same period was just 8%. Since 2008/09, bus patronage has remained relatively steady, and in 2014/15 there were a total of 16,300,000 passenger journeys.

### *Issues*

The Central Lincolnshire Local Plan reports on consultation/feedback from bus operators and states that they believe that congestion within Lincoln, particularly around the city centre and along the orbital routes, is acting as a constraint to further bus use growth which in turn, is leading to increased costs to maintain existing bus punctuality. Stagecoach have advised that "over the last 15 years bus running times have been increased by 25% simply to account for traffic delays". The unreliability of bus services in the city of Lincoln discourages people from using them and instead leads to increased use of the private car, thus exacerbating issues on the network.

**Congestion has been identified by operators as a significant constraint on bus operation within Lincoln.**

**Services operate along the major radial routes including the A15, A1435 Newark Road, A46 Lincoln Road, A158, A607 Grantham Road and B1378 Skellingthorpe Road as well as key local routes including Brant Road and Meadow Lane. These route currently experience significant congestion during peak periods.**

**Operators have stated that congestion around the city centre and along the orbital routes, is acting as a constraint to further bus use growth and leading to increased costs to maintain existing bus punctuality.**

### *Rail Network & Services*

The area to the south of Lincoln is served by four railway stations:

- Lincoln Central;
- Hykeham;
- Metheringham; and,
- Swinderby.

Lincoln train station is located within the city centre, a short distance away from the bus station, and can be accessed via the A57 (St Mary's Street). The railway line travels east-west through the city centre. The majority of A roads and B roads within the city centre cross the railway line via a bridge, with the exception of the B1262 (High Street), which requires a level crossing.

### *Routes and Frequency*

From Lincoln Central rail passengers are able to travel on direct services to Newark, Nottingham, Peterborough, Leicester, Sheffield, and Doncaster. Passengers can also reach Manchester by changing at Sheffield; Leeds by changing at Doncaster; and London Kings Cross via Newark Northgate.

Swinderby and Hykeham stations are both on the Lincoln – Nottingham line. Metheringham is on the Lincoln – Peterborough line, though a few northbound services continue on from Lincoln Central to Doncaster.

A summary of direct routes and service frequencies is provided in Table 4. It should be noted that on some routes it may be quicker to take a route involving a change that makes fewer overall stops between destinations.

### *Patronage*

Based on the data available, passenger rail usage at stations within the Lincoln area grew on average by some 6.8% between 2011/12 and 2015/16 (19.2% growth nationally), with passenger usage of Lincoln Central Station rising from 1.66m in 2011/12 to 1.75m in 2015/16. Passenger usage at Hykeham station, close to the route of the proposed NHRR, grew dramatically (over 100%), from 34,568 in 2011-12 to 71,056 in 2015-16. This increase is due to a number of factors including Access LN6 (now called Access Lincoln) which launched in 2012 and promoted sustianable transport to local businesses and residents. Furthermore free parking and new cycling storage at the station made it more accessibile.

Swinderby, despite an initial increase up to 2013/14 has since fallen to less than 70% of the 2011/12 passenger numbers. Patronage at Lincoln and Metheringham has fallen and then risen again, with Metheringham now at slightly lower patronage levels and Lincoln at slightly higher patronage levels than 2011/12.

**Table 4 – Lincoln Area Train Station Patronage**

| Station Name | 2011-12 | 2012-13 | 2013-14 | 2014-15 | 2015-16 | Percentage Change |
|---|---|---|---|---|---|---|
| Hykeham | 34,568 | 34,244 | 40,064 | 49,972 | 71,056 | 105.6% |
| Lincoln Central | 1,656,748 | 1,609,794 | 1,585,386 | 1,649,584 | 1,753,856 | 5.9% |
| Metheringham | 109,590 | 102,224 | 91,088 | 94,750 | 106,248 | -3.0% |
| Swinderby | 16,814 | 20,482 | 21,134 | 15,022 | 11,034 | -34.4% |
| Total | 1,817,720 | 1,766,744 | 1,737,672 | 1,809,328 | 1,942,194 | 6.8% |

Source: Office for Rail and Road (ORR)

### *Issues*

The presence of a railway line which dissects the city centre brings with it several issues which impact on the traffic flow through the area. Further to this, the two level crossings within the city centre, including the High Street railway level crossing, both adversely impact vehicular traffic and bus service reliability, creating a significant constraint to users. The crossing barrier downtimes are approximately 20 minutes per hour, which can significantly affect pedestrians, cyclists and vehicular traffic travelling through the city centre.

**Passenger use at Hykeham station has grown substantially over recent years indicating increasing travel demand in the area. Decreases in patronage at other stations including Lincoln Central indicates greater use and reliance on the private car.**

### *Public Transport Summary*

The key existing issues, discussed in this section, that are related to public transport in the Greater Lincoln Area are as follows:

- Bus patronage growth may be constrained by congestion which is resulting in unreliable services.
- There is a low frequency of bus services on Sundays and in the evenings.
- There is a lack of cross-city bus services, attributed to the constraints of the existing network.
- The railway network is relatively limited in the Lincoln area with no direct trains to London.
- Rail patronage has grown at Hykeham Station indicating growth in demand within this vicinity, whilst other stations may be underutilised.

**Existing Non-motorised user provision**

The existing infrastructure for pedestrians, cyclists and equestrians is discussed in the following sections. There are a number of Public Rights of Way (PRoW) within the south of Lincoln and this section discusses the characteristics of the PRoW network.

***Pedestrians***

Figure 7 shows the PRoW within the study area, the majority of these are grassed footpaths through fields or following hedgerows with some sections being dirt tracks/lanes. Notable PRoW within the study area include the bridleway from South Hykeham to Auborn and the nationally designated Viking Way which traverses 235km across Lincolnshire from the Humber to Oakham. These are both significant routes used for leisure purposes.

It is recognised in LCC's Rights of Way Improvement Plan (2014-2019) that walking and cycling to school is less common in Lincolnshire than nationally, likely to be reflected by the rural nature of the county and the relatively long journeys to school. The off-road network of PRoW is seen primarily as a recreational resource, with a higher proportion of walking taking place at the weekend. Walkers are entitled to use all types of PRoW, roads, access land and some other areas of public open space.

Congestion in the urban area of Lincoln, and particularly in the city centre, leads to the severance of several PRoW networks and therefore acts as a barrier to walking and other NMUs.

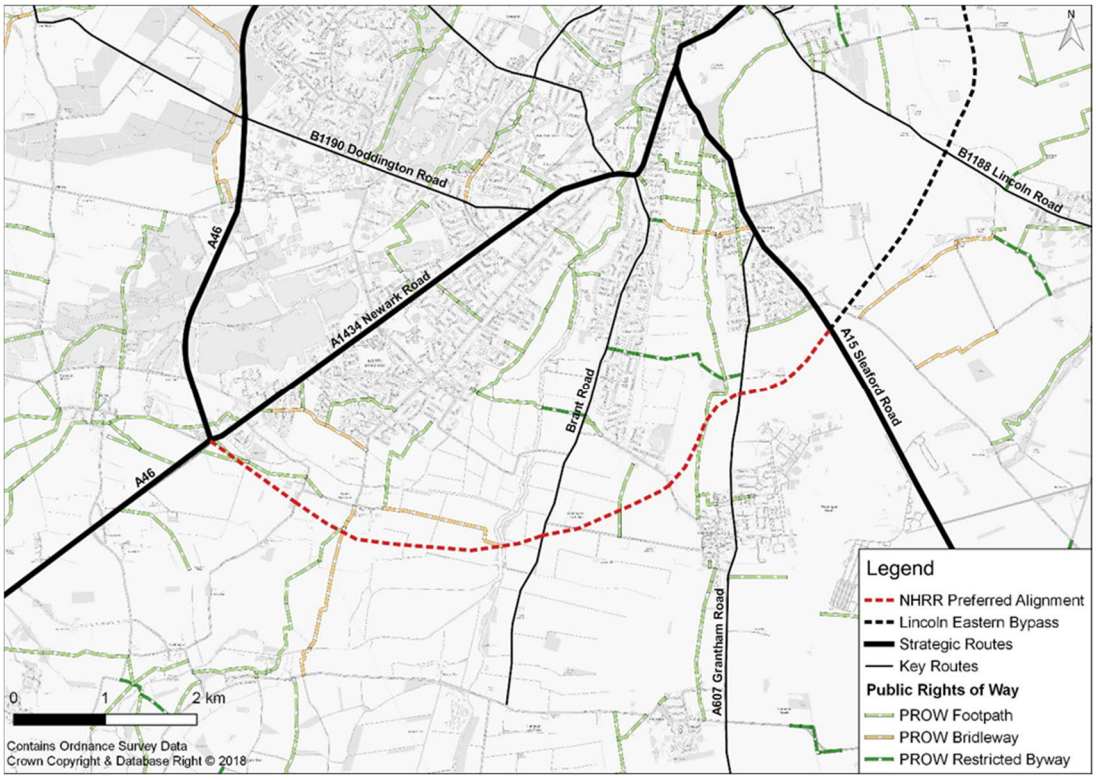



**Figure 7 – Public Rights of Way**

### Cycle provision

The existing designated cycle network within the study area (as shown in Figure 8) consists of Regional Route 93 which is an on-road section along Newark Road up to Bracebridge where the route continues into Lincoln city centre via a traffic-free route. Route 93 additionally diverts on-road up Fosse Lane to Whisby Nature Park. The Lincoln Eastern Bypass, which is currently under construction will be accompanied along its entirety by shared-use foot/cycleways.

As part of the Lincolnshire Local Transport Plan monitoring process, a total of 31 automatic cycle counters have gradually been installed across the county. Of these, 10 automatic counts, shown in Figure 9, are within the study area and these have informed an average daily cycle count within the study area at each of the count sites for each year from 2008 to 2017. Figure 10 identifies the average daily cycle flow in 2008 and 2017 to illustrate the change over this period. Year on year growth has been estimated by comparing a selection of those sites where there is at least 8 months comparable data with the previous year. This has then been converted into an index where the base year of 2008 = 100. Figure 10 illustrates that there has been a 5% increase over 10 years. Count data by site and by year can be seen in Figure 9.

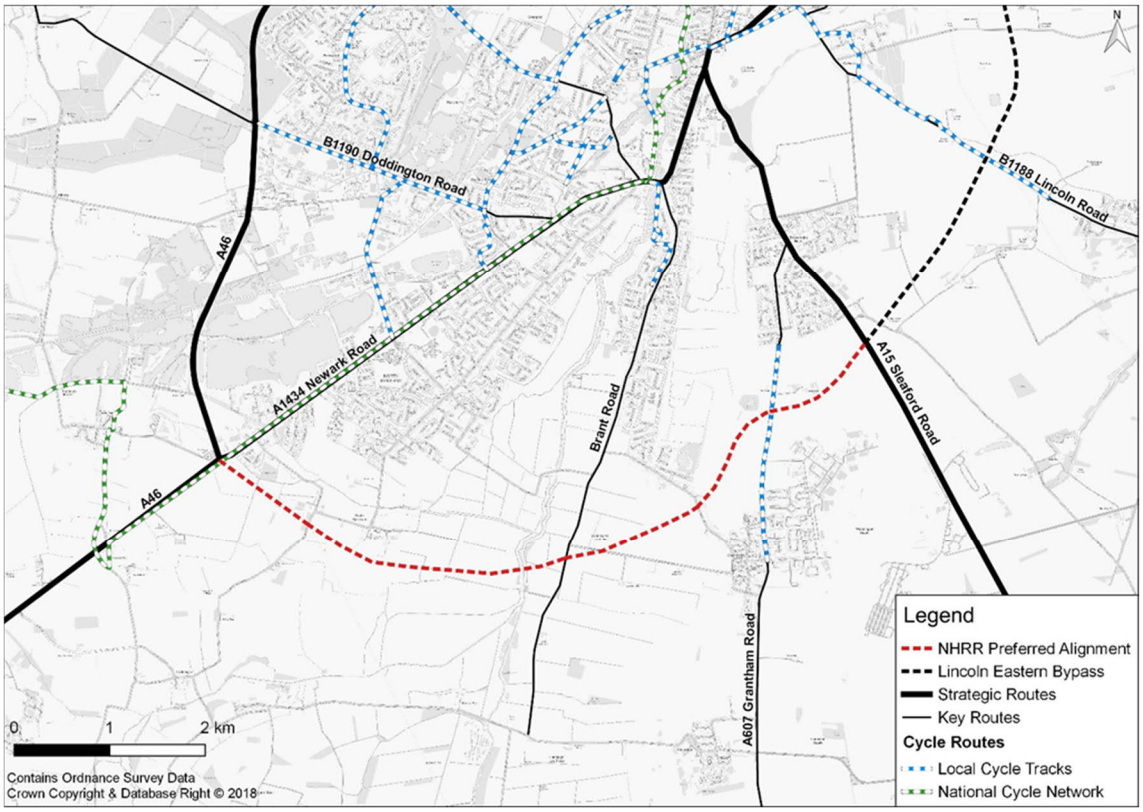



**Figure 8 – Existing Cycling Network**

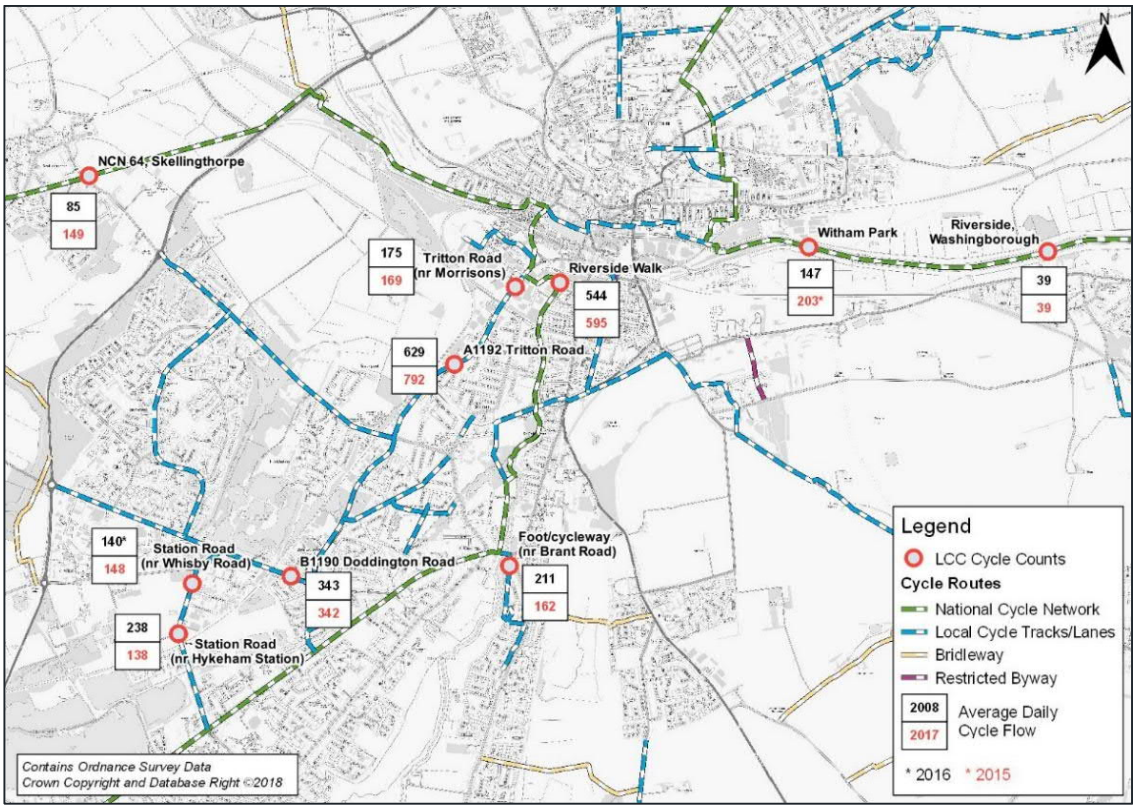



**Figure 9 – Lincoln Cycle Count Locations**

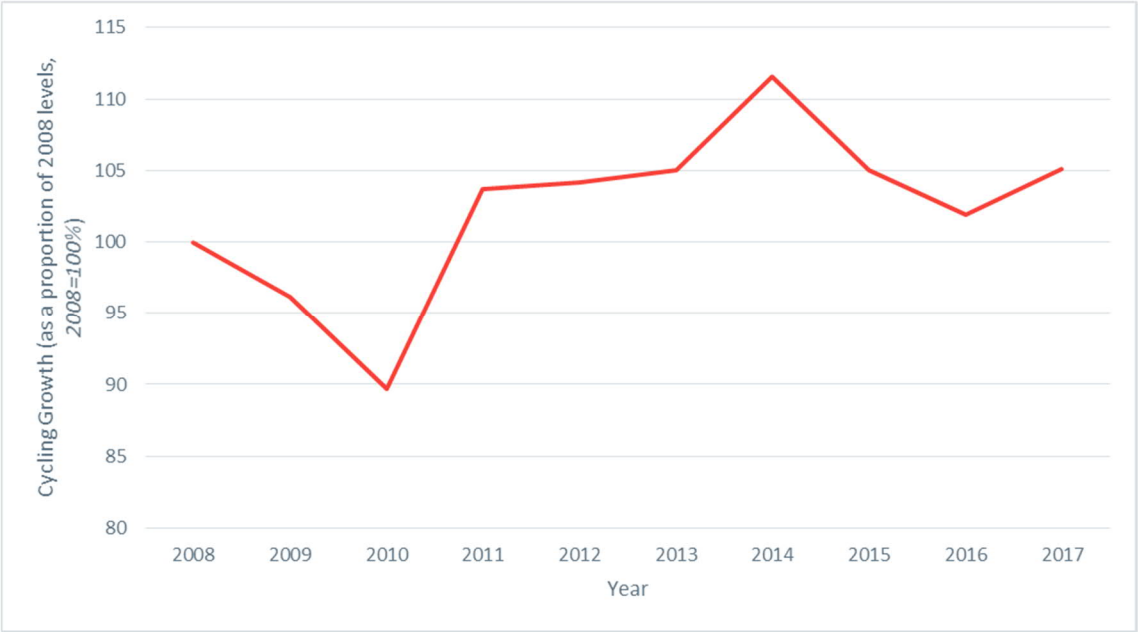



**Figure 10 – Lincoln Cycle Growth, 2008-2017**

**Congestion is a barrier to Non-Motorised Users in Lincoln due to severance and unattractiveness caused by high volumes of traffic.**

**There are several NMU routes within the study area, the most prominent of which is the Viking Way.**

**Whilst cycling levels have slightly increased, there are few existing designated routes within the study area.**

## 3.5. EXISTING TRANSPORT DEMAND

This section discusses motorised user travel demands on the current road network at both a strategic and local level.

### 3.5.1. Orbital & Major Road Network

Travel demand has continued to increase over the last few years both within rural and urban areas in Lincolnshire. The Lincolnshire Transport Monitoring Report (2017) shows that overall since 2012 (and the economic downturn) there has been a growth in vehicle kilometres travelled in Lincolnshire with an increase of 7% between 2012 and 2016 (similar to the national figure of 6.9%). This has continued to put the existing network under pressure particularly in Lincoln.

The scale of existing traffic flows on the network across Lincoln has been assessed using baseline traffic flows (2016) from the Greater Lincolnshire Transport Model. This has been presented as bandwidth maps for the AM Peak, Inter-Peak and PM Peak and shown in Figure 11, Figure 12 and Figure 13.

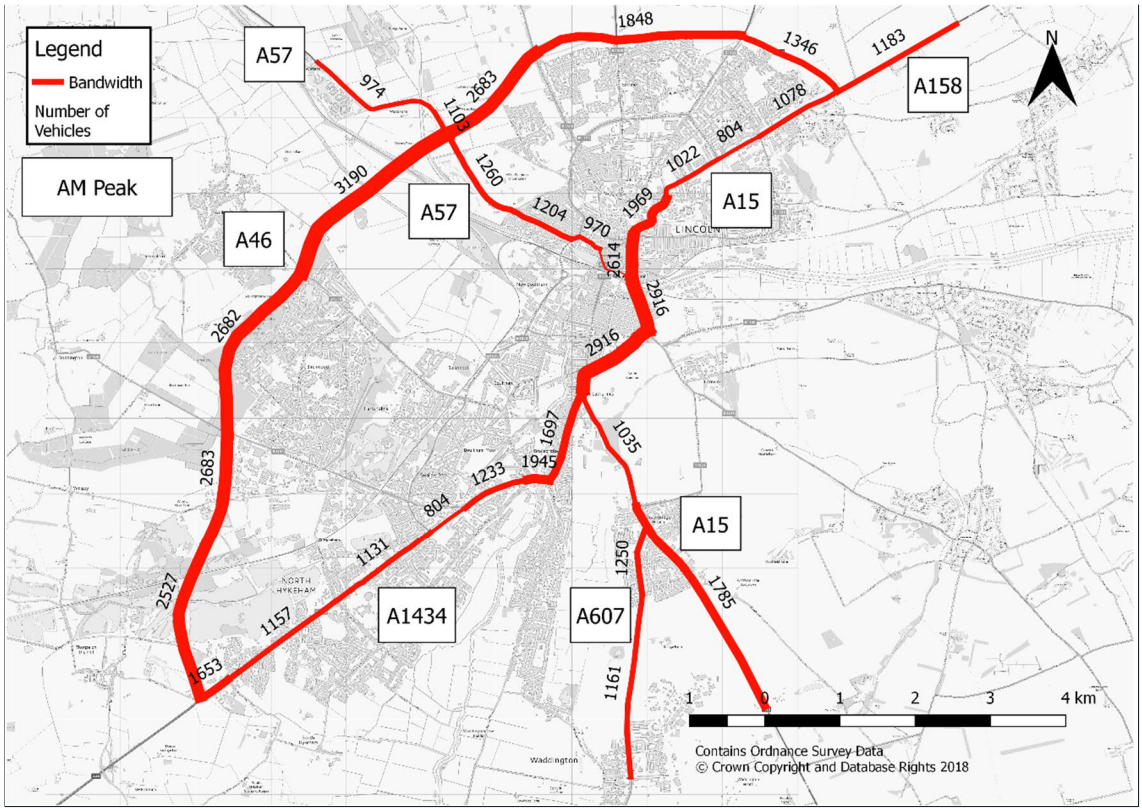



**Figure 11 – Bandwidth AM Peak (2016)**

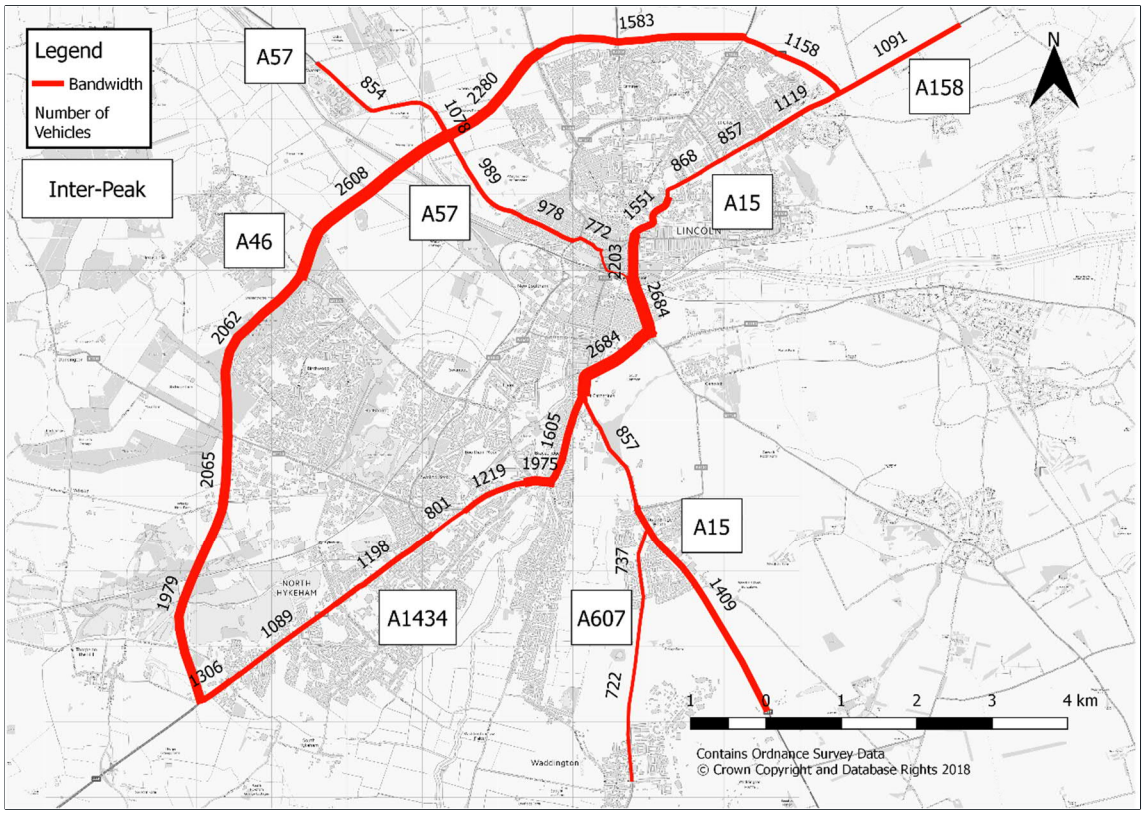



**Figure 12 – Bandwidth Inter-Peak (2016)**

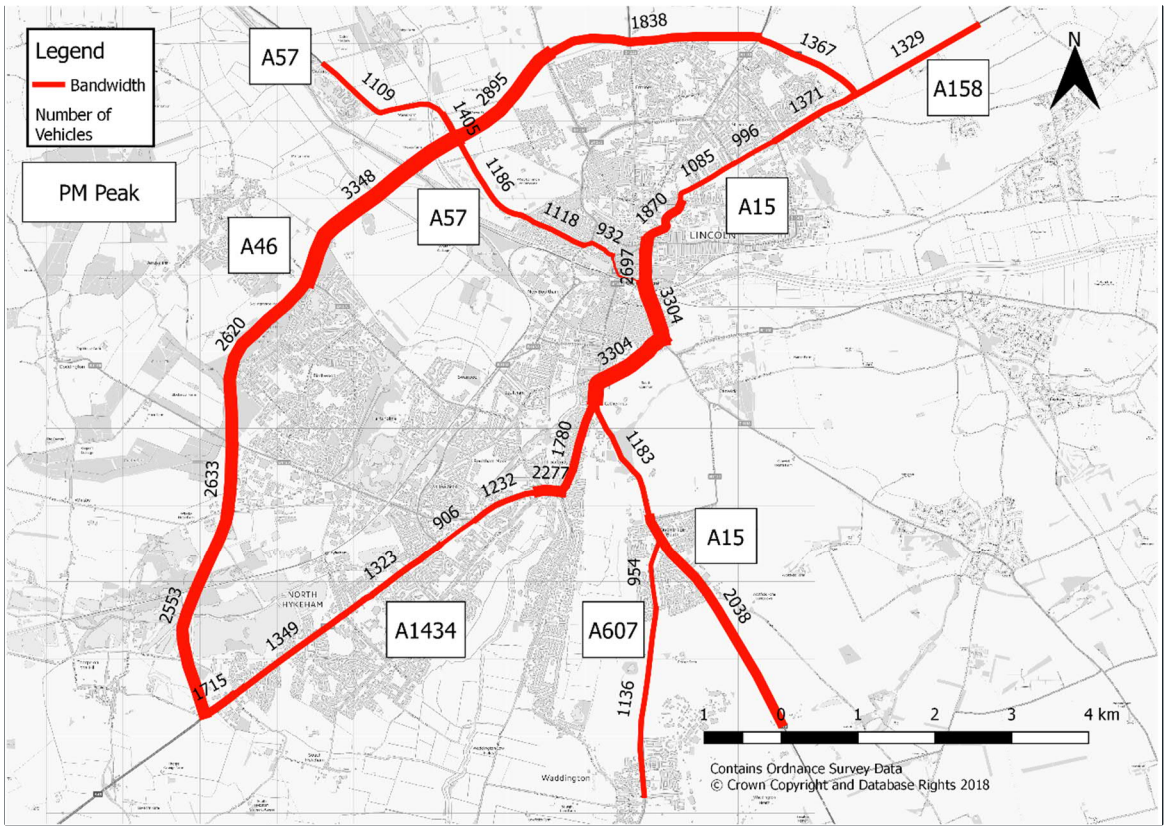



**Figure 13 – Bandwidth PM Peak (2016)**

Key observations from the baseline traffic flows include:

- **A46 Western Relief Road:** Traffic flows on the A46 range from 1,800 to 3,200 in the AM Peak; 1,600 to 2,600 in the IP; and 1,800 to 3,300 in the PM Peak. The section with the highest traffic flow is between A57 Saxilby Road and B1378 (AADF of 42,900) which is a dual carriageway section and the lowest flow is between Riseholme Road and the B1182 (25,100 AADF) which is a single carriageway section. Dual carriageway sections are between Whisby Road and Doddington Road; and between B1378 Skellingthorpe and the A15.

- **A57 Saxilby Road / Carholme Road:** Traffic flows range from 1,000 to 1,300 in the AM Peak; 900 to 1,100 in the IP; and 1,100 to 1,400 in the PM Peak. The section with the highest traffic flow is north of the A46 between Long Leys Road with an AADF of 17,000 vehicles. The section with the lowest AADF is north of Long Leys Road with an AADF of 13,900.

- **A15:** Traffic flows range from 800 to 2,900 in the AM Peak; 900 to 2,700 in the IP; and 1,000 to 3,300 in the PM Peak. The section with the highest traffic flow is between B1188 and A15 Melville Street which is a dual carriageway section which crosses the River Witham and has an AADF of approximately 42,400. The dual carriageway section starts from Portland Street to the south and ends at Lidlum Road to the north. The A15 will join to the north and south of the LEB. At the north it joins via Wragby Road East/A158 roundabout and to the south via A15 Sleaford Road. The lowest AADF of 13,000 is found on a single carriageway section between Ruskin Avenue and B1308 Outer Circular Road.

- **A1434 Newark Road:** Traffic flows range from 800 to 1,900 in the AM Peak; 800 to 2,000 in the IP; and 900 to 2,000 in the PM Peak. The section with the highest traffic flow is between Hykeham Road and Brant Road with an AADF of 29,900 and the lowest flow is between B1003 and Doddington Road with an AADF of 12,100.

- **A158:** Traffic flows range from 1,200 to 1,300 in the AM Peak; 1,100 to 1,200 in the IP; and 1,300 to 1,400 in the PM Peak either side of the Wragby Road East roundabout. The section with the highest traffic flow is between the A46 and Wragby Road East roundabout with an AADF of 18,400. To the north of Wragby Road East the AADF is 17,200.

- **A607 Grantham Road:** Traffic flows range from 1,200 to 1,300 in the AM Peak; flows of approximately 700 in the IP; and 900 to 1,100 in the PM Peak. The section with the highest traffic flow is between Waddington and Grantham Road with an AADF of 13,600 and to the north of this the AADF drops slightly to 13,400.

The above demonstrates that high demand on the existing network is not just limited to peak periods but also extends to the inter-peak, albeit this is not as high as the peak periods. To assess the reason for high flows on these routes particular links have been selected and analysed to see where people are travelling to and from. Full details of the select link analysis is presented in Appendix C. Key observations from the analysis include:

- A total of 15% to 20% of traffic utilising the A46 travels the full length of the orbital route indicating that these are strategic journeys which do not originate in and are not destined for Lincoln. The remainder of traffic which utilises the A46 orbital route dissipates into the urban area or originates from this area;
- The A1434 Newark Road forms a key radial route between the urban area of Lincoln and the A46. Select link analysis shows that the majority of traffic dissipates on/off Newark Road from/to the local road network. This indicates that the majority of journeys utilising Newark Road are destined for or originate from the urban area of Lincoln with around 30% travelling to/from the A46 south of Penells roundabout;
- Meadow Lane currently forms an important east-west link between the radial routes to the south of Lincoln and onto Sleaford Road. It is also the only crossing point of the River Witham to the south of Lincoln. As a result it caters for both local and non-local journeys due to a lack of alternative east-west routes to the south of Lincoln. The analysis shows that approximately 30% of traffic using Meadow Lane is using it as a through route and is travelling from and to areas outside of the Lincoln urban area; and
- The A15 Sleaford Road forms a key radial route to the south east of Lincoln. The vast majority of journeys originate from or are destined for the urban area of Lincoln.

***Traffic Growth in recent years (2012-2016)***

Figure 14 shows the change in two-way average annual daily flow (AADF) at DfT count sites around Lincoln's key road network between 2012 to 2016. It shows that since the economic downturn, traffic volumes on these routes have again started to increase. A total of 16 out of the 20 count sites have seen an increase over the period analysed. The scale of increase in traffic growth is as high as 13% at some locations over the four year period analysed. The most significant increases have been experienced along the A46 orbital route around Lincoln and the A1434 Newark Road which as

described earlier forms a primary radial route into the centre of the city from the south west of Lincoln through North Hykeham.

The level of traffic growth over this period is not limited to the strategic routes; the A607 Grantham Road is a key route on the local road network, serving a number of villages and providing access to RAF Waddington. The A607 experienced a 9% traffic growth at the Waddington site across the period up to 2016. It is noted that one count along the A607 route reported a slight reduction in traffic flow over the period studied, whilst the definitive reason for this is unknown, the movements of RAF Waddington i.e. the dispersing of the aircraft operating squadrons to other airfields from July 2014 could be a reason for a reduction in trips to/from the site impacting on this section of the A607.

Any continued increase in traffic flows on the major routes through and around Lincoln will continue to put pressure on the network and affect the wider aspirations for both economic and housing growth.

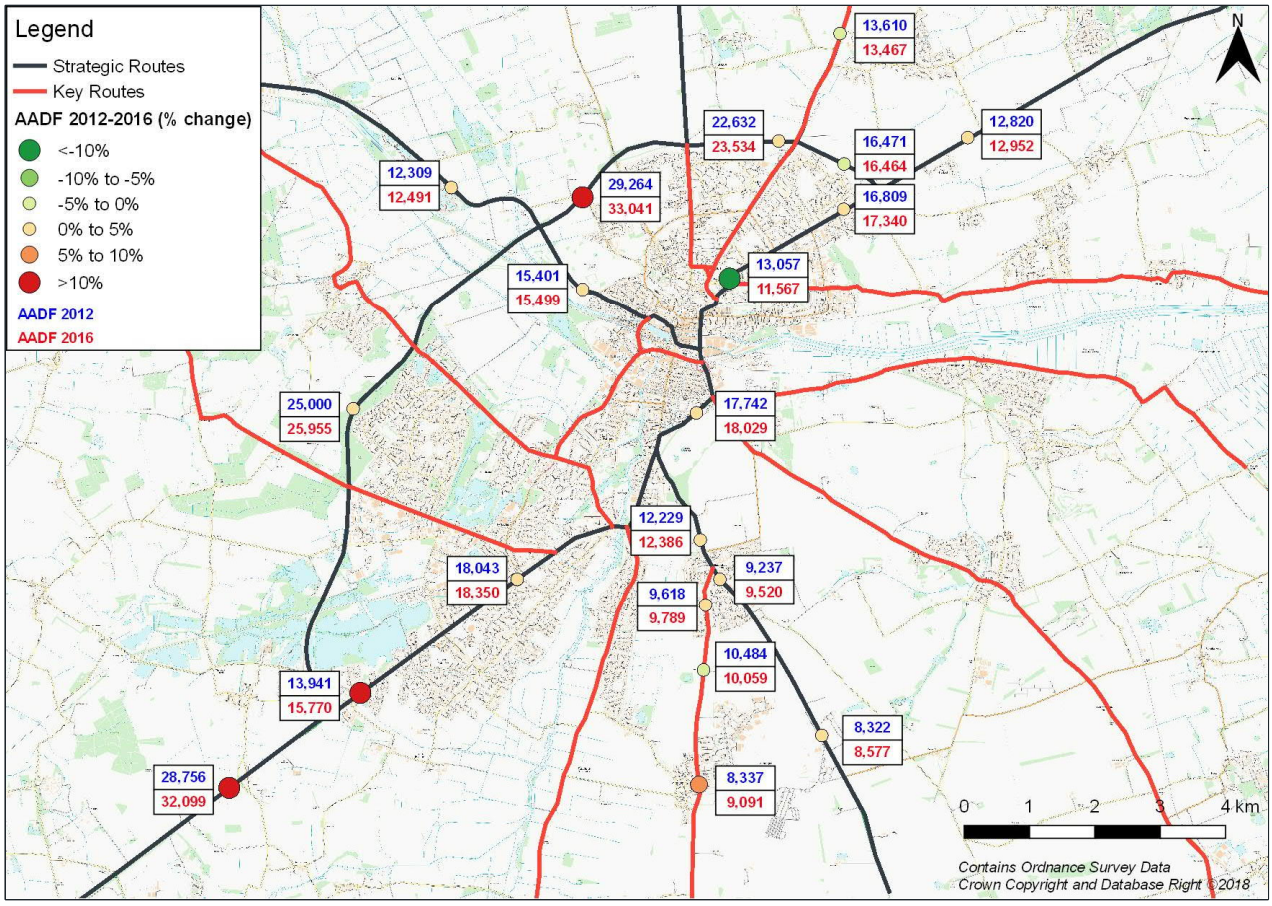



**Figure 14 – Lincoln AADF, 2012-2016**

Data source: DfT

### 3.5.2. Local Road Network

***Lincoln city centre***

As part of the Local Transport Plan monitoring process for the Greater Lincoln Area, annual cordon counts were established in Lincoln and around Lincoln. The cordon area and count points are shown in Figure 15.

Traffic surveys have been completed on an annual basis from 2006 to 2016. LCC undertakes surveys of inbound counts carried out between 7:00 am and 10:00 am on a typical weekday. These have been repeated on five different weekdays and then averaged. Surveys undertaken for 2016 have not been included within the analysis due to normal operation being disrupted for a number of reasons including:

- High Street was closed to traffic and pedestrianised between 10am and 4pm;
- Brayford Wharf East became one-way northbound;
- Opening of the East West link; and
- Surveys were disrupted by on-going construction of the new Lincoln Transport Hub which required the temporary closure of Norman Street and Oxford Street.

Consequently, in order to get a like to like comparison, 2016 data has not been utilised within this analysis. Figure 16 illustrates the traffic flows from the cordon surveys from 2006-2015.

This shows that there was a decrease in overall flow levels between 2008 and 2013 due to the effects of the economic downturn. However, since 2013 there has been an increase in inbound traffic flows into Lincoln city centre at an accelerated rate, it is forecast that this trend will continue particularly with the planned growth further details of which are summarised in Section 3.

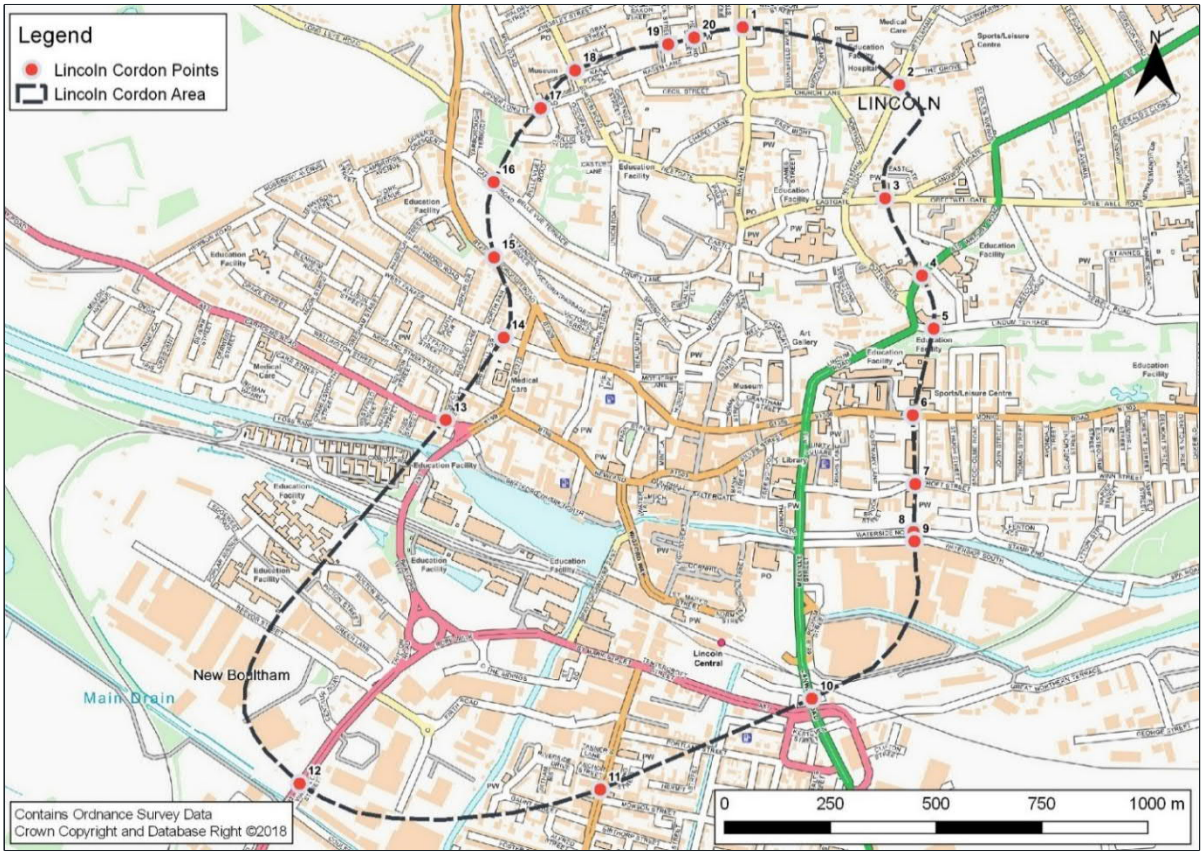



**Figure 15 – Lincoln Annual Cordon Survey**

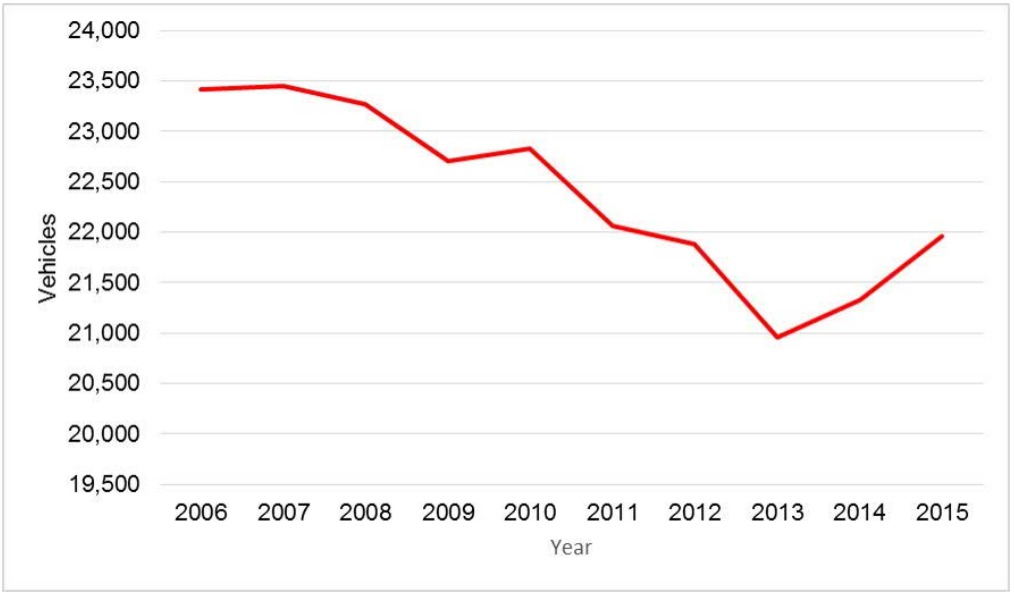



**Figure 16 – Lincoln Cordon Traffic Counts, Inbound AM Peak, 2006-2015**

***Traffic Flows in the Hykeham Area***

Whilst historic data for the local road network within North Hykeham is unavailable, a suite of surveys was carried out in November 2016 to inform the development of the Greater Lincoln Traffic Model, a number of which were undertaken in the North Hykeham area. The derived AADT flows from Junction Turning Counts (JTCs) is shown in the Figure 17.

Key points include:

- The A1434 Newark Road currently experiences traffic flows in excess of.17,000 vehicles/day. This is an urban single carriageway road which runs through a predominantly residential area with properties that front on to the carriageway;
- There are significant flows on the other key radial routes in the south of Lincoln that link into the city centre such as Brant Road, the A607 Grantham Road and Lincoln Road where current traffic flows range from 10,000 to 13,000 vehicles per day; and
- More localised east-west routes can also be seen to experience relatively high traffic flows for their characteristics, e.g. Moor Lane, Mill Lane and Station Rd (c10,000 vehicles/day).

The traffic data shows that a number of routes in the south of Lincoln are currently carrying at least 10,000 vehicles on a daily basis. These routes pass through built up residential areas, often with housing immediately adjacent to the highway. Settlements affected by significant levels of traffic include Bracebridge Heath, Bracebridge/Low Fields Swallow Beck, Boultham and North/South Hykeham. They are unsuitable for high volumes of traffic and are the result of limited route choice for both traffic travelling east west across the southern part of Lincoln and north south towards the city centre. Further details relating to rat-running traffic is provided in Section 2.6.8.

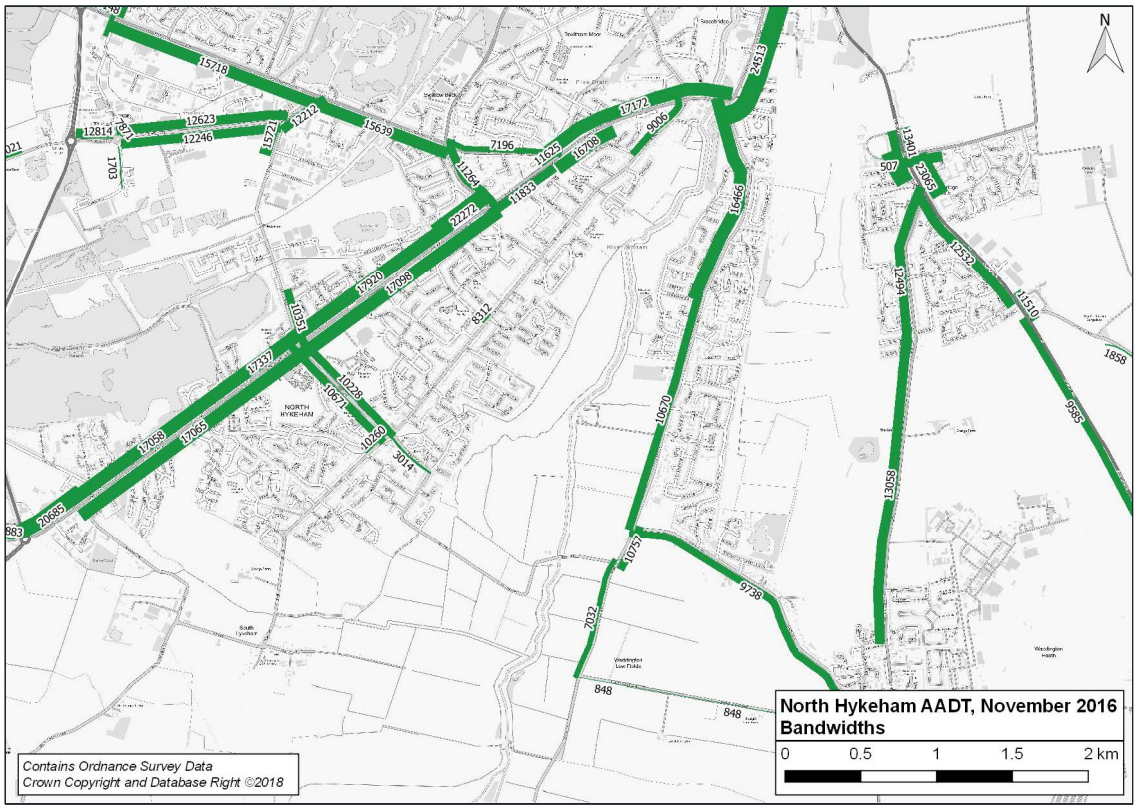



**Figure 17 – North Hykeham AADT, November 2016**

**On the Strategic and Major Road Network there are a several links that are currently carrying significant volumes of traffic:**

- **A46: In 2016 the AADF ranged from approximately 26,000 to over 42,000 and within the peak hours 1,800 to 2,900 . The highest traffic flow were found between the junction with Saxilby Road and the A15. From 2010 to 2016 the volume of traffic grew significantly on sections of the A46 with a 12.9% growth between Saxilby Road and the A15. The A46 is currently the only orbital route of Lincoln and therefore provides a key route for strategic traffic.**
- **A15: In 2016 AADF on the single carriageway sections to the south of Lincoln ranged from approximately 8,500 to over 12,400 and within the peak hours 800 to 3,300. DfT counts show a steady growth of traffic of around 3% from 2010 to 2016. Crucially the A15 will provide a link on to the southern and northern sections of the LEB. It currently fuctions as a key radial route into the city centre from the south east of Lincoln.**
- **A1434: In 2016 the AADF ranged from approximately 16,000 to over 18,000 and within the peak hours 800 to 2,200 . DfT counts show in parts a significant growth in traffic from 2010 to 2016 of over 13%. It currently functions as a key radial route between the city centre and the A46 where a high proportion of traffic utilises the route for access to/from residential areas in the urban area of Lincoln.**

**The assessment has shown:**

- **The highest current traffic flows and the largest increase in flows has been on Lincoln's orbital and major routes (A46, A15 and A1434).**
- **Traffic volumes including commuter traffic flows into Lincoln city centre are increasing again following the economic downturn.**

**On the local network several routes in the Hykeham area experience relatively high traffic volumes for their design standard, this can be attributed to the lack of east-west and north-south connectivity. Key points include:**

- **Moor Lane, Mill Lane and Station Road carry circa 10,000 vehicles/day. Critically these routes pass through residential areas, often with housing immediately adjacent to the highway.**
- **Meadow Lane currently forms an important east west link between radial routes to the south of Lincoln and is the only crossing point of the River Witham to the south of Lincoln. Without another viable alternative Meadow Lane will continue to carry significant voulmes of traffic compared to its design standard.**

## 3.6. EXISTING TRANSPORT PROBLEMS

This section discusses the impact of the current levels of motorised travel demand on the highway network. A range of traffic indicators are used to present this impact.

### 3.6.1. Overview and Context

The level of motorised user demand discussed in the previous section manifests in congestion particularly in the urban area of Lincoln. Congestion on the orbital road network, city centre and on the local road network, leads to longer and less reliable journey times for all road users, and also exacerbates environmental issues relating to air quality, noise and severance.

Traffic conditions have significantly deteriorated on the Western and Northern Relief Roads since their construction in the 1980s, with significant peak period congestion experienced on a number of links and at several junctions. This is likely to worsen over the next 20 years due to the planned growth in Central Lincolnshire as set out in the CLLP, and in neighbouring authorities as set out in other emerging Local Plans.

As described in the previouse section there are limited opportunities to cross the River Witham and Fosssdyke Navigation within Lincoln. These are confined to A46, Brayford Way on the western side of the city and Wigford Way and Bradgate in the centre of Lincoln; there isn't another crossing on the eastern side for some 18 miles. In the south of the city river crossings are limited to Meadow Lane in North Hykeham and Bridge Road in Auborn. Both are minor rural routes.

The limited number of routes for strategic traffic and river crossings results in strategic traffic having to travel through the centre of the city, through the main built up area of Lincoln adding to the issues of frequent delays, congestion, severance and subsequent environmental and safety impacts.

### 3.6.2. Link Capacity

An assessment of existing link capacity has been completed on the Lincoln area road network for the AM and PM peak. Volume to Capacity Ratio (VoC), is a measure of the capacity of a road in terms of the number of vehicles using the road divided by the number of vehicles which could theoretically use the route. Where the VoC is less than 1.0 or 100%, there is reserve capacity on the road.

Figure 18 and Figure 19 present the link Volume to Capacity Ratio (VoC) for the existing network (2016), for both peak periods. The colour shading highlights the VoC in the form of a traffic light system, where green represents links with traffic volumes generally within practical operating capacity and the closer the link is to its practical operating capacity the more red the link is coloured. The figures also show the actual flows on each link.

Figure 18 illustrates that the single carriageway sections of the A46 Western Relief Road (WRR) are clearly operating close to or at capacity, particularly the stretch between Junction 3 (Doddington Roundabout) and Junction 4 (Skellingthorpe Roundabout) where the volume capacity ratio (VoC) is between 85% and 100%. In addition the northbound lane between Pennell's roundabout and the Whisby Road junction is operating at 92% capacity which indicates clear issues for northbound traffic during the AM peak.

Several local roads within the city centre and to the south of the city have high traffic flows with Meadow Lane westbound operating at 81% capacity - this route provides a key route across the River Witham in the south of Lincoln.

Figure 19 indicates that in general the same capacity related issues are present on the network for road users during the PM peak. Sections of the A46 WRR are operating close to or above the 85% - 100% threshold. It is also evident that more links in the city centre appear to be operating close to capacity during the PM peak including the A15/B1188 Canwick Road and B1003 Silver Street.

Notably, the eastbound lane on the A46 Northern Relief Road between the A15 and A46 Welton Road junctions is operating at 80% capacity which also suggests issues during the PM peak for traffic heading out of the city centre.

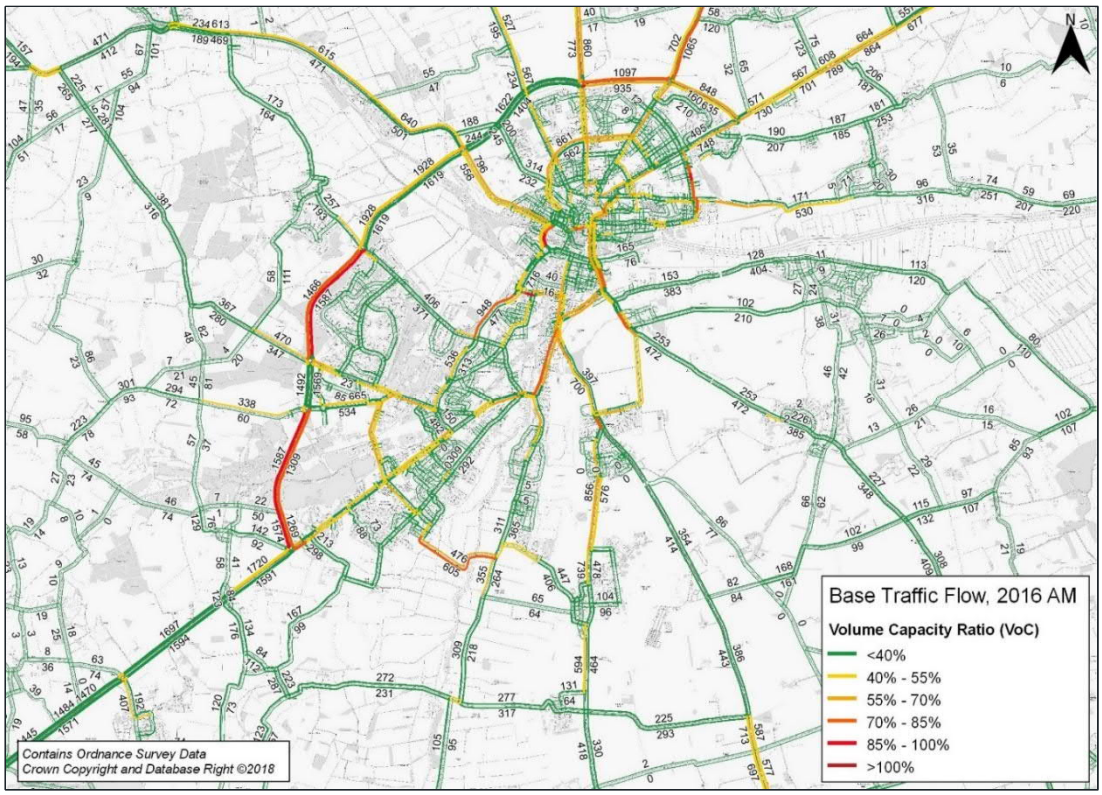



**Figure 18 – 2016 Base Year Volume to Capacity Ratio, AM**

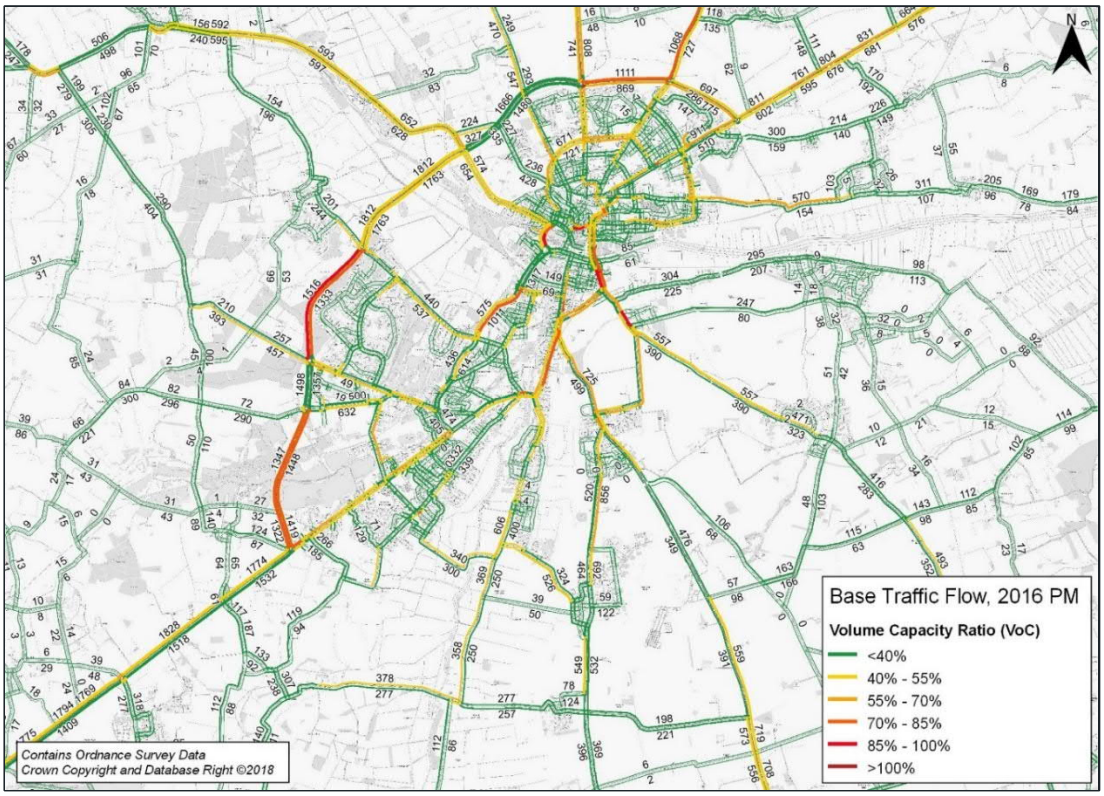



**Figure 19 – 2016 Base Year Volume to Capacity Ratio, PM**

### 3.6.3. Junction Volume Capacity Ratio

Volume capacity ratios have also been utilised to establish whether there are any existing junction capacity issues by looking at the VoC on the approach arms at several key junctions in the study area. Figure 20 and Figure 21 below show the maximum VoC at each peak at the assessed junctions. The junctions operating above 85% are:

- A46/Whisby Road
- A46/Doddington Road
- A46/Lincoln Road

The junctions approaching capacity (70-85%) are:

- A46/Newark Road
- A46/A158
- Newark Road/A15
- A15/Greetwell Road
- Greetwell Road/Ocd
- Skellingthorpe Road/Tritton Road
- Lincoln Road/Moor Lane/Chapel Lane

Junctions on the A46 see the greatest VoC ratio with several junctions operating close to or above the 85% threshold. Junctions on the A15 in the city centre were also observed to be approaching the 85% threshold. It is reasonable to presume that increasing growth across Lincoln in the future will contribute to increasing congestion at these junctions. A table providing the maximum VoC by junction in the existing peak periods can be found in Appendix D.

The results of the junction VoC analysis are also presented spatially below in Figure 20 and Figure 21. As can be seen in Figure 20 the junctions with capacity issues are located at the key entry points to the city centre including the A46 WRR junctions, A15/A1434, A15/Greetwell Road and Doddington Road/Tritton Road junctions. A similar situation is observed during the PM peak with the greatest effects seen on the orbital route junctions as traffic heads out of the city centre.

An alternative route to the WRR would deliver greater route choice and reduce the pressures of increasing levels of traffic at junctions across Lincoln at peak times which would lead to overall lower VoC ratios and therefore reduced congestion at these junctions at the peak times.

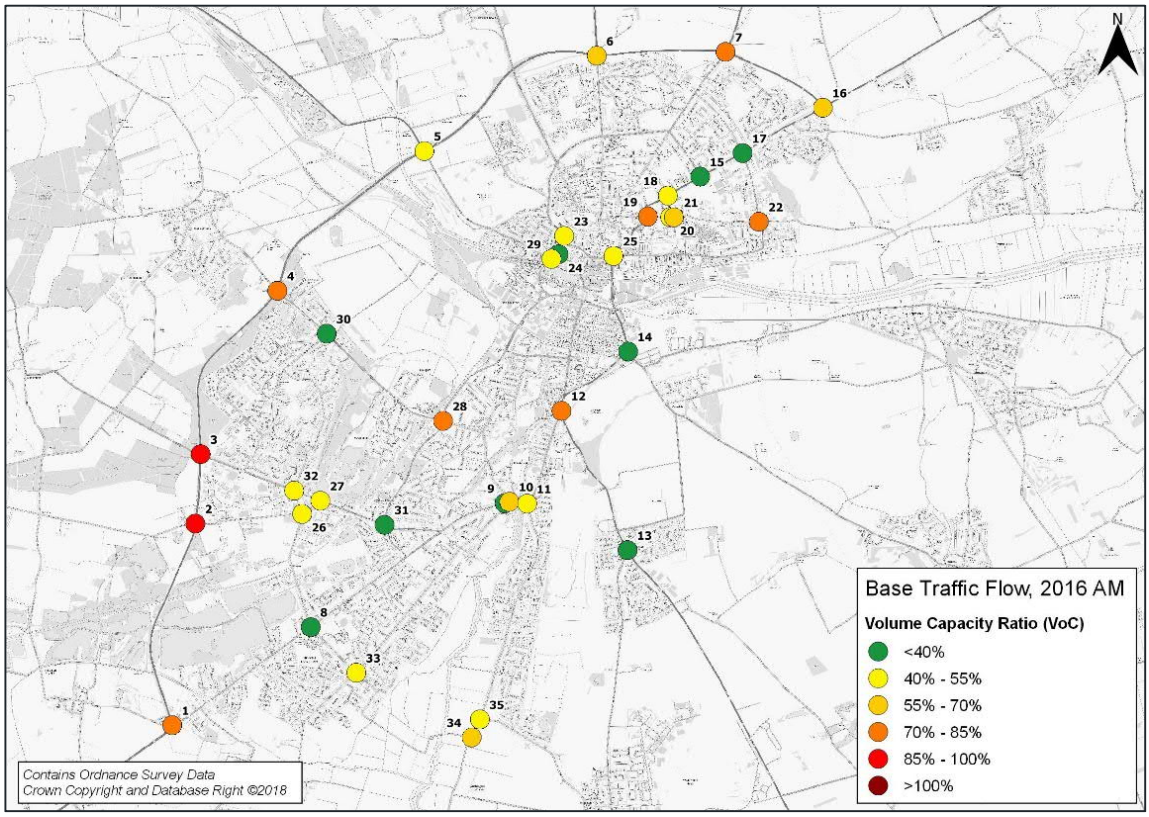



**Figure 20 – Max Junction VoC, 2016 AM**

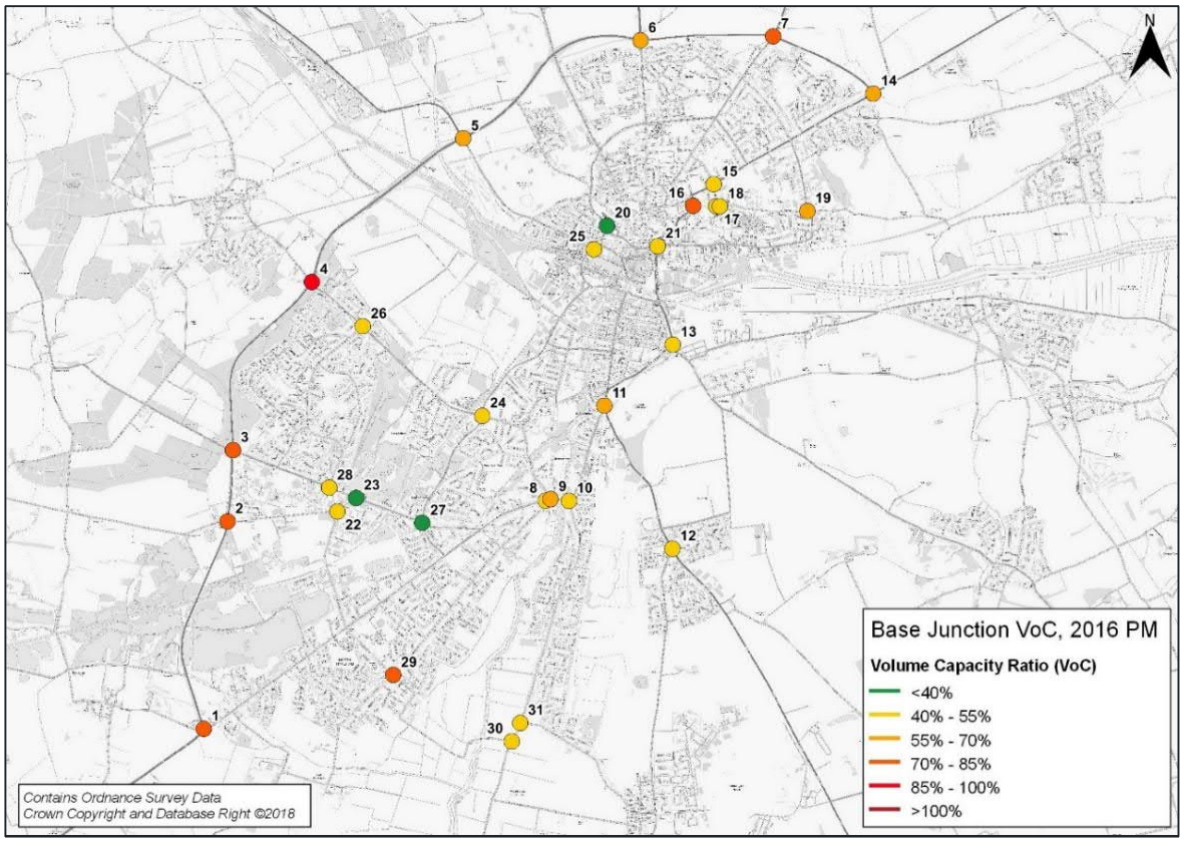



**Figure 21 – Max Junction VoC, 2016 PM**

**Key sections of the orbital network are operating either at capacity or would be expected to reach capacity in the short to medium term. This would impact on Lincoln's aspirations to grow.**

**There are a number of existing congestion hotspots. These are located on the A46, particularly between the Newark Road and Lincoln Road roundabouts and the junction with the A15. They also exist on more localised routes including Meadow Lane in Hykeham.**

**The A46 link between the B1190 and B1378 junctions and Hykeham roundabout to Whisby Road junction are operating close to capacity (at least 85% VoC). City centre and links in the Hykeham area e.g. Meadow Lane is operating at 81% capacity.**

**The congestion pinchpoints reflect a lack of route choice and network capacity for north-south and east-west journeys.**

### 3.6.4. Average Speeds

***Key Routes within the Study Area***

Average speeds give an indication of how well traffic moves on the network. Analysis of TrafficMaster data from 2016 for the major routes through and around Lincoln has identified a

number of routes including the A46 and others within the study area where the average AM and PM peak vehicle speed is significantly lower than that of free flow conditions. These routes are listed below:

- A46 Lincoln WRR
- A46 Welton Road
- A46 (Between Newark and Lincoln WRR)
- A607 Grantham Road/Lincoln Road
- A158 Northern Relief Road
- A15 (Riseholme)

Table 5 shows the average speeds recorded during AM and PM peak period and the difference to those recorded during free flow (off-peak) conditions for the key strategic routes that fall within the study area. The analysis shows that:

- The average speeds on the A46 WRR are between 10 and 12mph slower than in free flow conditions;
- The average speeds on the A1434 for north bound traffic (towards Lincoln) are 8.3mph slower than freeflow conditions during the morning peak hour and 6.9mph slower for southbound traffic during the PM peak;
- There is also evidence of significant congestion on routes where traffic is inbound to the city centre during the AM peak such as the northern section of the A15 where southbound average speeds are 11.6mph slower than the off peak average, and the southern section of the A15 where the northbound speeds are on average 10.7mph slower than in free flow conditions;
- Average speed along the A158 which begins at the eastern end of the A46 western relief road before routing east out of the city centre also vary considerably. During the AM peak on the southbound carriageway, traffic speeds are on average 9mph slower than free flow traffic speeds. During the PM peak, average speed on both the northbound and southbound carriageway is around 5mph slower on average than those recorded during the inter peak period.

Figure 22 and Figure 23 provide a more detailed visual and spatial representation of how average speed varies between the peak hours and the off peak period along each link of the major orbital and radial routes in the city, allowing a more detailed analysis to be made of where traffic speed is considerably lower at peak times. It shows that there are significant stretches and sections of the A1434, A46 and A15 where the average speeds are significantly lower than free flow periods indicating the scale of the congestion issues.

It is clear from all three figures that there are congestion hotspots and sections of the strategic and major route network and routes through the centre of Lincoln that experience capacity related issues during the peak periods. The lack of an alternative route to the A46 Western Relief Road and travelling through the city centre is apparent and will only worsen in line with the development proposals such as the western growth corridor and the growth related aspirations set out in the city's local plan. As described earlier in this document the LEB will significant improvement in conditions on the eastern side of Lincoln and through the City Centre. However the congestion currently

experienced on the western orbital and radial routes are expected to remain and deteriorate further with any increases in traffic.

**Table 5 – Average Speed 2016**

| Route | Details | Direction | Free Flow (mph) | Speed Limit (mph)* | Average Speed (mph) | | | Difference to Free Flow Speed (mph) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AM Peak | Off Peak | PM Peak | AM Peak | Off Peak | PM Peak |
| A15 | North | NB | 42.7 | 50 | 40.8 | 40.7 | 40.8 | -1.9 | -2.1 | -1.9 |
| | | SB | 39.4 | | 27.8 | 34.7 | 29.9 | -11.6 | -4.7 | -9.5 |
| | South | NB | 32.8 | 60 | 22.1 | 29.4 | 29.9 | -10.7 | -3.4 | -2.9 |
| | | SB | 35.6 | | 32.5 | 33.2 | 33.2 | -3.2 | -2.5 | -2.4 |
| | City Centre | NB | 24.6 | 30 | 16.3 | 19.2 | 17.6 | -8.3 | -5.4 | -7.0 |
| | | SB | 24.8 | | 19.8 | 20.3 | 16.4 | -5.0 | -4.5 | -8.4 |
| A46 | North | NB | 50.2 | 60 | 45.9 | 50.6 | 42.7 | -4.2 | 0.4 | -7.5 |
| | | SB | 49.7 | | 39.8 | 50.2 | 40.5 | -9.9 | 0.5 | -9.2 |
| | South | NB | 62.8 | 70 | 57.8 | 60.8 | 61.9 | -5.0 | -2.0 | -0.9 |
| | | SB | 62.4 | | 59.4 | 59.0 | 60.5 | -3.0 | -3.3 | -1.9 |
| | Western Relief Road | NB | 41.0 | 60/70 | 30.5 | 34.2 | 30.3 | -10.4 | -6.7 | -10.6 |
| | | SB | 41.5 | | 30.9 | 35.9 | 29.2 | -10.6 | -5.6 | -12.3 |
| A57 | North | NB/WB | 46.2 | 60 | 40.1 | 40.7 | 41.8 | -6.1 | -5.5 | -4.5 |
| | | SB/EB | 42.5 | | 30.7 | 37.8 | 37.4 | -11.8 | -4.7 | -5.1 |
| | City Centre | NB/WB | 26.9 | 30/40/ 60 | 12.1 | 25.2 | 17.9 | -14.8 | -1.7 | -9.1 |
| | | SB/EB | 24.6 | | 19.8 | 16.4 | 15.1 | -4.8 | -8.2 | -9.6 |
| A607 | South | NB | 33.2 | 30/40 | 29.5 | 30.3 | 29.3 | -3.7 | -2.8 | -3.8 |
| | | SB | 33.6 | | 31.0 | 31.0 | 30.0 | -2.6 | -2.7 | -3.6 |
| A158 | East | NB | 46.5 | 40 | 42.0 | 41.4 | 41.6 | -4.5 | -5.1 | -4.9 |
| | | SB | 44.2 | | 35.2 | 39.3 | 39.0 | -9.0 | -4.9 | -5.2 |
| | Ring Road | EB | 47.7 | 60 | 44.2 | 44.1 | 45.8 | -3.5 | -3.6 | -1.9 |
| | | WB | 44.6 | | 34.4 | 38.0 | 38.9 | -10.2 | -6.6 | -5.7 |
| A1434 | City Centre | NB | 28.6 | 40 | 20.3 | 24.8 | 24.0 | -8.3 | -3.9 | -4.7 |
| | | SB | 29.4 | | 25.0 | 23.9 | 22.6 | -4.4 | -5.5 | -6.9 |

**Some sections have more than one speed limit and therefore a figure for each individual limit is provided.*

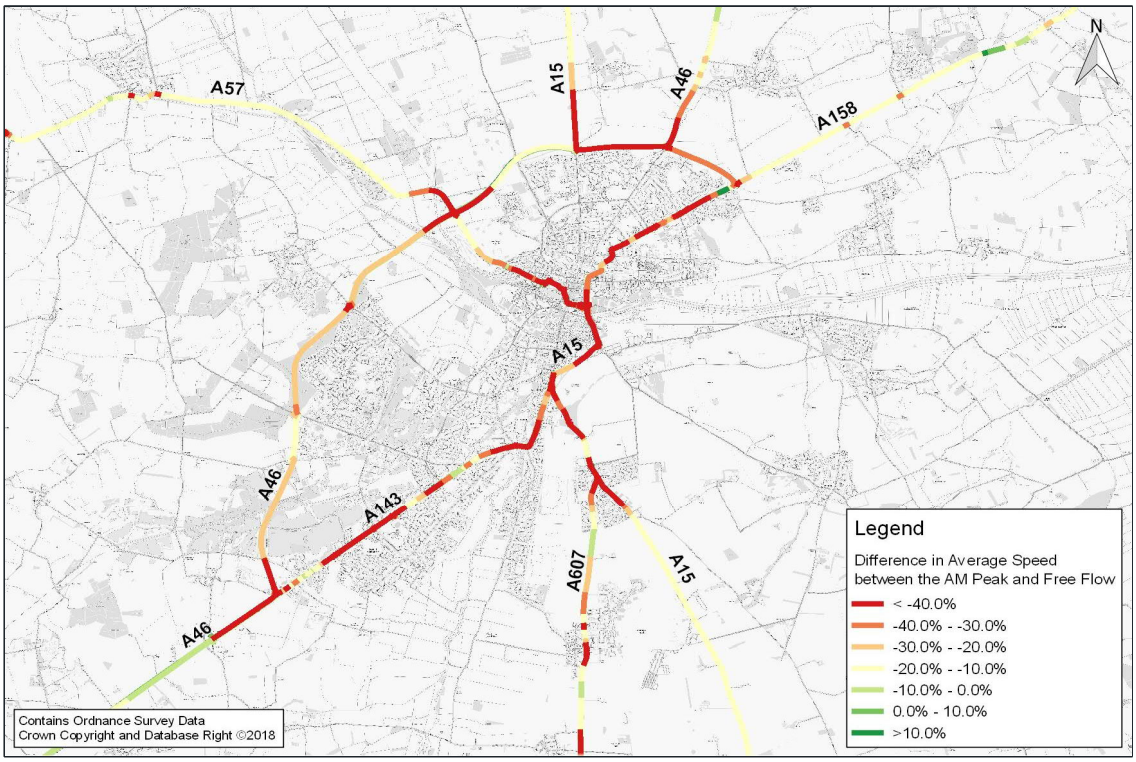



**Figure 22 – Average Speeds – AM compared to Free Flow, 2016**

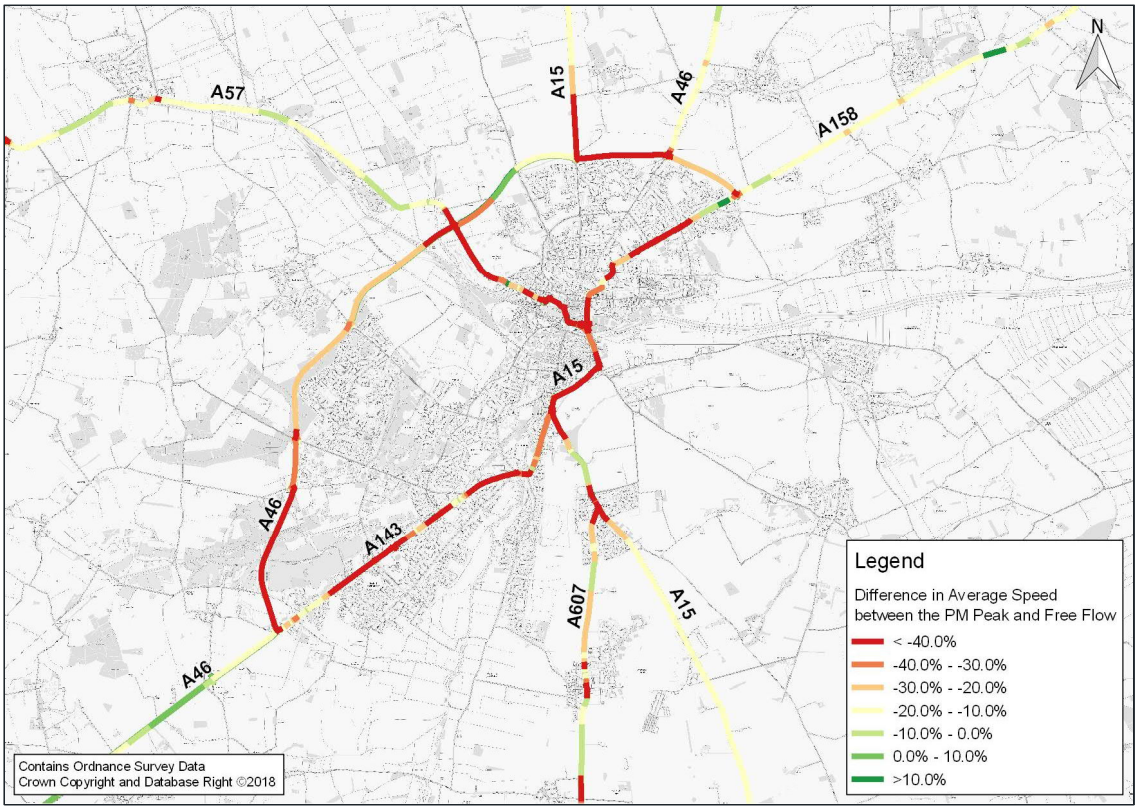



**Figure 23 – Average Speeds – PM compared to Off Peak, 2016**

**Journey times for the key routes in and around Lincoln are poor in the morning and evening peaks compared to 'free flow' conditions, particularly for journeys via the A46.**

**Traffic speeds on the A15 and A57 are most variable between peak and off peak periods, with over 40% variance in average speeds.**

**Delay in peak periods is particularly severe on the A46, B1003 and Meadow Lane. The most significant junction delays occur on Lincoln Road and at the Hykeham Roundabout.**

### 3.6.5. Journey Time Reliability

This section explores existing journey reliability and variance along the strategic and major routes and key local routes. In particular it focuses on the journey times for the following routes:

- A46;
- A15;
- A57;
- A158;
- A1434;
- Local routes around Harmston; and,
- Local routes around South Hykeham.

**Strategic & Major Routes**

To assess the journey time variability of each of the routes the coefficient of variation (CV) has been calculated using average speed. The CV is a measure of relative variability and it is the ratio of the standard deviation to the mean (average). Table 6 and Table 7 shows the CV for each route during the morning and evening peak for a neutral month (September 2016). The results show and highlight route sections that experience the most significant variance in journey times. In particular where the standard deviation is higher than 20% of the mean speed, i.e. where the CV is higher and speeds vary the most, the links are highlighted in red. Where the standard deviation is between 10–20% of the mean, the links are highlighted in yellow

**AM Peak Period**

Table 6 shows the following:

- The A46 between the B1378 Skellingthorpe Road /Lincoln Rd and A57/Saxilby Rd (eastbound), A57/Saxilby Rd and A15/Riseholme Rd (westbound) and A15/Riseholme Rd and A158/A46/B1182 experience average speeds that vary by 20% or more of the standard deviation indicating poor journey time reliability;
- The worst performing link of the A46 is between B1378 Skellingthorpe Road /Lincoln Rd and A57/Saxilby Rd (eastbound), where there is up to 40% variance in journey times compared to the standard deviation;
- Most sections of the A15 and A57 currently experience at least a 20% variance in journey times. B1188/A15 Canwick Road to the A57 Oxford Street being the worst performing; and
- The A1434 Newark Road also suffers from journey time reliability issues particularly for northeast bound trips.

**Table 6 – Journey Time Reliability along Strategic, Major & Key Local Routes: AM Peak (08:00-09:00)**

| Route | Start | End | Northeast bound | | Southwest bound | |
|---|---|---|---|---|---|---|
| | | | SD | % mean | SD | % mean |
| A46 | Newark Rd/Middle Ln (J1) | Whisby Rd (J2) | 5 | 8% | 5 | 8% |
| | Whisby Rd (J2) | B1190/Doddington Rd (J3) | 5 | 7% | 5 | 7% |
| | B1190/Doddington Rd (J3) | B1378/Lincoln Rd (J4) | 5 | 9% | 5 | 10% |
| | B1378 Skellingthorpe Road /Lincoln Rd (J4) | A57/Saxilby Rd (J5) | 15 | 40% | 9 | 11% |
| | A57/Saxilby Rd (J5) | A15/Riseholme Rd (J6) | 5 | 7% | 11 | 35% |
| | A15/Riseholme Rd (J6) | A158/A46/B1182 (J7) | 4 | 6% | 7 | 27% |
| | A158/A46/B1182 (J7) | A158/Bunkers Hill/Wragby Rd (J8) | 9 | 21% | 3 | 4% |
| A15 | Dunston Heath Lane (1) | A1434 St Catherines (2) | 5 | 14% | 4 | 6% |
| | A1434 St Catherines (2) | B1262/A15/South Park (3) | 5 | 24% | 5 | 18% |
| | B1262/A15/South Park (3) | B1188/A15 Canwick Road (4) | 7 | 26% | 3 | 7% |
| | B1188/A15 Canwick Road (4) | A57 Oxford Street (5) | 7 | 70% | 6 | 36% |
| | A57 Oxford Street (5) | B1308 Greetwell Road (6) | 4 | 28% | 5 | 22% |
| | B1308 Greetwell Road (6) | A158/Bunkers Hill/Wragby Rd (7) | 4 | 20% | 6 | 26% |
| | A1500 Till Bridge Lane (8) | A46/A15/Riseholme Rd (9) | 3 | 4% | 10 | 27% |
| A57 | Mill Lane (1) | Fen Lane (2) | 3 | 4% | 66 | 4% |
| | Fen Lane (2) | A46 (3) | 12 | 47% | 3 | 4% |
| | A46 (3) | B1273 Brayford Way (4) | 5 | 10% | 11 | 62% |
| | B1273 Brayford Way (4) | B1273/B1003/Rope Walk (5) | 7 | 33% | 6 | 30% |
| | B1273/B1003/Rope Walk (5) | High Street (6) | 6 | 66% | 4 | 17% |
| A158 | Junction with A15 | Scothern Lane | 3 | 5% | 4 | 6% |
| A1434 | A46/Newark Rd/Middle Ln (1) | Newark Rd/Hathersage Av (2) | 6 | 32% | 5 | 18% |
| | Newark Rd/Hathersage Av (2) | A15 St Catherines | 6 | 26% | 5 | 13% |
| A46 (Auborn to Harmston) to A15 | A46 (1) | A607 Grantham Rd (2) | 4 | 7% | 3 | 6% |
| | A607 Grantham Rd (2) | A15 Sleaford Rd (3) | 4 | 9% | 6 | 9% |
| South Hykeham to Waddington | A1434 Newark Rd (1) | A607 Grantham Rd (2) | 4 | 10% | 4 | 11% |

### PM Peak Period

The analysis of the PM peak period data in Table 7 shows:

- That several sections of the A46 between experience significant variance in journey times in the PM peak, including the sections between Whisby Road and B1190 / Doddington Road Roundabout, B1378 Skellingthorpe Road /Lincoln Rd and A57/Saxilby Rd (eastbound);

- As in the AM peak period the worst performing link of the A46 is between B1378 Skellingthorpe Road /Lincoln Rd and A57/Saxilby Rd (northbound), where there is up to 30% variance in journey times compared to the standard deviation;
- Southbound sections of the A15 also experience significant journey time variability. This includes the sections between the B1262 /A15 /South Park and B1188/A15 Canwick Road and B1188/A15 Canwick Road and A57 Oxford Street in central Lincoln; and
- The A1434 Newark Road again suffers from journey time reliability issues in the PM particularly on the section between A46/Newark Rd/Middle Lane and Newark Rd / Hathersage Avenue.

**Table 7 – Journey Time Reliability along Strategic, Major & Key Local Routes: PM Peak (17:00-18:00)**

| Route | Start | End | Northbound | | South bound | |
|---|---|---|---|---|---|---|
| | | | SD | % mean | SD | % mean |
| A46 | Newark Rd/Middle Ln (J1) | Whisby Rd (J2) | 6 | 15% | 6 | 13% |
| | Whisby Rd (J2) | B1190/Doddington Rd (J3) | 11 | 22% | 9 | 14% |
| | B1190/Doddington Rd (J3) | B1378/Lincoln Rd (J4) | 5 | 9% | 6 | 11% |
| | B1378/Lincoln Rd (J4) | A57/Saxilby Rd (J5) | 14 | 27% | 6 | 7% |
| | A57/Saxilby Rd (J5) | A15/Riseholme Rd (J6) | 11 | 18% | 6 | 9% |
| | A15/Riseholme Rd (J6) | A158/A46/B1182 (J7) | 11 | 30% | 6 | 28% |
| | A158/A46/B1182 (J7) | A158/Bunkers Hill/Wragby Rd (J8) | 4 | 5% | 9 | 21% |
| A15 | Dunston Heath Lane (1) | A1434 St Catherines (2) | 7 | 16% | 4 | 6% |
| | A1434 St Catherines (2) | B1262/A15/South Park (3) | 5 | 28% | 7 | 22% |
| | B1262/A15/South Park (3) | B1188/A15 Canwick Road (4) | 6 | 17% | 9 | 54% |
| | B1188/A15 Canwick Road (4) | A57 Oxford Street (5) | 4 | 17% | 7 | 40% |
| | A57 Oxford Street (5) | B1308 Greetwell Road (6) | 6 | 26% | 6 | 30% |
| | B1308 Greetwell Road (6) | A158/Bunkers Hill/Wragby Rd (7) | 6 | 28% | 5 | 17% |
| | A1500 Till Bridge Lane (8) | A46/A15/Riseholme Rd (9) | 4 | 5% | 8 | 19% |
| | | | *Eastbound* | | *Westbound* | |
| A57 | Mill Lane (1) | Fen Lane (2) | 4 | 5% | 3 | 4% |
| | Fen Lane (2) | A46 (3) | 6 | 15% | 3 | 5% |
| | A46 (3) | B1273 Brayford Way (4) | 5 | 13% | 10 | 50% |
| | B1273 Brayford Way (4) | B1273/B1003/Rope Walk (5) | 6 | 37% | 7 | 35% |
| | B1273/B1003/Rope Walk (5) | High Street (6) | 7 | 113% | 6 | 26% |
| A158 | Junction with A15 | Scothern Lane | 4 | 5% | 4 | 6% |
| A1434 | A46/Newark Rd/Middle Ln (1) | Newark Rd/Hathersage Av (2) | 5 | 20% | 5 | 21% |
| | Newark Rd/Hathersage Av (2) | A15 St Catherines | 5 | 19% | 5 | 16% |
| | | | *Eastbound* | | *Westbound* | |
| A46 (Auborn to Harmston) to A15 | A46 (1) | A607 Grantham Rd (2) | 4 | 8% | 4 | 7% |
| | A607 Grantham Rd (2) | A15 Sleaford Rd (3) | 6 | 11% | 5 | 9% |

| Route | Start | End | Northbound | | South bound | |
|---|---|---|---|---|---|---|
| | | | SD | % mean | SD | % mean |
| South Hykeham to Waddington | A1434 Newark Rd (1) | A607 Grantham Rd (2) | 4 | 10% | 4 | 10% |

The analysis for both AM and PM peak periods shows that there is a considerable variance in journey times on several major routes into Lincoln and sections of the existing strategic orbital route around Lincoln. This again indicates the level of congestion currently experienced and demonstrates the pressure that the network is under.

**Journey time reliability is a key concern along the A46 Western Relief Road during both the AM and PM peaks with some sections varying up to 40% of the standard deviation. Journey times are particularly unreliable between the Skellingthorpe Road and Nettleham roundabouts.**

**Elsewhere on the network, journey times are particularly unreliable on the A15, where variance of up to 70% of the average speed is experienced, and on the A57, where one section of the corridor experiences variance of up to 113% of the average speed.**

**The A1434 also has some significant journey time reliability issues.**

3.6.6. Heavy Goods Vehicles

The limited north-south and east west connectivity in and around Lincoln also results in significant proportions of HGVs using a limited number of routes. The proportion of HGVs using the key routes around Lincoln has been assessed and derived from permanent LCC counters, DfT counts and Webtris Data and can be seen illustrated in Figure 24.

The analysis shows that the proportion of HGVs can be seen to be between 5% and 10% on the WRR and exceed 10% on the A46 between Pennell's Roundabout and the Whisby Road roundabout. Of note is the number of links within Lincoln city centre which can be seen to be carrying HGVs comprising of between 5% and 10% of the total traffic. The narrow routes within the historic core of Lincoln, e.g. Tentercroft Street, B1262 and Wragby Road are not suited to use by heavy vehicles.

In the area within the vicinity of the NHRR, Newark Road and Sleaford Road the proportion of HGVs is between 5% and 10%. Both of these routes traverse through highly residential areas such as North Hykeham, Swallow Beck, Bracebridge and Bracebridge Heath which will negatively impact on these small-medium sized, largely rural settlements. In the south west quadrant of the study area, Kingsley Road leading to Teal Park and Whisby Road also carry relatively large proportions of HGVs (5%-10%).

The proportions of HGVs are in excess of what would be expected for these type of routes:

- On average on the Local Major Road Network (includes A Roads managed by Local Authorities) 4% of all traffic can be expected to be classified as a HGV[2]. The data shows that a number of routes in and around Lincoln exceed this, including the A46 where between 5% and 10% of traffic is classified as a HGV;
- On average on Urban A Roads 3% of all traffic can be expected to be classified a HGV. Again the proportion of HGVs on sections of the A1434 exceed this where between 5% and 10% of the traffic is a HGV.

This reflects the lack of alternative routes designed to an appropriate standard suitable for HGVs.

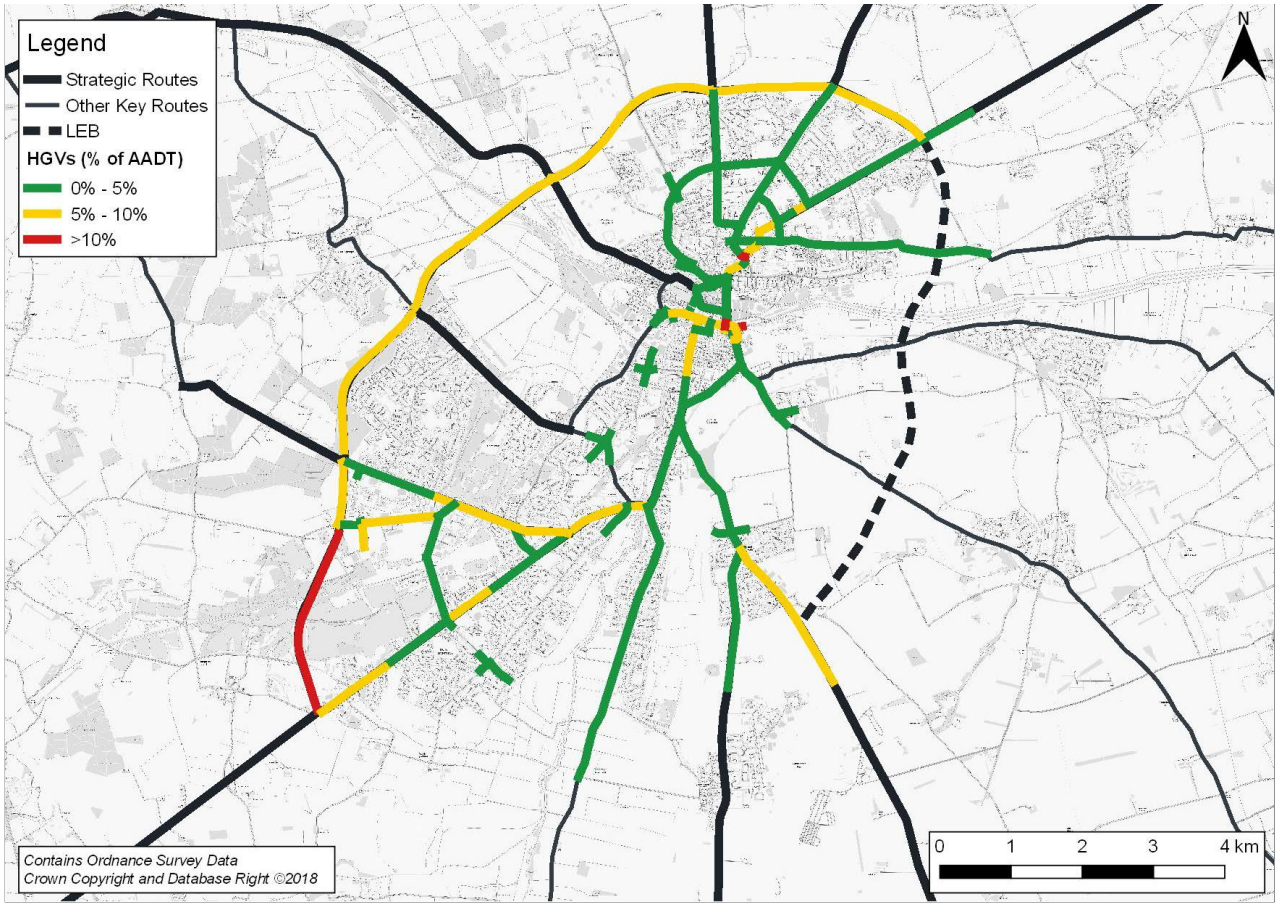



**Figure 24 – Heavy Goods Vehicles**

**The proportion of Heavy Goods Vehicles on sections of Lincoln's Road Network exceeds 10%. This is in excess of what would be expected for the type of route and reflects the lack of alternative routes designed to an appropriate standard suitable for HGVs.**

[2] (Road Traffic Estimates: Great Britain 2017, DfT).

### 3.6.7. Collision Analysis

An assessment of the number and location of collisions has been undertaken within the study area to understand whether there are any existing issues relating to collision location, frequency and severity.

***Killed or Seriously Injured (KSI) Radial and Orbital Routes***

Figure 25 shows the locations of the links assessed and Table 8 shows how the KSI on each section of the key orbital and radial routes compare with the national average for that particular road type. Generally, the KSI ratio on these routes is lower than the national average with the exception of the following:

- A15 (South Park Avenue - Canwick Hill);
- A15 (Canwick Hill - B1308);
- A15 (Greetwell Road - Outer Circle Road); and
- A57 (B1273 - A15)

The section which had the highest KSI ratio was along the A15 between the South Park Avenue and Canwick Hill junctions where 25% of all recorded accidents between 2012 and 2016 were classified as serious or fatal.

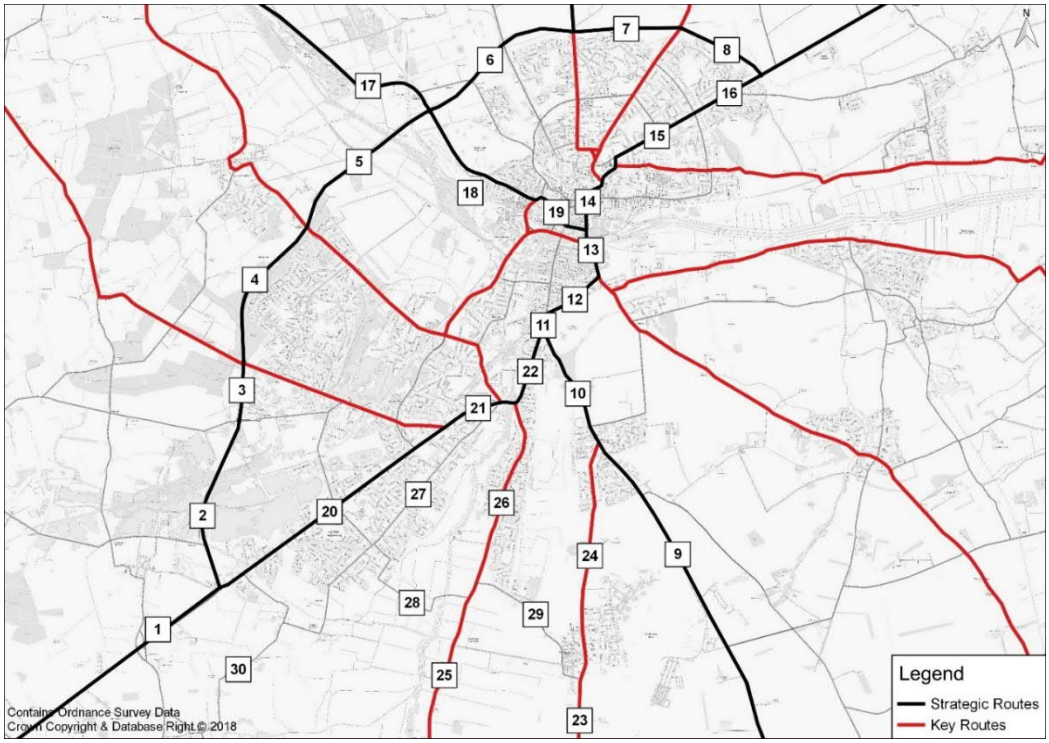



**Figure 25 – Collision Links Reference**

**Table 8 – KSI ratio on key radial/orbital routes 2012 - 2016**

| Route | ID | Section | DfT road type | National KSI (%) | Actual KSI (%) |
|---|---|---|---|---|---|
| A46 | 1 | A46 (Pennells Roundabout Approach) | Rural A Road | 20.2 | 7.7 |
| | 2 | A46/Newark Rd/Middle Ln - A46/Whisby Rd | Rural A Road | 20.2 | 19.0 |
| | 3 | A46/Whisby Rd - A46/B1190/Doddington Rd | Urban A Road | 12.8 | 5.4 |
| | 4 | A46/B1190/Doddington Rd - A46/B1378/Lincoln Rd | Rural A Road | 20.2 | 16.0 |
| | 5 | A46/B1378/Lincoln Rd - A46/A57/Saxilby Rd | Rural A Road | 20.2 | 8.8 |
| | 6 | A46/A57/Saxilby Rd - A46/A15/Riseholme Rd | Rural A Road | 20.2 | 8.1 |
| | 7 | A46/A15/Riseholme Rd - A158/A46/B1182 | Rural A Road | 20.2 | 8.0 |
| | 8 | A158/A46/B1182 - A158/Bunkers Hill/Wragby Rd | Rural A Road | 20.2 | 3.7 |
| A15 | 9 | B1178 - A607 | Rural A Road | 20.2 | 18.2 |
| | 10 | A607 - Newark Rd | Rural A Road | 20.2 | 6.3 |
| | 11 | Newark Road - South Park Avenue | Urban A Road | 12.8 | 6.3 |
| | 12 | South Park Avenue - Canwick Hill | Urban A Road | 12.8 | 25.0 |
| | 13 | Canwick Hill - B1308 | Urban A Road | 12.8 | 15.3 |
| | 14 | B1308 - Greetwell Road | Urban A Road | 12.8 | 8.3 |
| | 15 | Greetwell Road - Outer Circle Road | Urban A Road | 12.8 | 20.0 |
| | 16 | Outer Circle Road - A158/LEB | Urban A Road | 12.8 | 11.1 |
| A57 | 17 | Fen Lane - Carholme Roundabout | Rural A Road | 20.2 | 13.3 |
| | 18 | Carholme Roundabout - B1273 | Urban A Road | 12.8 | 6.9 |
| | 19 | B1273 - A15 | Urban A Road | 12.8 | 16.9 |
| A1434 | 20 | Pennells Roundabout - Doddington Road | Urban A Road | 12.8 | 11.0 |
| | 21 | Doddington Road - Brant Road | Urban A Road | 12.8 | 5.3 |
| | 22 | Brant Road - A15 | Urban A Road | 12.8 | 12.5 |

### *Killed or Seriously Injured (KSI) Local Routes*

Similarly, Table 9 shows the KSI ratio for key local routes to the south of Lincoln. It can be seen that Lincoln Road / Hykeham Road/Mill Lane was the only route to exceed the national average with 17.4% of all recorded accidents being classified as serious or fatal.

**Table 9 – KSI ratio on key local routes 2012 - 2016**

| Route | ID | Section | DfT road type | National KSI (%) | Actual KSI (%) |
|---|---|---|---|---|---|
| A607 | 23 | Church Lane - Tinker's Lane | Rural A Road | 20.2 | 12.5 |
| | 24 | Tinker's Lane - A15 | Rural A Road | 20.2 | 9.1 |
| Brant Road | 25 | Blackmoor Road - Meadow Lane | Other Rural Road | 20.5 | 12.5 |
| | 26 | Meadow Lane - Newark Road | Other Urban Road | 14.4 | 11.5 |
| Lincoln Road/ Hykeham Road/ Mill Lane | 27 | Long Lane - Newark Road | Other Urban Road | 14.4 | 17.4 |
| Meadow Lane | 28 | Chapel Lane – A607 | Other Urban Road | 14.4 | 8.3 |
| Station Road | 29 | A607 – A15 | Other Urban Road | 14.4 | 0 |
| South Hykeham Road | 30 | A1434 – Chapel Lane | Other Rural Road | 20.5 | 12.5 |

***Study Area Accident Rates – National Comparison***

The DfT currently assess accident rates for a particular road type by the number of accidents/rate per billion vehicle miles. In line with this method, the accident rates (2012-2016) for key orbital and radial routes in Lincoln have been calculated and compared against national averages. The results of this analysis are presented in Table 10.

It can be seen that in the five year period, a number of routes had accident rates above the national average. The section of the A57 between the B1273 and A15 junctions had an accident rate 144% higher than the national average for an urban A-road. Furthermore, the A15 between Newark Road and South Park Avenue had an accident rate 143% higher than the national average. Other links that had significantly higher accident rates than the national average include the A46 Northern Relief Road between Welton Road and Wragby Road East (119%) and the A15 Canwick Hill (60%). The introduction of the LEB is likely to result in improvements to accident rates within Lincoln, particularly along the A15 as it will reduce the volume of traffic along this route. However, the impact on the orbital and major routes on the western side of Lincoln is expected to be marginal and a continued growth in traffic could exacerbate any existing accident issues.

## Table 10 – Accident rates for key orbital and radial routes (2012 – 2016)

| Route | ID | Section | DfT road type | National accident rate (no. accidents / rate per billion miles) | Actual accident rate (no. accidents / rate per billion miles) | % difference with average accident rate for Road Type |
|---|---|---|---|---|---|---|
| A46 | 1 | A46 (Pennells Roundabout Approach) | Rural A Road | 270 | 312 | +16% |
| | 2 | A46/Newark Rd/Middle Ln - A46/Whisby Rd | Rural A Road | 270 | 318 | +18% |
| | 3 | A46/Whisby Rd - A46/B1190/Doddington Rd | Urban A Road | 822 | 904 | +10% |
| | 4 | A46/B1190/Doddington Rd - A46/B1378/Lincoln Rd | Rural A Road | 270 | 209 | -23% |
| | 5 | A46/B1378/Lincoln Rd - A46/A57/Saxilby Rd | Rural A Road | 270 | 262 | -3% |
| | 6 | A46/A57/Saxilby Rd - A46/A15/Riseholme Rd | Rural A Road | 270 | 223 | -18% |
| | 7 | A46/A15/Riseholme Rd - A158/A46/B1182 | Rural A Road | 270 | 349 | +29% |
| | 8 | A158/A46/B1182 - A158/Bunkers Hill/Wragby Rd | Rural A Road | 270 | 590 | +119% |
| A15 | 9 | B1178 - A607 | Rural A Road | 270 | 165 | -39% |
| | 10 | A607 - Newark Rd | Rural A Road | 270 | 318 | +18% |
| | 11 | Newark Road - South Park Avenue | Urban A Road | 822 | 2,001 | +143% |
| | 12 | South Park Avenue - Canwick Hill | Urban A Road | 822 | 233 | -72% |
| | 13 | Canwick Hill - B1308 | Urban A Road | 822 | 1,312 | +60% |
| | 14 | B1308 - Greetwell Road | Urban A Road | 822 | 924 | +12% |
| | 15 | Greetwell Road - Outer Circle Road | Urban A Road | 822 | 634 | -23% |
| | 16 | Outer Circle Road - A158/LEB | Urban A Road | 822 | 233 | -72% |
| A57 | 17 | Fen Lane - Carholme Roundabout | Rural A Road | 270 | 235 | -13% |
| | 18 | Carholme Roundabout - B1273 | Urban A Road | 822 | 438 | -47% |
| | 19 | B1273 - A15 | Urban A Road | 822 | 2,005 | +144% |
| A1434 | 20 | Pennells Roundabout - Doddington Road | Urban A Road | 822 | 650 | -21% |
| | 21 | Doddington Road - Brant Road | Urban A Road | 822 | 897 | +9% |
| | 22 | Brant Road - A15 | Urban A Road | 822 | 1,057 | +29% |

Table 11 identifies the national accident rate comparison with local routes in the study area. The greatest variation in terms of a higher level of accidents in the study area compared to the national average can be seen on South Hykeham Road between the A1434 and Chapel Lane at +63%. Aside from this section, in general the exceedance between the national average and the particular route is relatively minimal. Lincoln Road between Long Lane and Newark Road (-66%) and Station Road between the A607 and A15 (-63%) are the routes with the greatest variance in terms of demonstrating a lower than average accident rate.

**Table 11 – Accident rates for local routes (2012 – 2016)**

| Route | ID | Section | DfT road type | National accident rate (no. accidents / rate per billion miles) | Actual accident rate (no. accidents / rate per billion miles) | % difference with average accident rate for Road Type |
|---|---|---|---|---|---|---|
| A607 | 23 | Church Lane - Tinker's Lane | Rural A Road | 270 | 289 | +7% |
| | 24 | Tinker's Lane - A15 | Rural A Road | 270 | 310 | +15% |
| Brant Road | 25 | Blackmoor Road - Meadow Lane | Other Rural Road | 460 | 473 | +3% |
| | 26 | Meadow Lane - Newark Road | Other Urban Road | 763 | 399 | -48% |
| Lincoln Road | 27 | Long Lane - Newark Road | Other Urban Road | 763 | 263 | -66% |
| Meadow Lane | 28 | Chapel Lane – A607 | Other Urban Road | 763 | 862 | +13% |
| Station Road | 29 | A607 – A15 | Other Urban Road | 763 | 285 | -63% |
| South Hykeham Road | 30 | A1434 – Chapel Lane | Other Rural Road | 460 | 749 | +63% |

***Frequency of incidents on the northern and western relief road***

The table below highlights the average frequency of accidents and KSIs from 2012 to 2016 on the existing orbital route. Table 12 shows that incidents occured most frequently on the A46 between Newark Road/Middle Lane and Whisby Road. This is the single carriageway section of the WRR which shown in the previsous sections already experiences congestion and journey reliability problems. The analysis shows that on average there has been a major incident once every 261 days which would be expected to result in a road closure and diversions. As shown in Section 2.4.4 the diversion route for this section of the WRR uses the A1434 and Doddington Road. These routes are single carriageway urban roads which again already suffer from congestion and are unsuitable for additional volumes of traffic.

**Table 12 – Frequency of incidents (2012-2016)**

| Route | ID | Section | KSI frequency (days) | Frequency of accidents (days) |
|---|---|---|---|---|
| A46 | 1 | A46 (Pennells Roundabout Approach) | 1,825 | 140 |
| | 2 | A46/Newark Rd/Middle Ln - A46 / Whisby Rd | 261 | 43 |
| | 3 | A46/Whisby Rd - A46/B1190 / Doddington Rd | 913 | 49 |
| | 4 | A46/B1190/Doddington Rd - A46/B1378 / Lincoln Rd | 608 | 73 |
| | 5 | A46/B1378/Lincoln Rd - A46 / A57 / Saxilby Rd | 608 | 54 |
| | 6 | A46/A57/Saxilby Rd - A46 / A15 / Riseholme Rd | 913 | 49 |
| | 7 | A46/A15/Riseholme Rd - A158 / A46 / B1182 | 913 | 73 |
| | 8 | A158/A46/B1182 - A158 / Bunkers Hill / Wragby Rd | 1,825 | 68 |

***Accident clusters***

The location of any accident clusters has also been assessed. Accident clusters in this instance have been defined as four or more accidents occurring within a 3 year time frame and within 100 metres of each other. The map below (Figure 26) shows the location of accident clusters within the study area for incidents which occurred between 2012 and 2016 and Table 13 provides a summary of the number of accidents and KSI's at each location.

The analysis shows that the A46 has the largest number of clusters (14 in total) on the route with a particularly high number of accidents on the junction with Doddington Road (60 accidents). The A1434 and A15 also show a particularly high number of clusters with 9 and 10 respectively. Accident clusters are also found on the radial routes south of Lincoln on Brant Road and Lincoln Road/Hykeham Road. These routes form the strategic and major routes through and around Lincoln and as shown in the previous sections of this document already experience high traffic flows. A significant increase in traffic on these routes also has the potential to exacerbate any existing accident issues.

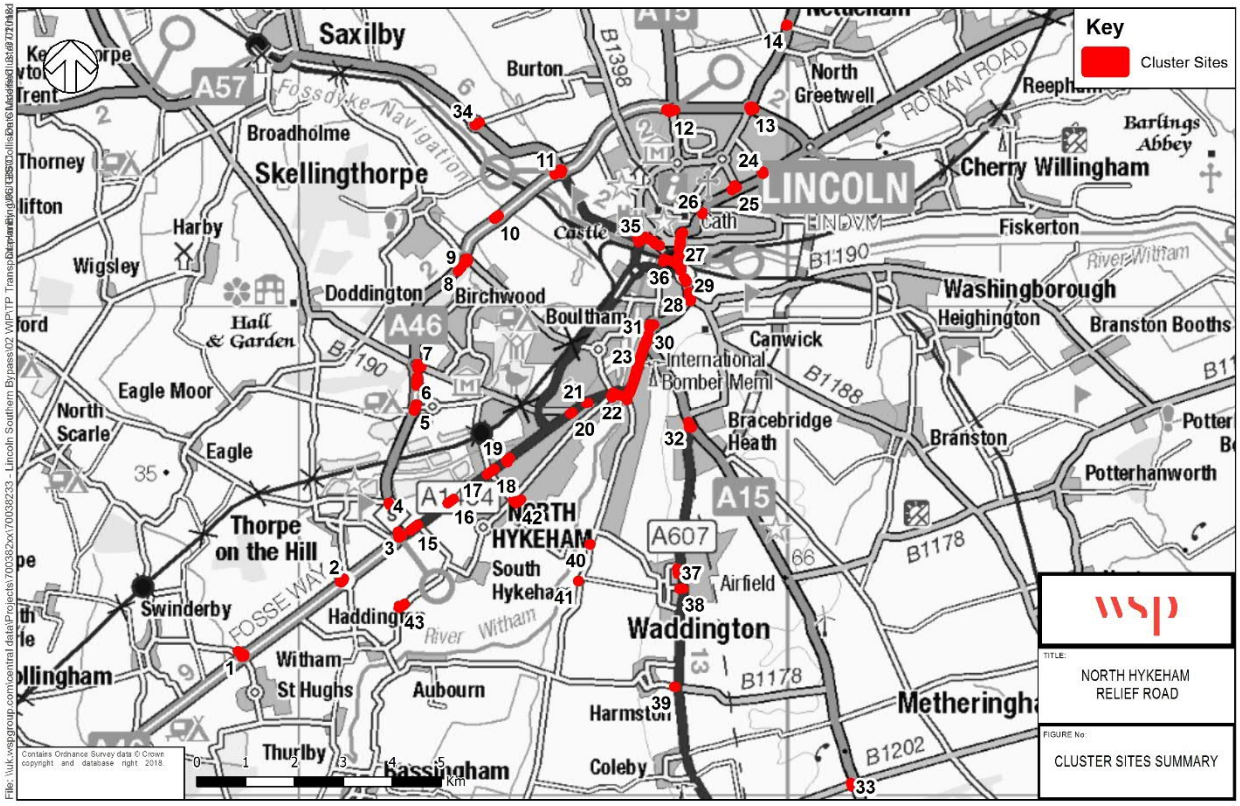



**Figure 26 – Accident clusters**

**Table 13 – Accident cluster summary**

| Road | Ref | Approximate location | Number of accidents | KSI | KSI rate (%) |
|---|---|---|---|---|---|
| A46 | 1 | A46/Halfway House Lane | 13 | 1 | 7.7 |
| | 2 | A46/Fosse Lane | 5 | 1 | 20 |
| | 3 | A46/A1434 | 24 | 2 | 8.3 |
| | 4 | A46/Moor Lane | 5 | 2 | 40 |
| | 5 | A46/Whisby Road | 14 | 2 | 14.3 |
| | 6 | A46 South of Doddington Road | 9 | 0 | 0 |
| | 7 | A46/Doddington Road | 60 | 3 | 5 |
| | 8 | A46 South of Skellingthorpe Road | 4 | 2 | 50 |
| | 9 | A46/Skellingthorpe Road | 15 | 0 | 0 |
| | 10 | A46 North of Skellingthorpe Road | 6 | 1 | 16.7 |
| | 11 | A46/A57 | 37 | 0 | 0 |
| | 12 | A46/A15 | 26 | 3 | 11.5 |
| | 13 | A46/A158 | 20 | 0 | 0 |
| | 14 | A46/Deepdale Lane | 4 | 1 | 25 |
| A1434 | 15 | A1434 North of A46 | 6 | 0 | 0 |
| | 16 | Mappleton to Heron walk | 15 | 3 | 20 |
| | 17 | Station Road | 13 | 1 | 7.7 |

| | | | | | |
|---|---|---|---|---|---|
| | 18 | Lindum Mews | 9 | 1 | 11.1 |
| | 19 | Supermarket roundabout | 7 | 0 | 0 |
| | 20 | Doddington Road | 4 | 1 | 25 |
| | 21 | De Wint Ave | 5 | 0 | 0 |
| | 22 | Hykeham Road to Brant Road | 35 | 2 | 5.7 |
| | 23 | Brant Road to A15 | 43 | 6 | 14 |
| A15 | 24 | Outer Circle dr | 5 | 0 | 0 |
| | 25 | Ruskin Ave | 11 | 1 | 9.1 |
| | 26 | Greetwell Gate | 7 | 1 | 14.3 |
| | 27 | Lindum Road to Tentercroft Street | 54 | 8 | 14.8 |
| | 28 | Tentercroft Street | 10 | 1 | 10 |
| | 29 | Canwick Road | 46 | 2 | 4.3 |
| | 30 | High Street | 14 | 1 | 7.1 |
| | 31 | A1434 | 7 | 0 | 0 |
| | 32 | Grantham Road | 5 | 1 | 20 |
| | 33 | B1202 | 9 | 2 | 22.2 |
| A57 | 34 | Burton Waters | 5 | 0 | 0 |
| | 35 | Brayford Way to Wigford Way | 45 | 5 | 11.1 |
| | 36 | Lincoln Central | 25 | 5 | 20 |
| A607 | 37 | Stone Lane | 4 | 0 | 0 |
| | 38 | Bar Lane and Mere Road | 5 | 0 | 0 |
| | 39 | Church Lane | 6 | 0 | 0 |
| Brant Road | 40 | Meadow Lane | 5 | 0 | 0 |
| | 41 | Somerton Gate Lane | 5 | 1 | 20 |
| Lincoln Road/Hykeham Road | 42 | Moor Lane and Chapel Lane | 5 | 0 | 0 |
| South Hykeham Road | 43 | Breacon Hill Cottage | 8 | 0 | 0 |

**There are higher than average levels of KSI on several sections of the A15 and A57. The greatest issue in terms of KSI rates on local routes is on Lincoln Road/ Hykeham Road between Long Lane and Newark Rd.**

**There are accident rates significantly higher than the national average on sections of the A57, A15 and A46. At a local level, of key relevance to the study area is a high accident rate on Hykeham Road between the A1434 and Chapel Lane.**

**The introduction of the LEB and the subsequent reduction in traffic in the centre of the city is likely to result in improvements to accident rates, particularly along the A15 as it will reduce the volume of traffic along this route.**

**However, the impact on the orbital and major routes on the western side of Lincoln is expected to be marginal and a continued growth in traffic could exacerbate any existing accident issues.**

### 3.6.8. Rat-running

As identified within Section 2.5 there are currently high levels of traffic on several major and local routes through and aroud the Lincoln area including the A46 Western Relief Road, the A57 Saxilby Road / Carholme Road, A15, A1434 Newark Road, A158 and A607 Grantham Road. Current levels of traffic and resulting congestion on the major route network results in traffic using minor routes through suburban areas and surrounding villages at 'rat-runs' to avoid the congestion. This issue is exacerbated by the lack of a high standard east-west route in the south of the area which leads to traffic making those movements via local roads. This is demonstrated by the current levels of traffic on minor routes both in urban areas and along rural routes.

Specifically rat running currently affects the following corridors:

- A1434 Newark Road/A15 Sleaford Road
- South Hykeham/Waddington
- Aubuorn/Harmston

The first of these three corridors is urban and is a major route into and through the Lincoln urban area and as such caters for a range of functions and journeys including local within the urban area, longer movements across Lincoln and strategic movements into Lincoln from outside the area. The other two corridors, however, are primarily edge of urban area or rural in nature and are appropriate only for local traffic. The current traffic flows at the central points of the South.Hykeham/Waddington and Aubourn/Harmston corridors are shown in the table below. For what should be relatively quiet local rural roads, these are significant traffic flows supporting the case that they presently serve more than a purely local function.

**Table 14 – Peak Hour Traffic Flows on 'Rat-run' Corridors**

| Route | Road | AM Peak | | PM Peak | |
|---|---|---|---|---|---|
| | | Eastbound | Westbound | Eastbound | Westbound |
| South Hykeham/Waddington | Meadow Lane | 421 | 530 | 332 | 252 |
| Aubuorn/Harmston | Station Road | 301 | 432 | 396 | 360 |

Below are figures presenting Select Link Analysis from the Greater Lincoln Transport Model (GLTM) for central points in each of the above corridors showing the routing of traffic within them; the figures present data for 2016 AM peak.
The following two figures show the routing of traffic at the central point of the A1434 Newark Road/A15 Sleaford Road corridor; the first is eastbound and the second westbound. The figures show that there is a clear east-west movement through the corridor in addition to the larger movements between the A46, Newark Road and the city centre.

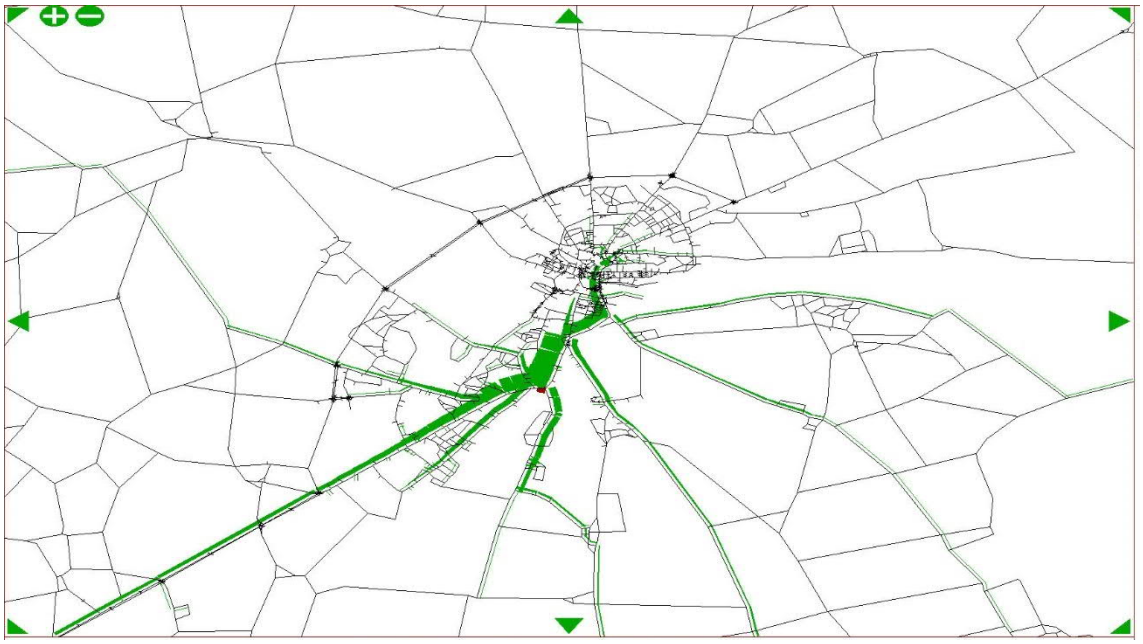


**Figure 27 SLA A1434 Newark Road/A15 Sleaford RoadCorridor AM Peak 2016 Eastbound**

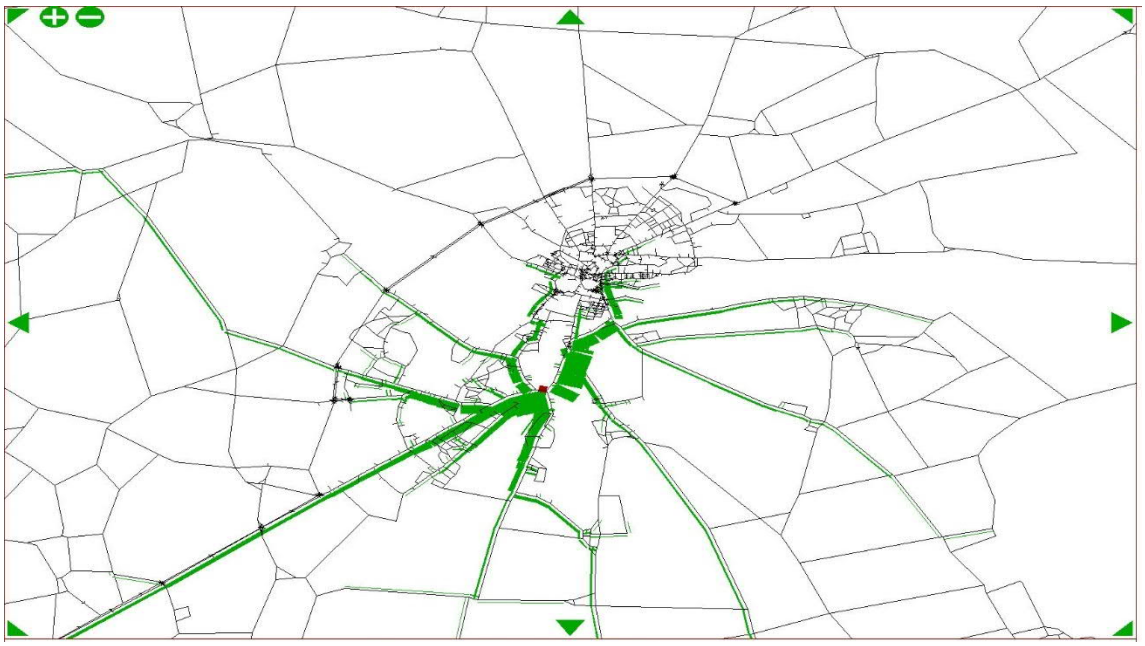


**Figure 28 SLA A1434 Newark Road/A15 Sleaford RoadCorridor AM Peak 2016 Westbound**

The following two figures show the routing of traffic at the central point of the South Hykeham/Waddington corridor; the first is eastbound and the second westbound. These figures show a clearer east-west movement highlighting traffic between the employment areas immediately to the east of the A46 and the A15 and villages to the south of the Lincoln urban area. They highlight rat-running routes through inappropriate edge of urban area and rural roads .

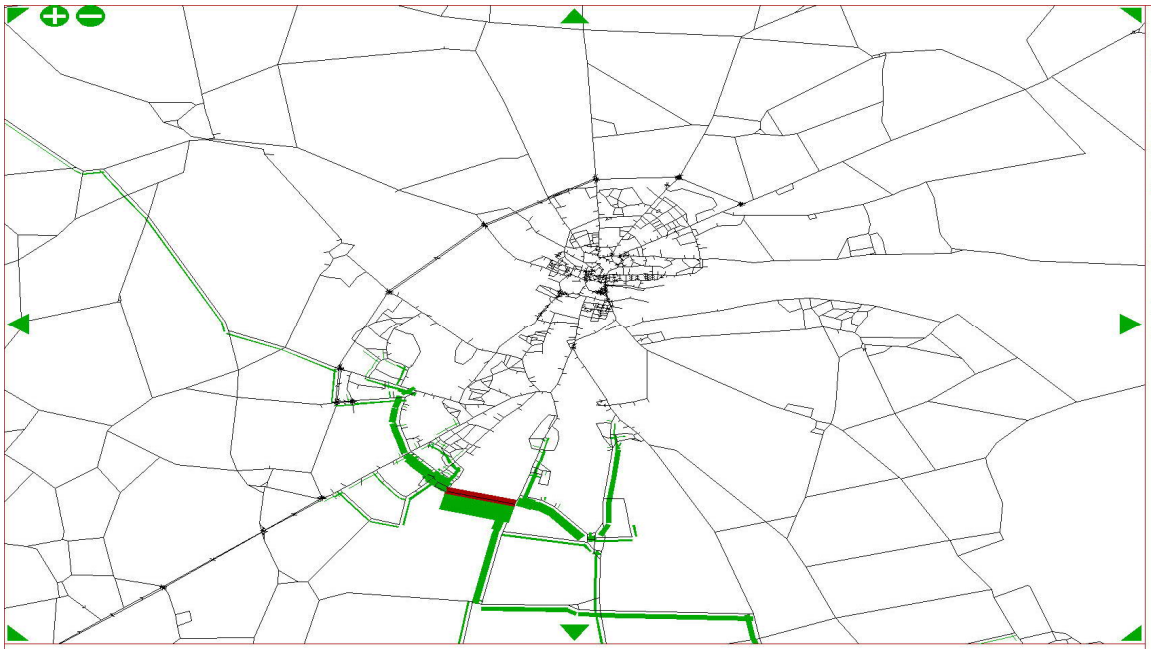


**Figure 29 SLA South Hykeham/Waddington Corridor AM Peak 2016 Eastbound**

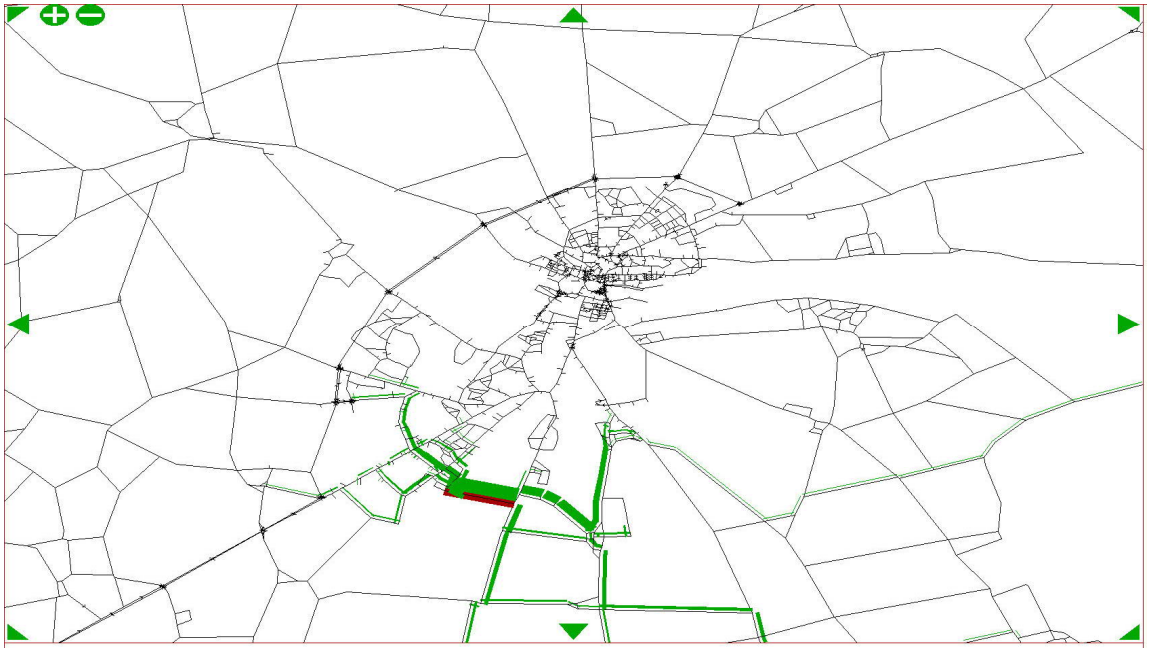


**Figure 30 SLA South Hykeham/Waddington Corridor AM Peak 2016 Westbound**

The following two figures show the routing of traffic at the central point of the Aubourn/Harmston corridor; the first is eastbound and the second westbound. These figures highlight routing through rural roads between the A46 and A15 but also movements through the rural area to and from RAF Waddington and into the main Lincoln urban area.

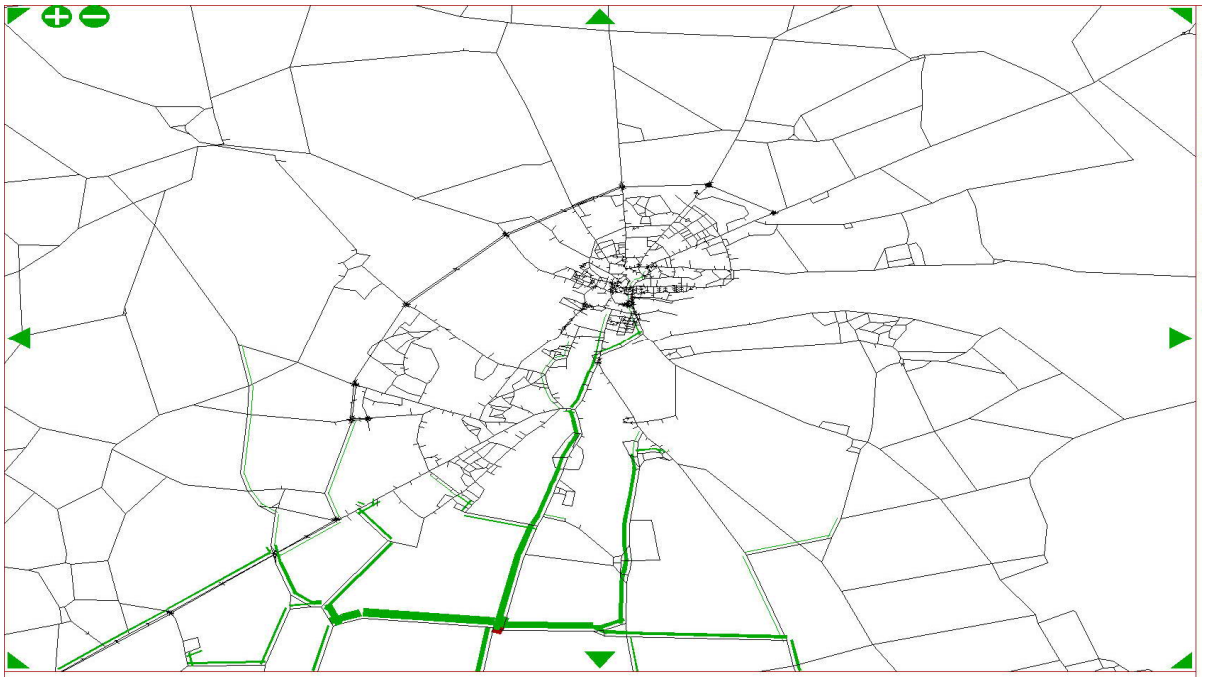


**Figure 31 – SLA Auborn/Harmston Corridor AM Peak 2016 Eastbound**

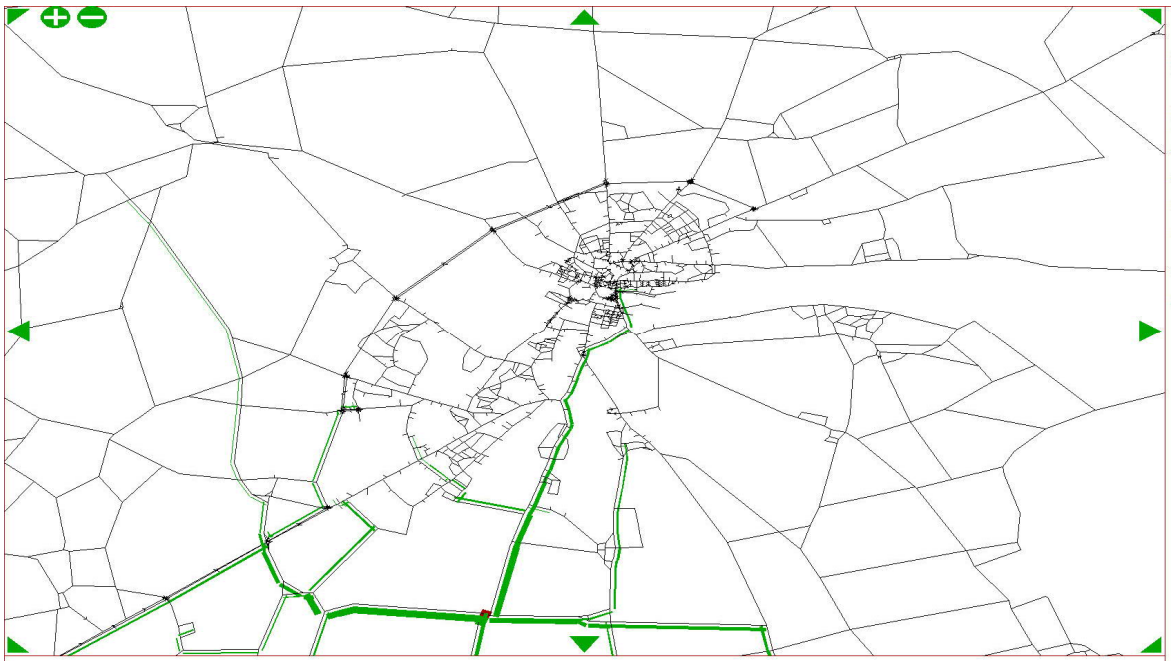


**Figure 32 – SLA Auborn/Harmston Corridor AM Peak 2016 Westbound**

In addition the lack of resilience in the network, due to the limited choice in strategic routes results in traffic being re-routed through unsuitable areas when incidents occur. For example, as detailed in Section 2.4.4 closures between the Hykeham and Doddington Roundabouts causes the diversion of traffic on to the A1434 Newark Road which has many local accesses therefore creating numerous pinch points along the route. Closures further north along the A46 between the Doddington and Skellingthorpe roundabouts, traffic is diverted either along the same section of the B1190

Doddington Road and on to the B1003 Tritton Road. These routes are relatively minor in nature and travel through existing urban areas which are unsuitable for large volumes of traffic.

### 3.6.9. Severance

The high levels of traffic on the major and local routes through Lincoln and surrounding villages also causes severance which in turn affects access to key and local services for non-motorised users and particularly vulnerable groups. The general traffic on local routes is added to by the rat-running identified above causing traffic flows to be higher, this impacts on noise and air quality and reduces opportunities for people to cross local roads. Severence is particularly affected by traffic levels in the suburbs and villages, Table 15 and Figure 33 summarise the existing traffic flows within these areas:

**Table 15 – Routes Affected by Severance**

| Location | Affected Routes | Traffic Flows | Route Description & Characteristics |
|---|---|---|---|
| North Hykeham | A1434 Newark Road | 15,770 | • Urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| | Station Road | 10,604 | • Minor urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| | Moor Lane | 10,826 | • Minor urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| | Mill Lane | 8,295 | • Minor yuban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| South Hykeham | Long Lane | 5,023 | • Rural single carriageway<br>• Minor route from South Hykeham to A1434 Newark Road |
| | Boundary Lane | 5,329 | • Minor rural single carriageway<br>• Minor route from South Hykeham to A1434 Newark Road |
| Bracebridge Low Fields | Brant Road | 11,360 | • Urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| Bracebridge Heath | Lincoln Road/Grantham Road | 9,789 | • Urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| Waddington | A607 Grantham Road<br>Station Road | 9,091<br>9,998 | • Urban single carriageway<br>• Residential area with properties fronting onto the carriageway |
| Harmston | Church Lane/Station Road | 3,707 | • Rural single carriageway through Harmston Village<br>• Narrow road through the village<br>• Properites front onto the carriageway |
| Audourn | Church Road/Royal Oak Lane/Chapel Lane/Harmston Road | 6,184 | • Rural single carriageway through Harmston Village<br>• Narrow road through the village<br>• Properites front onto the carriageway |

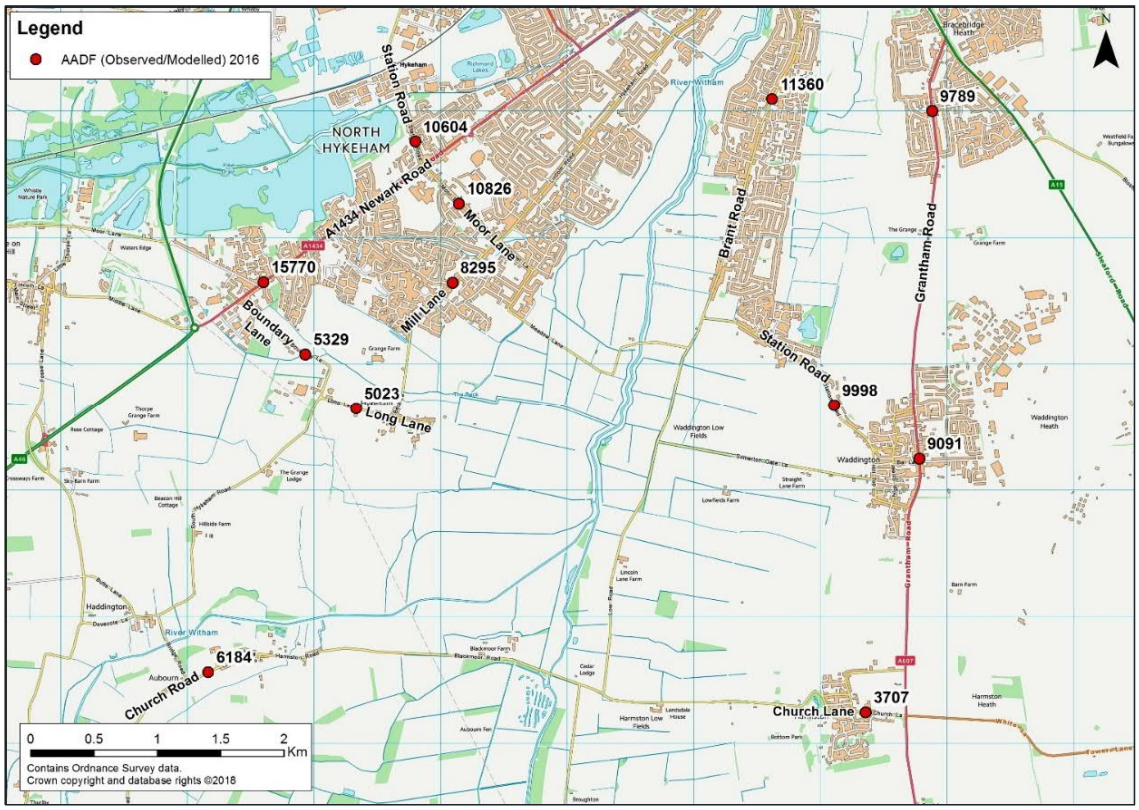



**Figure 33 – Locations affected by Severance**

## 3.7. EXISTING CONSTRAINTS

An assessment of existing constraints within the study area has been completed and included as Appendix E. Key points include:

- **Environmental:** A high level review of the potential environmental constraints affecting the study has been presented in the Environmental Constraints Report (Appendix E). Key findings from the report include:
  - An area identified by the Environment Agency as being Flood zone 3[3] runs from north to south directly through the proposed scheme;
  - Within 1 km of the study area there is an Air Quality Management Area (AQMA); 16 listed buildings; and various sensitive receptors including three primary schools and various farms;
  - Within 2.5 km there is one scheduled monument; Whisby Nature Park (LNR); 15 Local Wildlife Sites (LWS), one Local Geological Site (LGS); two Sites of Nature Conservation interest

[3] This designation identifies land which has an annual probability of 1 in 100 or greater of river flooding and, as such, a flood risk assessment will be required as part of any planning application.

(SNCIs); one Lincolnshire Wildlife Trust (LWT); sustrans regional and local cycle routes as well as walking footpaths and bridleways which cross the proposed scheme corridor; and
    - Within 5.5 km there are three Grade II registered parks and gardens; Swanholme Lakes Site of Special Scientific Interest (SSSI) and a Local Nature Reserve (LNR).

- **Landownership:** Key points from an initial land registry review show 124 land registry titles downloaded; 13 parcels of unregistered land; and 35 residential properties.
- **Geotechnical:** A geotechnical desktop study of NHRR was undertaken as part of the development of the OAR process. It identified the following:
    - **Geology:** The route is entirely underlain by a sequence of Jurassic strata. In the area of Grange Farm near Waddington, a number of generally north south trending faults downthrow the strata to the east.
    - **Ground stability**: There is a generally low to very low potential for ground stability hazards, collapsible ground, compressible ground, potential for landslide, potential for ground dissolution and potential for running sand ground stability hazards. There is a low to moderate potential for landslide ground stability on the Lincoln Edge.
    - **Geomorphology**: A limestone ridge runs north south from the Humber Estuary to Grantham, known as the Lincoln Edge.
    - **Hydrogeology:** The band of Alluvium associated with the River Witham is classed as a secondary A aquifer and as a minor aquifer with variable permeability for groundwater vulnerability. The Lincolnshire Limestone is a principal aquifer and is classed as a major aquifer for groundwater vulnerability. It is included in Zone 3 (total catchment) for source protection zone. There are a number of water abstraction points along the River Witham and from the pond to the south of The Grange.
    - **Groundwater and flooding**: Large sections of the site are at risk from 100 to 1000 year return surface water flooding. There is potential for groundwater flooding to occur at the surface along the line of the River Witham. There is a likelihood of extreme flooding from rivers without defences (Zone 2) between South Hykeham and the River Witham.
    - **Sensitive land:** The site is classified as a Nitrate Vulnerable Zone and there is a nature reserve 800m north-west of the A46 roundabout.

## 3.8. UNDERSTANDING THE CURRENT SITUATION SUMMARY

The findings of this Chapter can be summarised as follows:

- National policy themes include improving strategic connectivity, route capacity and enabling economic growth and delivering housing. Regional policy themes include sustainable economic growth and within local policy the NHRR is cited and supported as a scheme.
- The existing principal road network currently has a number of limitations. North-south traffic has limited route choice, especially in the south of the Lincoln Urban Area, with traffic forced to use either the A46 or A1434 and A15 to pass by or through the city.
- There are limited crossing opportunities of the River Witham and the Fossdyke Navigation in Lincoln and very few opportunities to cross the river in the south of Lincoln. These include a number of relatively minor routes that are particularly unsuited to strategic traffic.
- The existing network limitations result in significant volumes of traffic having to use a limited number of strategic and major routes or unsuitable routes through residential areas. East west traffic in the south of Lincoln is forced to using minor rural routes to the south of Lincoln.
- Traffic volumes have increased on a number of strategic and major routes including the A46 Western Relief Road and the A4134 Newark Road which provides a major radial route into central Lincoln. The expectation is that they will continue to increase putting the network under further pressure.
- There is a lack of network resilience due to the limited availability of appropriate alternative routes around and through Lincoln.
- Several parts of the existing network are at or close to capacity including the A46, with congestion resulting in poor average speeds, variable journey times and delay in both peak periods and to some extent also in off peak conditions.
- There are routes and sections of the network which are carrying levels of HGV traffic in excess of that expected for these types of routes.
- Predominantly rural residential settlements in the south of Lincoln experience unfavourable conditions due to the volume of traffic utilising routes due to lack of suitable alternatives.
- There are routes within the study area which have a significantly higher than average KSI and accident rate.

# 4. UNDERSTANDING THE FUTURE SITUATION

## 4.1. OVERVIEW

This section of the OAR presents a view of the future development and transport situation in the study area. The section follows the DfT's Transport Appraisal Process guidance which states that the following should be taken in to account to gain an understanding of the future transport situation:

- Future land-uses and policies;
- Future changes to the transport system; and
- Future travel demands and levels of service.

The subsequent sections of this Chapter are structured as follows:

- **3.2: Future Provision -** Future Land-Uses and Policies setting out the levels of planned growth in locations relevant to our study area and Future Changes to the Transport System identifying changes to the provision of transport infrastructure and services.
- **3.3: Future Travel Demands and Levels of Service** – Forecast traffic using the infrastructure and services.
- **3.4: Future Transport Problems: Forecast Impact of Future Demand** – On infrastructure and services illustrated by a range of indicators.

## 4.2. FUTURE PROVISION

### 4.2.1. Land-Uses and Policies

The levels of planned growth in locations relevant to our study area are set out in various regional and local policy documents, reviewed below.

**Greater Lincolnshire Enterprise Partnership Strategic Economic Plan**

The Greater Lincolnshire Local Enterprise Partnership (GLLEP) produced a Strategic Economic Plan (SEP) in 2014 which sets out a strategy for driving growth. A refresh of the SEP was subsequently published in 2016 which provides an update on the previous version. The SEP sets out ambitious targets to achieve 13,000 new jobs, support 22,000 businesses, increase the value of the Greater Lincolnshire economy by £3.2 billion and deliver up to 100,000 new homes by 2030; nearly 20% of these homes are to be provided in the Lincoln urban area. Infrastructure improvements are required to facilitate this growth.

The SEP highlights that Lincoln is at the heart of the strategy and the aim is to:

- Prioritise improved skills, growing new markets, and modern telecommunications at the forefront of growing businesses and sectors further; and
- Make the most of Lincolnshire's attractiveness to investors through protecting businesses, improving connectivity, and increasing housing.
- These plans for growth will increase demand for movements of people and goods throughout the LEP area and have impacts on the capacity of the transport network. The SEP also notes that 'The Greater Lincolnshire LEP will lead on:
    - Sector-specific schemes that give businesses the confidence to invest;

- Area-based schemes that unblock housing developments, improve transport, and increase the vitality of our area

One of the key priorities for the LEP is to promote Greater Lincolnshire as a place for sustainable growth through improved transport infrastructure. This will provide greater connection to national and international markets, enabling wider enjoyment of its world-class heritage sites, culture and strong communities.

The SEP states that the LEP seeks the assistance of Central Government in contributing to the achievement of these goals by 'Investing in transport infrastructure to reduce bottlenecks and improve connectivity thereby creating more confidence for investors'.

The document recognises that road and rail links will require review as part of the planning process to achieve sustainable growth, with infrastructure schemes identified to ensure that growth can be delivered whilst minimising the impact on the wider transport network.

According to the SEP, the demand for movement of people and goods will continue to grow across Greater Lincolnshire and will therefore increase stress on the existing transport networks. Large numbers of heavy goods vehicles adding to the pinch points in traffic congestion and the resulting poor access will weaken the future sustainability of the economy, with a particular effect on the agri-food supply chain as the industry is extremely time sensitive. The SEP states that it will prioritise investment towards pinch point and sustainable transport schemes, and also recognises that economic growth will be delivered faster and more effectively through:

- An amendment to the Highways England programme to produce faster east-west links as set out in the Midlands Engine commitments;
- A commitment from the DfT to allocate funding within its second Roads Investment Strategy 2020;
- Recognition of the major road corridors within Greater Lincolnshire that fulfil a national role in moving people and goods;
- Rationalisation of the appraisal process for transport projects;
- Powers to adopt bus service franchise powers and apply a discounted fuel duty scheme to support transport in rural areas; and,
- Phased implementation of the outcomes of the Greater Lincolnshire LEP's rail strategy, which supports the Midlands Engine commitment to improving rail services.

Whilst the LITS is not explicitly referred to within the Strategic Economic Plan, it does make a point of recognising the role that is being carried out by the local authorities in developing transport strategies that promote economic growth and regeneration through their respective Local Transport Plans.

The LEP emphasises that it will continue to promote a package of deliverable projects that offer a strong growth deal to Greater Lincolnshire and national economic growth. Table 1 sets out the criteria described in the LEP.

**Table 1 – LEP Project Support Criteria**

| Criteria | Description |
|---|---|
| Deliverability | Does a project have match funding, planning permission and necessary delivery structures in place? |
| Impact | Will the whole of the LEP area benefit? |
| Productivity | Does a project offer direct outcomes that support economic growth?<br>Do the outcomes represent good value for money?<br>Will the investment lever other funding?<br>Is there a clear plan in place to realise the benefits of the project? |
| Priority sectors | Does a project directly support agri-food, visitor economy, engineering, care, ports, or low carbon?<br>Is there a project that is available to all businesses? |
| Housing | Does a project directly create housing growth? |
| Infrastructure | Does it provide critical infrastructure for growth? |
| Social value | Does the project deliver wider social, economic, and environmental benefits?<br>Will it help to reduce deprivation? |

### Central Lincolnshire Local Plan

The Central Lincolnshire Local Plan 2012-2036 was adopted by the Central Lincolnshire Joint Strategic Planning Committee (CLJSPC) in April 2017, replacing the Local Plans of the City of Lincoln, West Lindsey and North Kesteven District Councils.

The document provides a vision for what Central Lincolnshire could be like in 2036 including objectives and policies setting out how much development should take place. There are significant plans for growth in Lincolnshire in the CLLP area.

The Plan identifies a need for an additional 36,960 dwellings and 11,894 jobs across the period 2012-2036, with growth to be concentrated in the Greater Lincoln area, this is illustrated in Table 2.

**Table 2 – Local Plan Housing and Employment Allocations in the Greater Lincoln Area**

| Local Authority | Housing Target | Employment Target | Significant Developments |
|---|---|---|---|
| Central Lincolnshire (West Lindsey, City of Lincoln and North Kesteven). | 36,960 dwellings in the period to 2036, of which 64% will be in the Lincoln urban area; 12% in Gainsborough; 12% in Sleaford. | 11,894 net new jobs. | Lincoln Western Growth Corridor – 3,200 dwellings in period to 2036; 20ha employment land.<br>Lincoln South East Quadrant – 3,500 dwellings in period to 2036; 7ha employment land.<br>Lincoln North East Quadrant – 1,400 dwellings in period to 2031; 5ha employment land.<br>Sleaford West Quadrant – 1,400 dwellings; 3ha employment land.<br>Sleaford South East Quadrant – 1,450 dwellings.<br>Gainsborough Southern – 1,400 dwellings; 4ha employment land.<br>Gainsborough Northern - 750 dwellings; 7ha employment land. |

The Plan also sets out the location of several Sustainable Urban Extensions (SUEs), along with what is expected to be delivered for each. In the Greater Lincoln area, these are:

- Lincoln Western Growth Corridor (WGC)
- Lincoln South East Quadrant (SEQ)
- Lincoln North East Quadrant (NEQ)
- Lincoln South West Quadrant (SWQ)

Broad locations are identified for future growth additional to the SUEs to provide further capacity and flexibility. A number of other development sites are expected to come forward across the Lincoln area, smaller than the SUEs but still significant cumulatively, in order to deliver the planned scale of housing and employment growth across the plan period.

The location of the SUEs and broad locations discussed above are illustrated in Figure 1, along with the LEB and the indicative route of the NHRR. Within the Local Plan the NHRR is identified on the Policies Map and is safeguarded. Any development proposal on or near either route, which would prejudice the efficient and effective delivery of either of the schemes will be refused. The Local Plan states that the North Hykeham Relief Road will link the Eastern Bypass, at the A15 Sleaford Road, with the existing A46 Western Bypass, at the Newark Road junction, to create a complete ring road around Lincoln.

The Local Plan highlights that fact that authorities in Lincoln see NHRR as a part solution to the city's transportation challenges, with the proposals featuring in the LITS.

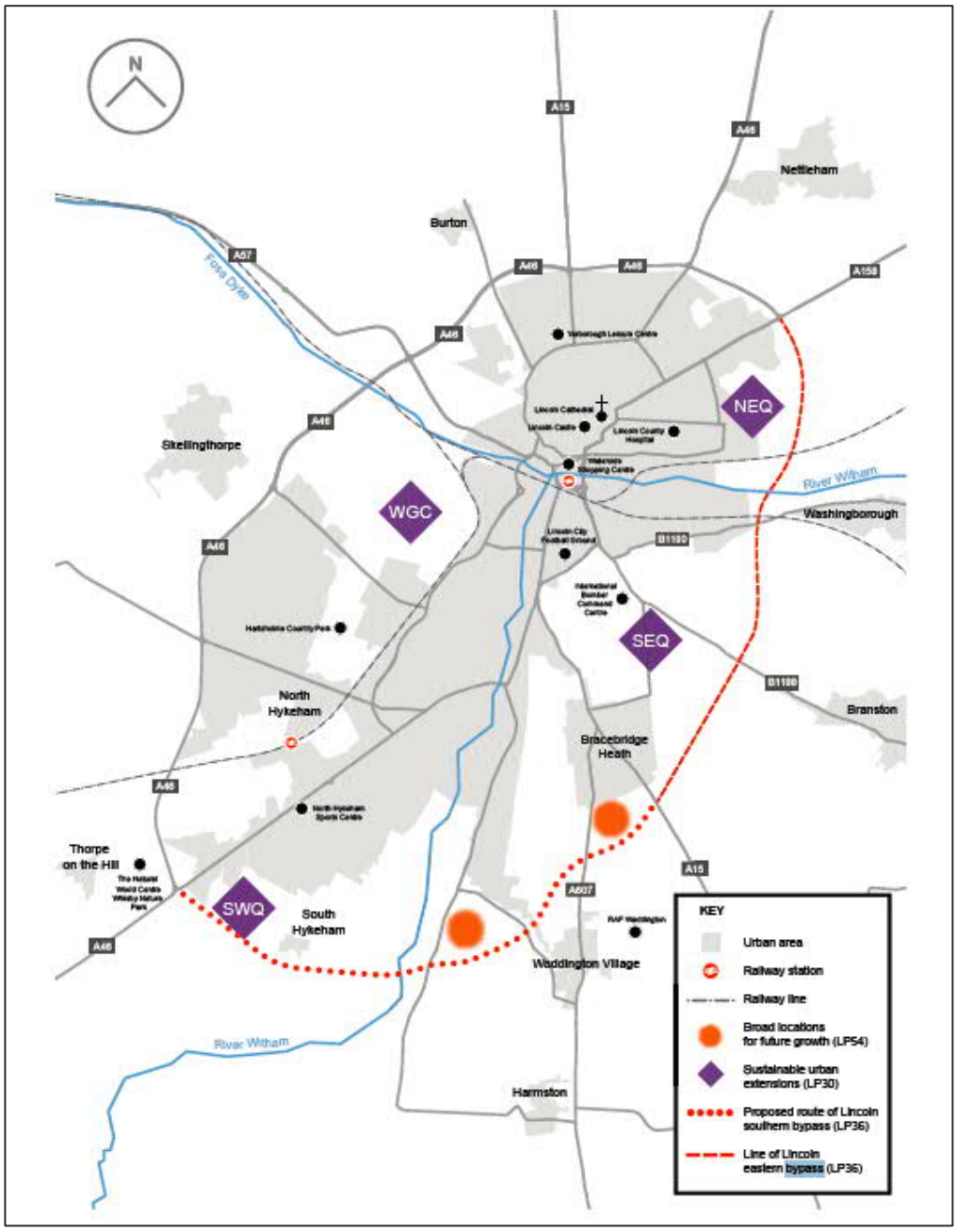



**Figure 1 – Central Lincolnshire Local Plan Lincoln Urban Area Developments**

### Sustainable Urban Extensions

The Central Lincolnshire Local Plan identifies a need for an additional 36,960 dwellings and 11,894 jobs across the period 2012-2036, with much of that growth to be concentrated in the Lincoln urban area..

The Lincoln Strategy Area is identified to accommodate around 64% (24,000) of this growth target in new homes and employment land. Approximately 40% (9,700) of the allocation for the Lincoln Strategy Area will be provided within the local plan periods.

A key tool in meeting these future needs of the Lincoln Strategy Area is the development of sustainable urban extensions (SUEs). SUEs will form an important part of the delivery strategy and are located in areas that can be aligned with the capacity of existing infrastructure, or which can be planned at a scale that is viable to include new or improved infrastructure.

Overall, the scale of this development within these SUEs alone represents a near 50% increase in the number of dwellings in Lincoln by the mid-2030s. Table 3 sets out details of each SUE and their current status.

**Table 3 – Sustainable Urban Extensions**

| SUE | Description | Current Status | Proposed access/transport improvements |
|---|---|---|---|
| Lincoln Western Growth Corridor (WGC): Land at Swanpool, Fen Farm and Decoy Farm. | Up to approximately 3,200 dwellings and 20ha of employment and leisure land uses, together with related uses, a new neighbourhood centre, community facilities, and infrastructure.<br>Consultation on the proposals closed on 15th November 2017. | The SUE is currently in the pre application stages with technical work ongoing.<br>The application is expected to be submitted in late 2018. | Spine road incorporating bus prioritisation measures for fast access to the city centre.<br>New link from Skellingthorpe Road to Tritton Road, and roads within the site designed to discourage high speeds.<br>Several public rights of way pass through the site and new connections to these existing walking and cycling routes are included within the proposals. |
| Lincoln South East Quadrant (SEQ): Land at Canwick Heath and Bracebridge Heath | Approximately 6,000 dwellings (3,600 in the plan period to 2036) and 7 ha of employment land, together with related uses, a district centre, a small local centre, community facilities, and infrastructure.<br>The implementation and progress of the development is reliant on the delivery of the LEB being completed. | Planning permission for 120 dwellings granted in outline (Linden Homes) and an application for 450 dwellings (Barratt Homes) is currently under consideration.<br>Further traffic modelling is anticipated in Spring 2018 as part of the consideration of the Barratt application and to identify necessary transport mitigations for the delivery of the SUE. | Links to the LEB via other routes with junction and other infrastructure improvements proposed.<br>It is expected that the developer will make provision for the extension of public transport services to the site and that cycling and walking infrastructure will be provided to link the site to surrounding areas. |
| Lincoln North East Quadrant (NEQ): Land at Greetwell including the former Greetwell Quarry | Approximately 1,400 dwellings and 5 ha of employment land, together with related uses, a local centre, community facilities, and infrastructure.<br>Delivery linked to and coordinated with LEB. | NEQ has planning Outline Planning Permission for 500 dwellings.<br>Pre-application discussions are in progress for the development of the first phase of c.180 dwellings, the maximum that could be delivered in advance of the LEB being concluded.<br>We expect a planning application to be submitted this summer, and at present the developers are engaging with LCC on both highways and drainage matters ahead of that submission. | Infrastructure to encourage walking, cycling and public transport use in order to maximise take up of sustainable travel in line with LITS.<br>High quality, safe, and effective pedestrian and cycling links that both within and adjoining the development, including links to NCN and |

| SUE | Description | Current Status | Proposed access/transport improvements |
|---|---|---|---|
| Lincoln South West Quadrant (SWQ): Land at Grange Farm, Hykeham. | Approximately 2,000 dwellings, 5ha of employment land, a local centre, and community facilities.<br>The implementation of the development requires, and will fund in part, the first phase of the NHRR – a connection to Brant Road being necessary to provide local traffic mitigation.<br>SWQ lies to the south west of the City of Lincoln to the south of the existing built up area of North Hykeham and to the east and north of South Hykeham Fosseway and South Hykeham Village, well located for access to Lincoln and the A46. | NKDC minded to grant planning permission subject to s106 for the construction of 167 dwellings (Tennyson Homes).<br>Discussions on-going with Landowners toward the production of a masterplanning and access strategy for the delivery of the SUE. | Linked to delivery of the first phase of the North Hykeham Relief Road.<br>The first phase of the North Hykeham Relief Road initially connecting the A46 at its Newark Road Junction to the site's primary access road.<br>The primary access road will connect to Meadow Lane to the north east of the site with construction of the next phase of the Relief Road from South Hykeham Road to Brant Road. |

Of particular relevance to the NHRR is the SWQ which has the potential to accommodate around 2,000 dwellings, up to 5ha of employment land and other supporting uses. It is located to the south west of Lincoln, predominantly in North Hykeham and a smaller proportion in South Hykeham. See Figure 2 for the locations of all four SUEs in relation to NHRR and the wider area. The Lincoln South West Quadrant SUE, comprising of a significant 1,400 dwellings and 4ha of employment land, will be developed immediately adjacent to the proposed NHRR.

Additionally, land at Canwick Heath and Bracebridge Heath (SEQ) is within close proximity to the proposed NHRR. The SEQ development will generate increased east-west traffic which the NHRR could assist in providing additional network capacity and connectivity.

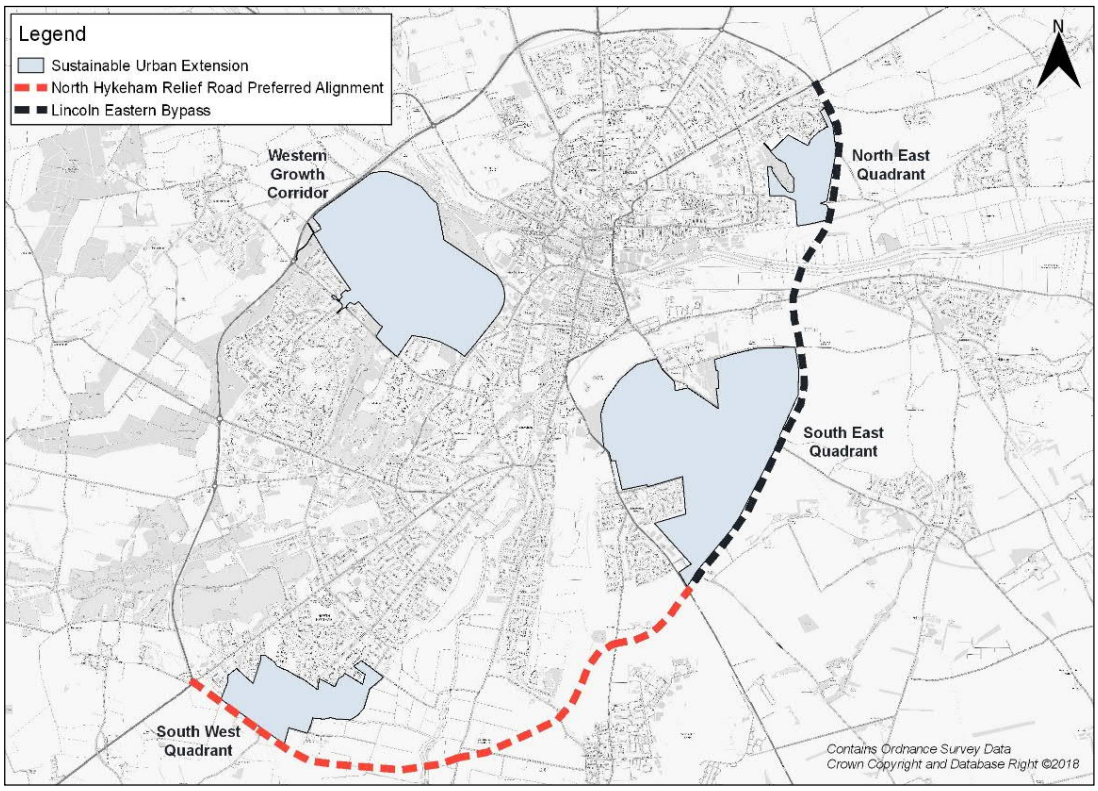



**Figure 2 – Location and Footprint of Sustainable Urban Extensions**

The Sustainable Urban Extension Joint Delivery Statement for Lincoln South West Quadrant[4] highlights the need for the SWQ to create a strong sense of place and identity based on easily navigable walkable routes linking neighbourhoods, employment and community uses and open spaces. It highlights that connections to North Hykeham will be established where appropriate, maximising the links to existing neighbourhoods and securing access to the new NHHR. A requirement of the scheme will be a new Primary Access Road which will form the 'spine' of the development connecting Meadow Lane to the north east of the site with the first phase of the NHRR to Brant Road. Master-planning of the site will be expected to make provision for the extension of public transport links into the site and connecting to surrounding areas. The developer will be expected to contribute to the costs of bus service provision.

Key points to note for the NHRR include:

- The SWQ delivery is linked to the delivery of the first phase of the NHRR.
- The SWQ design ethos of open spaces and navigable walking routes between neighbourhoods must be considered when designing the NHRR; and

[4] Sustainable Urban Extension, Joint Delivery Statement Evidence Topic Paper for Lincoln South West Quadrant, LCC, April 2016.

- The developers of the SWQ will be expected to contribute to the extension of public service links and therefore the NHRR design must accommodate this requirement.

**A policy objective has been set to deliver a number of sustainable urban extensions to facilitate job creation and employment within Lincoln. In relation to the NHRR, the SWQ is dependent on the NHRR to provide access to it; and the design of NHRR must consider public transport and sustainable forms of travel given this underpins the SWQ design ethos.**

**Proposals for the creation of a Major Road Network**

Following a case made by the Rees Jeffreys Road Fund report 'A Major Road Network for England' for the Strategic Road Network (SRN) to incorporate another 3,800 miles of local authority controlled 'A' roads to constitute an 8,000 mile Major Road Network (MRN), the Government has outlined its plans for an MRN of local roads including proposals on funding and how the routes and schemes will be chosen.

The DfT has stated that the MRN will consist of the most strategic local routes in England and will dedicate over £1bn a year in funding from the planned National Roads Fund created by ring-fencing vehicle excise duty (VED).

Under the proposals, local highways authorities would retain their existing responsibilities and submit proposals for transport schemes (between £20m and £50m) to sub-national transport bodies or equivalent regional groups. These bodies would then consult Regional Evidence Bases which take into account network performance issues and then proceed to select appropriate schemes to be developed. These selected schemes would then be passed on to the transport secretary to allocate funds under a MRN Investment Programme. In line with the existing Road Investment Strategy cycle, the Investment Programme and the Regional Evidence Bases would be updated every two years, with the MRN itself reviewed every five years.

Schemes eligible for funding include:

- Bypasses
- Missing Links
- Widening of existing MRN roads
- Major structural renewals
- Major junction improvements
- Traffic management / smart technology
- Packages of improvements

Consultation began in late December 2017 and outlines the Government's proposals for the MRN, seeking views on its core principles, the definition of the network, investment planning, and eligibility and investment assessment.

Within the consultation document, the Government lists five central policy objectives:

- Reduce congestion
- Support economic growth and rebalancing
- Support housing delivery
- Support all road users
- Support the Strategic Road Network (SRN)

The DfT is proposing to shape the MRN using both an objective analytical basis, and local knowledge and requirements. It states that the consultation seeks views on the criteria being used to define the network which include:

- To use current traffic data as the starting point by which to identify those roads that should be considered for inclusion in the MRN.
- To use qualitative criteria in order to create a coherent and consistent network.
- To take into account evidence from local and regional partners concerning regional variations.
- To include, where appropriate, previously de-trunked roads.

As part of the consultation and to help respondents in providing their views, a map of an indicative MRN has been published, as shown in Figure 3.

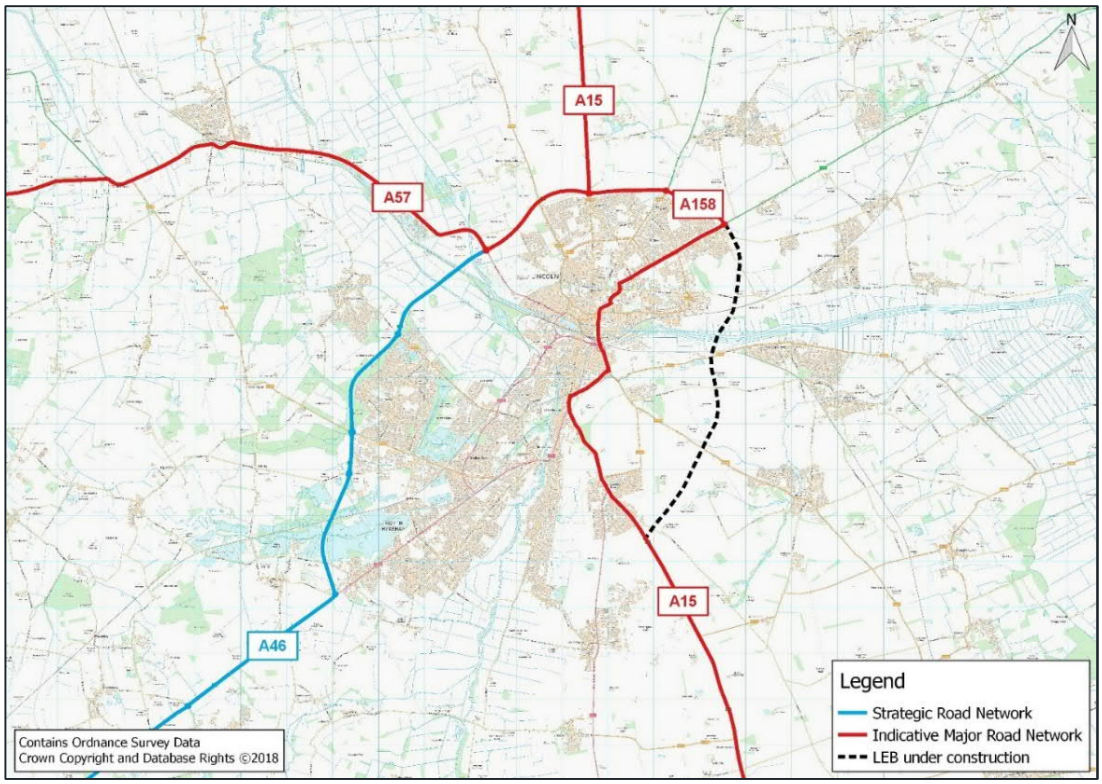



**Figure 3 – MRN Proposals within Lincoln Area**

It can be seen that included within the indicative MRN are the A15, A57 and A46, three links that make up the key radial and orbital routes within the Lincoln urban area. Once completed, the LEB will be formally classified as the A15, between the A158 to the north and the existing alignment of the A15 south of Bracbridge Heath.

With reference to the North, TfN have published their 'Initial Major Roads Report' which builds on the Rees-Jeffrey's Road Fund study along with the Northern Powerhouse Independent Economic Review and Northern Powerhouse Strategy. The report provides early proposals and indicates that the MRN will be a live network that evolves to meet the emerging needs of the Northern economy and its connectivity priorities both now and in the future.

This will be critical to the North to transform:

- Agglomeration

- The North's productivity gap
- The ability to better connect current and future Important Economic Centres (IECs) to the SRN, MRN and rail networks
- Reducing the cost of exporting goods to national and international markets
- Time, reliability and resilience benefits

Within the report, TfN lists 13 broad transport corridors, referred to as connectivity priorities, identified for further appraisal. Amongst these priorities is the South Humber Trans-Pennine corridor which includes the A15 and A46 and their connection to the South Humber Bank from Lincolnshire.

Whilst the A15 and A46 have been identified as part of the indicative MRN and are recognised as being a connectivity priority to the South Humber Bank by TfN, the current congestion problems and forecast levels of traffic growth within Lincoln will likely inhibit any proposal to develop a programme of work along these routes and the effectiveness of the MRN through Lincoln.

It would be expected that the completion of the orbital ring road around Lincoln will further support the reassignment of strategic traffic from existing orbital and the major route network through the city centre alleviating pressures on the existing network and allowing the benefits that result from meeting the objectives listed above to be realised.

Lincoln is also covered by The Midlands Connect Partnership area, with the Midlands Connect Strategy aiming to improve journey times and network resilience so that all journeys can be completed within 20% of the median journey time for that period. The principals of the strategy are underpinned by the following objectives:

- To support the vision of the Midlands Engine through a transport strategy to transform strategic transport networks; and
- To maximise economic growth through increasing productivity of existing businesses and unlocking the creation of new jobs across the region.

**The Transport Investment Strategy**

The Transport Investment Strategy, published in July 2017, sets out the case for the Government's continued investment in transport infrastructure and how it will address specific national challenges related to transport:

- Network connectivity and reliability - By 2040, it is estimated that congestion on the SRN could lead to 28 million lost working days, a £3.7 billion cost to the freight industry, and each household spending an average of 16 hours stuck in traffic a year;
- Productivity and rebalance - UK productivity has been falling behind other G7 countries;
- Global competitiveness - Around a quarter of businesses cite the quality of domestic connections to international gateways as a barrier to exporting; and
- Housing – Current build out rate of new homes is well below the estimated 225,000 to 275,000 homes per year needed to keep up with population growth and tackle years of under-supply
- To meet the challenges described above, the strategy lists a number of objectives, all of which future investment decisions should be focused on:
- Creating a more reliable, less congested and better connected transport network that works for the users who rely on it;

- Building a stronger, more balanced economy by enhancing productivity and responding to local growth priorities;
- Enhancing global competitiveness by making Britain a more attractive place to trade and invest; and
- Supporting the creation of new housing.

The strategy highlights the need to expand existing capacity to ease congestion and to make it better able to cope with demand through investment in new infrastructure. It emphasises that upgrades to the transport network, including bypasses, which tackle congestion typically have high returns, with £1 spent leading to an average return of at least £4.5.

Furthermore, the strategy recognises that connectivity of the transport system is a fundamental component of the positive economic contribution it can make and that investment is required to add new capability to the network in order to create new links between communities and workplaces, connect housing developments to the network and to provide new routes on city and commuter networks.

**Future Land-use and policies summary**

The future land-use changes and key polices which are expected to have a significant impact on Lincoln and the surrounding area can be summarised as follows:

**The SEP sets out ambitious targets to achieve 13,000 new jobs, support 22,000 businesses, increase the economy by £3.2 billion and deliver up to 100,000 new homes by 2030.**

**The CLLP identifies a need for an additional 36,960 dwellings and 11,894 jobs across the period 2012-2036, with growth to be concentrated in the Greater Lincoln area.**

**The Lincoln South West Quadrant SUE, comprising of around 2,000 dwellings and 5ha of employment land, will be developed immediately adjacent to the proposed NHRR.**

**The NHRR is a critical transport link identified in the Central Lincolnshire Local Plan that will provide access on to the SWQ. Furthermore the design ethos of the SUE includes walkable routes, open spaces and public transport services to the surrounding area and consequently this must be considered when designing the NHRR.**

### 4.2.2. Future Changes to the Transport System and Levels of Service

The LITS has been the key transport strategy over a number of years that has set out the transport priorities for the Lincoln area. Since its adoption there have been a number of changes to the transport system in and around the Lincoln urban area and others that are currently being progressed. Table 4 provides a summary of the key schemes and recent changes to the transport network.

**Table 4 – LCC Future Schemes**

| Scheme | LITS | CLLP | Status |
|---|---|---|---|
| Small-scale Walking/Cycling/Public Transport Schemes | ✓ | | Cycling and walking improvements have been implemented through the Community Travel Zones including a new cycle hub at Lincoln Train Station which opened in December 2016. Further public realm schemes in the city centre have also been implemented |
| Public Transport Interchange | ✓ | | Lincoln transport hub opened in January 2018 including a new bus station and multi-storey car park |
| Park & Ride | ✓ | ✓ | Park and Ride service launched in February 2017 on Nettleham Road |
| Quality Bus Corridors | ✓ | | QBC1 has been delivered and QBC2 is under development. Further QBCs proposed along Broadgate (QBC3) and Dixon Street (QBC4). |
| Extension of Real Time Passenger Information | ✓ | | Lincolnshire's real time bus tracking project 'True Times' is currently being rolled out to services |
| Lincoln Eastern Bypass | ✓ | ✓ | Under construction. Expected to open to traffic in early 2020. |
| East-West Link | ✓ | ✓ | Opened to traffic in November 2016 |
| North Hykeham Relief Road | ✓ | ✓ | Funding for preparation of an outline business case secured in July 2017. |
| Western Growth Corridor Link | ✓ | ✓ | WGC consultation period closed in November 2017. Planning application will be submitted by the end of March 2018 |
| City Centre Pedestrian Improvements | ✓ | ✓ | Brayford Wharf footbridge given final approval in November 2017. The Lincoln High Street public realm improvement scheme completed in January 2018 |
| Further Traffic Management Measures | ✓ | | New roundabout at the A46/Lincoln Road junction granted planning permission, due for completion in May 2020. Junction improvements scheduled along Wragby Road and Wolsey Way due to be completed in July 2018. Other traffic management schemes are also being progressed |

Table 4 provides an update on the current status of the schemes and highlights whether they are included in LITS and the emerging CLLP. In the majority of cases schemes are included in both documents, clearly showing the continued relevance of LITS to the ongoing future development of the city. The key significant change to the transport system in Lincolnshire is the provision of the Lincoln Eastern Bypass that is currently under construction. Once complete LEB will provide the penultimate component of the envisaged ring road around Lincoln, Linking the eastern end of the Northern Relief Road to the A15 Sleaford Road, south of Bracebridge Heath.

In terms of Lincoln Western and Northern Relief Road Improvements the following changes have been identified:

- **Improvements to the A46 Riseholme and Nettleham Roundabouts**: Improvements to the A46 roundabout junctions at Nettleham and Riseholme are presently being taken through the

development stage by Lincolnshire County Council. Improvements are proposed to include amendments to the size of the roundabouts themselves as well as widening of entries; the junctions would remain un-signalised.**Improvements to the A46 around Newark:** The process to develop Highways England's next Road Investment Strategy to cover the Roads Period between 2020 and 2025 has identified a potential scheme on the edge of the study area in the form of the A46 Newark Northern Bypass. This scheme would look to enhance A46/A1 junction to improve access to Newark and Lincoln, as well upgrade the A46 around Newark to complete a dual carriageway from Leicester to Lincoln.

**The LEB will create significant change to the transport system in Lincolnshire. Once complete LEB will provide the penultimate component of the envisaged ring road around Lincoln, linking the eastern end of the Northern Relief Road to the A15 Sleaford Road, south of Bracebridge Heath.**

**The NHRR is identified in LITS as a priority for delivery in the next 10-15 years.**

**LCC is assessing improvements to Lincoln Western and Northern Relief Roads.**

## 4.3. FUTURE TRAVEL DEMAND

Whilst an analysis of current performance of the routes has been undertaken, it is also important to understand how future traffic growth may affect the routes. This section uses modelling forecasts based on TEMPRO as a reference case against which the proposals in the CLLP have been assessed. The aim is to develop an understanding of the 'without scheme' situation.

To enable an assessment of future traffic levels, TEMPRO has been used to provide growth factors. TEMPRO provides outputs from the National Trip End Model and can be used to provide factors that are focussed on specific areas and road types. In the case of this analysis, the growth factors have been produced for rural and urban principal roads in Lincolnshire.

The updated GLTM was developed to support the modelling and appraisal of new projects brought forward by LCC and its partners. One of the primary objectives for GLTM is to provide a robust tool for analysis and appraisal for land use development management.

GLTM has been developed to provide detailed coverage of the Lincoln urban area and immediately surrounding area (see Figure 37), with the simulation area boundary roughly defined by a cordon around the existing A46 bypass and the under-construction LEB. The network and zoning detail is sufficiently detailed to facilitate the core uses of the model including analysing the future travel demands and levels of service of the city.

The Do-Minimum modelling scenario, undertaken for the study, assesses the impact of growth on the highway network based on the implementation of only the completed and committed schemes included within the proposed CLLP which are the LEB (single carriageway option), the East-West link and the infrastructure proposed as part of the SUE developments, namely the NEQ, SEQ and WGC. It should be noted that SWQ has not been included in the Do-Minimum scenario as this development is dependent on the scheme.

The following results from the Do-Minimum modelling are presented:

- Total trips
- Peak hours flows and AADT

### 4.3.1. Total Trips

- By, 2026, trips are set to increase by 11% to approximately 34,600 during the AM peak and 10% to 35,800 during the PM peak.
- By 2036, vehicular trips are forecast to increase by 20% to approximately 37,500 during the AM peak and by 19% to 38,600 during the PM peak.

The growth from base year to 2036 exceeds a total of 6,000 vehicle trips per hour indicating a substantial rise in traffic volume.

Table 5 provides a summary of the total forecast modelled trips during the AM and PM peak hours within the Lincoln urban area up to 2036. In the model base year (2016) there are approximately 31,200 vehicular trips in the AM peak hour and 32,500 in the PM peak hour:


- By, 2026, trips are set to increase by 11% to approximately 34,600 during the AM peak and 10% to 35,800 during the PM peak.
- By 2036, vehicular trips are forecast to increase by 20% to approximately 37,500 during the AM peak and by 19% to 38,600 during the PM peak.

The growth from base year to 2036 exceeds a total of 6,000 vehicle trips per hour indicating a substantial rise in traffic volume.


**Table 5 – Total Vehicle Trip Growth 2016 – 2036**

| Peak Hour | | Base Year (2016) | 2026 | 2036 |
|---|---|---|---|---|
| AM | Vehicle Trips | 31,200 | 34,600 | 37,500 |
| | % Change | 0% | 11% | 20% |
| PM | Vehicle Trips | 32,489 | 35,800 | 38,600 |
| | % Change | 0% | 10% | 19% |


- By, 2026, trips are set to increase by 11% to approximately 34,600 during the AM peak and 10% to 35,800 during the PM peak.
- By 2036, vehicular trips are forecast to increase by 20% to approximately 37,500 during the AM peak and by 19% to 38,600 during the PM peak.

The growth from base year to 2036 exceeds a total of 6,000 vehicle trips per hour indicating a substantial rise in traffic volume.


Table 5 illustrates that over the next 20 years there is forecast to be a substantial increase in traffic on the network in Lincoln. Even with the investment and addition of the single carriageway LEB, the network on the western side of Lincoln will be affected by this growth. In particular conditions on the A46, A1434 and local road network in the Hykeham area are expected to continue to deteriorate.

### 4.3.2. Traffic Forecasts – 2026 Do-Minimum AADT

Figure 4 shows the AADT for 2026 on the key orbital and radial routes in the Lincoln urban area along with some of the more local routes within North Hykeham around the proposed location of the scheme. Figure 5 illustrates the forecasted change in two-way AADT at DfT count sites around Lincoln's strategic road network and other key radial routes from 2016 to 2026.

The forecast show that there are forecast to be some significant increases in traffic on several routes into and around Lincoln including those routes which already experience congestion or are already operating close to or at capacity. This includes sections of the A46 Western Relief Road where traffic is expected to increase by between 10 and 11% and the A4134 where traffic is forecast to increase by 7%. Several rural routes to the south of Lincoln are also forecast to experience a significant increase, these include Meadow Lane, Station Road, Brant Road and Blackmoor Road. Traffic along these routes is expected to increase by between 19% and 53%. These routes are narrow rural roads which pass through residential areas and villages, they are unsuitable for large volumes of traffic and a significant increase will impact on these communities and increase severance.

***LEB Impact***

The completion of the LEB during this period will result in changes to traffic flows on the existing network. Significant reductions in traffic will occur on the following:

- **A15 –** There will be a reduction in flow on the dual carriageway section of the A15 in the centre of the city and along Wragby Road and Bunkers Hill. The AADT is forecast to decrease by approximately 14% on this route due to the opening of the LEB as traffic re-routes on to the new orbital route and avoids travelling in to the city centre along the A15
- **A607 Grantham Road –** South of Waddington the AADT is forecast to decrease by 25%.

However, the introduction of the LEB will result in increases on some sections of the network, for example on the A15 south (A15 Sleaford Road) traffic will increase substantially. This is attributed to the opening of the LEB/A15 junction which will result in traffic reassigning to access the bypass. In addition, at the LEB's northern end where it will connect the A158 Bunkers Hill junction the increase in AADT will be 49%. Despite the introduction of LEB, traffic is forecast to continue to grow overall across the network leaving some areas of the network severely congested and constrained. As detailed above this includes the A46 WRR and the A1434 as well as local routes including Brant Road, Meadow Land and Boundary Lane.

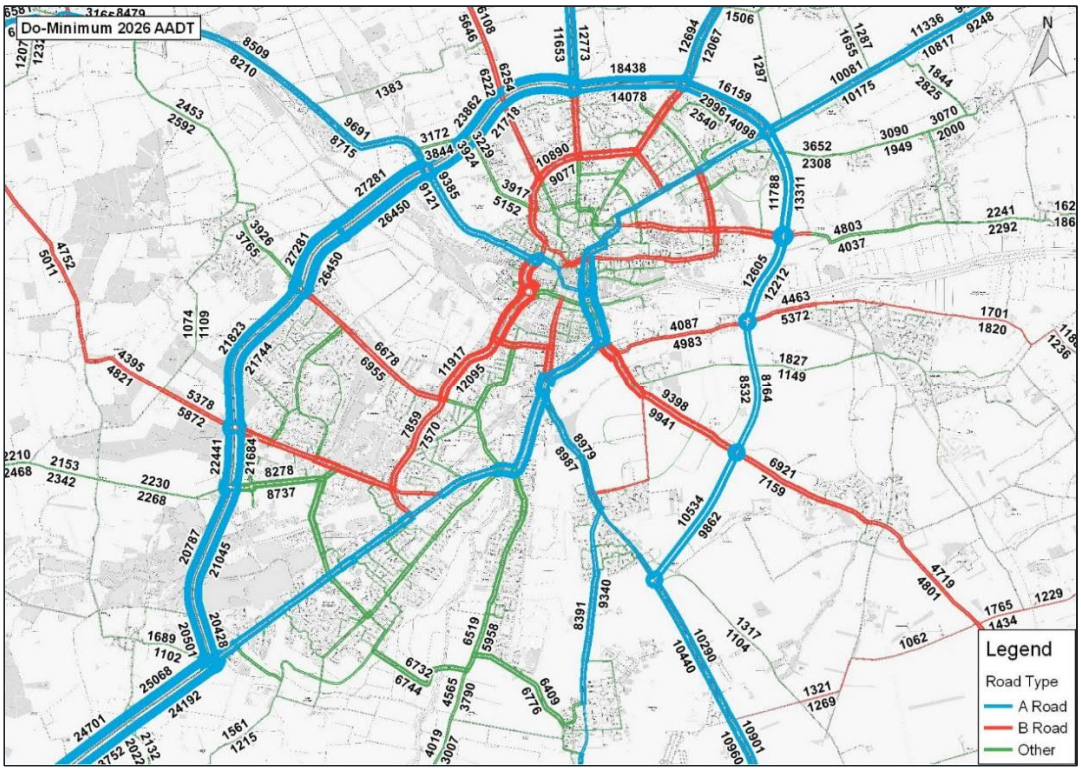



**Figure 4 - Forecast 2-way AADT flows - Do-Minimum 2026**

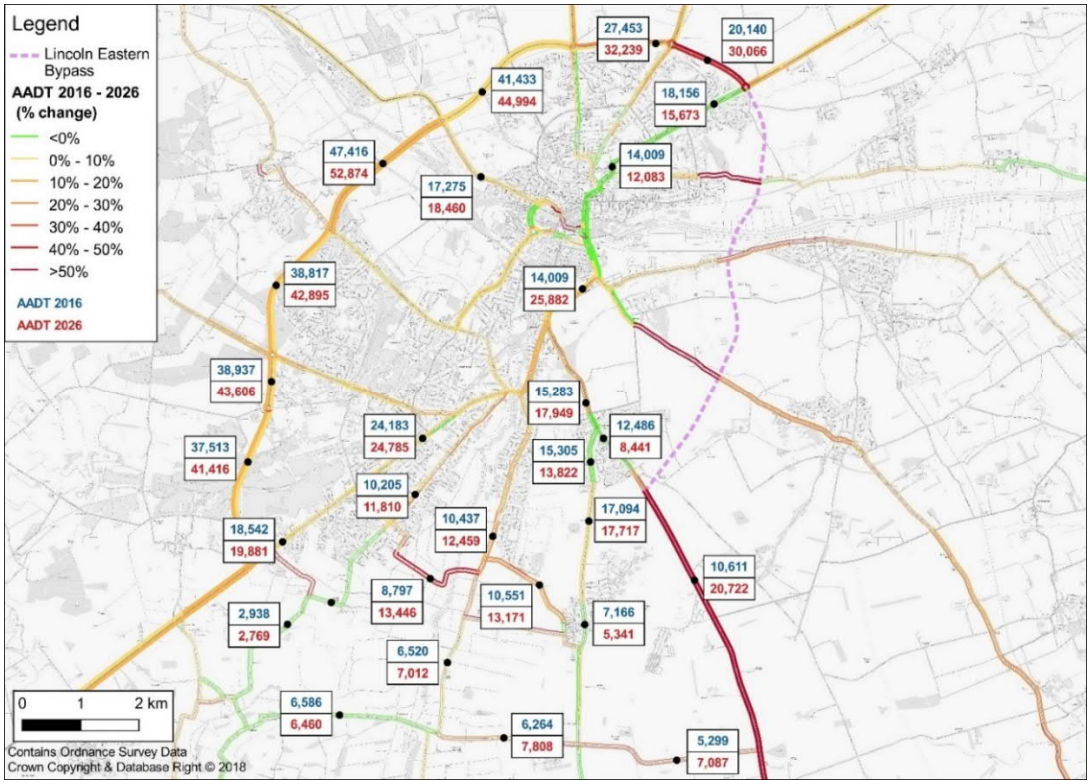



**Figure 5 – Forecast AADT Change 2016-2026**

### 4.3.3. Traffic Forecasts – 2036 Do-Minimum AADT

Figure 6 shows the forecast AADT for 2036 on the key orbital and radial routes in the Lincoln urban area along with some of the more local routes within North Hykeham. Local roads such as Meadow Lane and Station Road are forecast to carry high amounts of traffic in both directions in 2036.

Figure 7 shows the forecast change in traffic flows up to 2036 and demonstrates that traffic is expected to continue to increase on several major routes in and around Lincoln. As in the previous section the analysis shows that traffic is expected to continue to increase on the A46, A1434 and A15 where conditions will be expected to deteriorate further. By 2036 traffic is expected to have increased by between 16% and 21% on the A46, 14% on the A1434 and 134% on the A15.

In addition traffic on the local and rural routes in the south of Lincoln is expected to continue to increase. Meadow Lane in particular is forecast to increase by 28% (eastbound) and 22% (westbound) between 2026 and 2036. South Hykeham Road is among the links with the highest forecast increase in AADT between the two modelled years, 51% for southbound traffic and 26% for northbound traffic. The existing east west route between the A46 and the A15 (Harmston Road, Blackmoor Road and Station Road) to the south of Lincoln through the villages of Aubourn and Harmston also is also expected to experience substantial increases in traffic. The forecasts show that traffic is likely to increase by up to 70% on some sections. This will impact on the existing villages and communities increasing severance as well as affect air quality and noise.

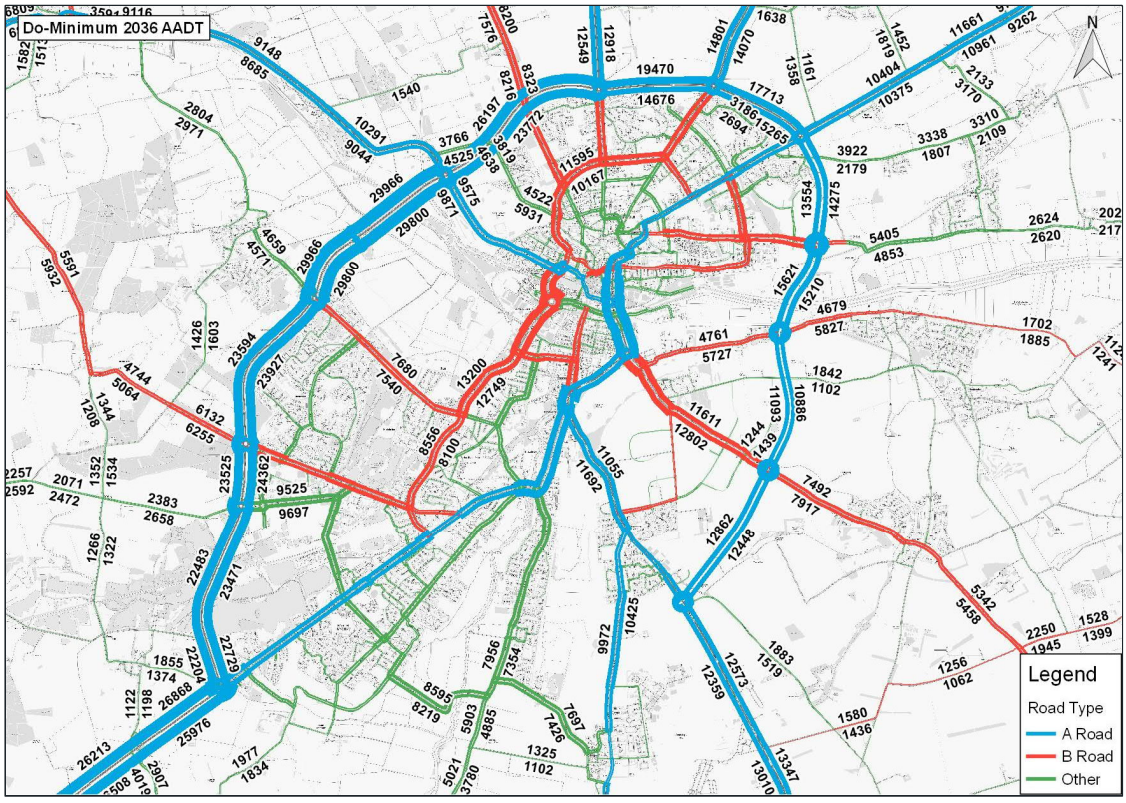



**Figure 6 - Forecast 2-way AADT flows - Do-Minimum 2036**

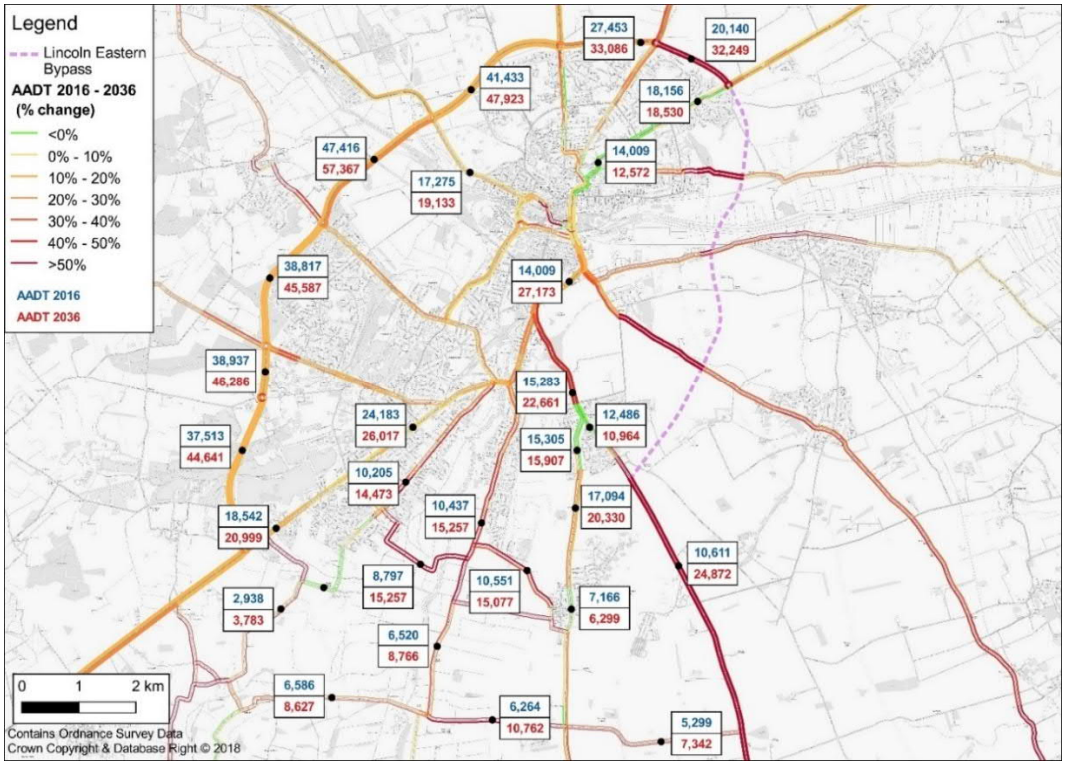



**Figure 7 - AADT Change 2016-2036**

In the 10 years following the forecast opening of LEB, traffic growth is set to continue at a marked rate across the Greater Lincoln Area road network. Figure 7 illustrates AADT change from existing traffic levels to those forecast in 2036, providing a longer term picture of traffic volumes.

In summary, analysis shows that without any further changes to the transport network, current levels of growth will result in traffic levels increasing significantly on many of the strategic orbital and radial routes in and around Lincoln. Further to this, AADT on the local road network in North Hykeham, to the south of the city, is expected to continue to increase significantly, to a level which is not appropriate for the nature of the roads and the type of traffic that use them.

**An analysis of future travel demands within the study area has revealed that total trips are expected to increase substantially over the next 20 years.**

**Traffic levels are forecast to increase in the region of 11% up to 2026 and up to 20% by 2036 from a 2016 base year.**

**The opening of the LEB will improve conditions in the centre of Lincoln. However traffic is expected to continue to grow on a number of major routes including the A46 WRR, A1434 Newark Road, A607 Grantham Road and local routes in the south Lincoln area. These routes already experience congestion and conditions are expected to deteriorate.**

**Analysis undertaken as part of the Local Plan identifies significant additional traffic resulting from development and the identification of the NHRR as a prioritised scheme.**

**Traffic flows on the existing rural east west routes to the south of Lincoln are also expected to increase substantially. This will have a detrimental impact on the existing villages and communities within this area affecting air quality and noise and increasing severance.**

## 4.4. FORECAST IMPACT OF FUTURE DEMAND

The following section presents the impact of the forecast levels of travel demand on the network illustrated through the following indicators:

- Link Capacity;
- Junction Volume Capacity; and
- Average Speed.

### 4.4.1. Link Capacity

This section presents a visual representation of the Link Volume to Capacity Ratio (VoC) across the network. The colour shading highlights the ratios with green being under 50% of capacity and red being over 85% of capacity. The figures also show the modelled 'actual' flows on each link.

This provides an indication of the efficiency of the network and areas where there are likely to be problems in the future. However, it should be noted that those links that have a high volume to capacity ratio may not experience poor conditions over the entire link length.

***2026 Forecast Impact***

Figure 42 shows the outputs for the scheme opening year (2026) Do-Minimum AM peak hour (as described previously the 'Do-Minimum' scenario is based on the assumption that only committed schemes will have come forward by the forecast year – i.e. East-West link and LEB (single carriageway).

The forecasts show that the single carriageway sections of the A46 WRR between the A1434 Newark Road and B1378 Skellingthorpe Road junctions is expected to be operating over capacity by 2026. Capacity related issues for the east-west movements can also be identified along Meadow Lane to the south of the city which is expected to be operating at capacity by 2026 – this provides the only crossing of the River Witham in the south of Lincoln. It also shows that sections of the A1434 Newark Road are expected to be operating at capacity by 2026.

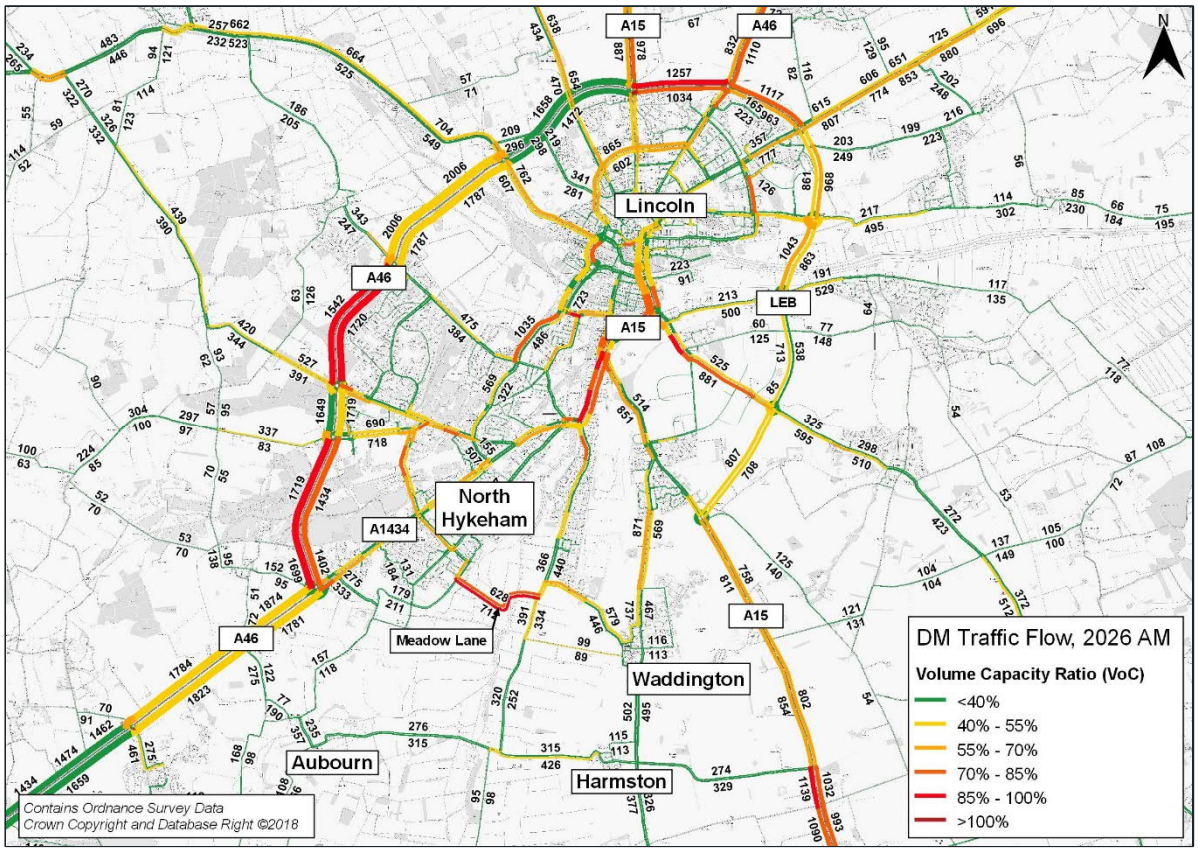



**Figure 8 – Link Volume to Capacity Ratio - Do-Minimum - 2026 - AM Peak**

Figure 9 illustrates 2026 PM. It shows that conditions will be similar to the AM Peak with the same stretches of the A46 WRR operating close to or above 85% of capacity along with the eastbound section between the A15 and the A46 Welton Road junctions, north of the city. In addition, it can be seen that the ring road section of the A158 to the north-east of the city is also close to operating over 85% of capacity in both directions along with the adjoining A46 Lincoln Road (northbound lane).

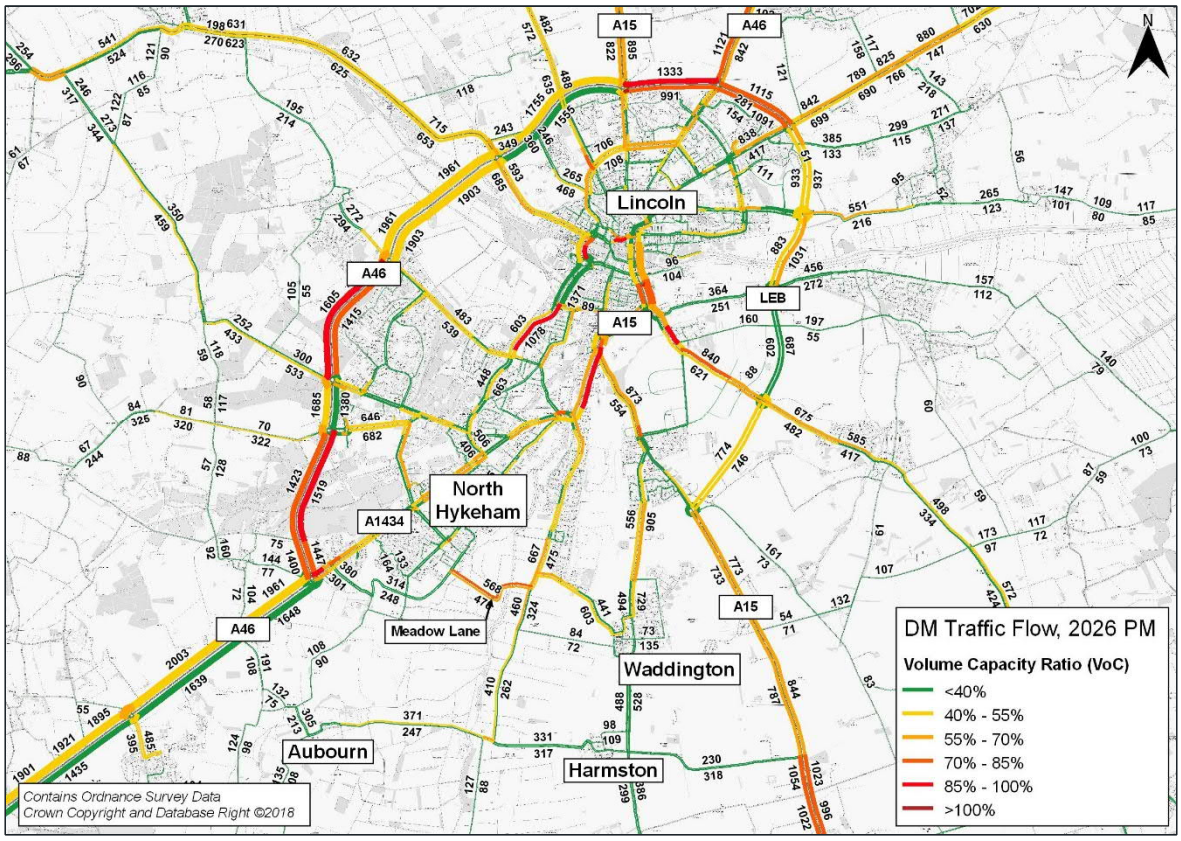



**Figure 9 – Link Volume to Capacity Ratio - Do-Minimum - 2026 - PM Peak**

***2036 Forecast Impact***

Figure 10 presents the outputs for the current design year (2036) Do-Minimum AM peak hour. The analysis shows that conditions are expected to deteriorate significantly from the existing situation and in 2026 as a result of the forecast growth traffic across the network. The figure highlights continued pressure on the orbital network and an increase in links that are expected to be operating above 85% of capacity, particularly in the centre of Lincoln, resulting in further pressure on the network. The A46 WRR is forest to be operating over capacity on the northbound section of relief road between B1190 Doddington Road and B1378 Skellingthorpe Road and the southbound section between Whisby Road and Newark Road.

The inbound lanes of the A607 Grantham Road, A15 Sleaford Road and the B1188 Lincoln Road are amongst some of the most significant radial routes into the city centre that would be operating above 85% of capacity.

In Figure 11 (2036 PM), more links operate above 85% of their capacity compared to 2026, particularly the A46 WRR where once again increases in peak hour flows are resulting in conditions deteriorating as both northbound and southbound movements are now operating over 85% of capacity. Outbound movements of some city centre links including the A1434 Newark Road between the A15 St Catherine's and Brant Road junctions along with the B1003 Tritton Road are also now operating above 85% of capacity with many surrounding links close to exceeding the threshold.

A review of the above AM and PM peak figures reveals that the following links are forecast to operate above 85% of capacity or exceed capacity in 2036:

- A46 WRR between:
  - A1434 Newark Road and Whisby Road
  - B1190 Doddington Road and B1378 Skellingthorpe Road
  - A15 and A46 Lincoln Road
  - A46 Lincoln Road between A158 and Deepdale Lane
- A15 Cross O'Cliff Hill between A1434 Newark Road and B1131 Canwick Avenue;
- B1188 Lincoln Road between B1131 Lincoln Road and Lincoln Eastern Bypass;
- Meadow Lane between Brant Road and Russell Avenue;
- Tritton Road between B1378 Skellingthorpe Road and B1360 Dixon Street;
- A1434 Newark Road between St Catherines and Brant Road;
- Canwick Hill between B1131 Lincoln Road and Hall Drive;
- Lindum Road and Wragby Road between Monks Road and Langworthgate;
- Silver Street; and
- Brayford Way

This includes Meadow Lane which provides the key crossing of the River Witham in the South of Lincoln and the A46 where conditions are expected to continue to deteriorate even with the eastern bypass in place.

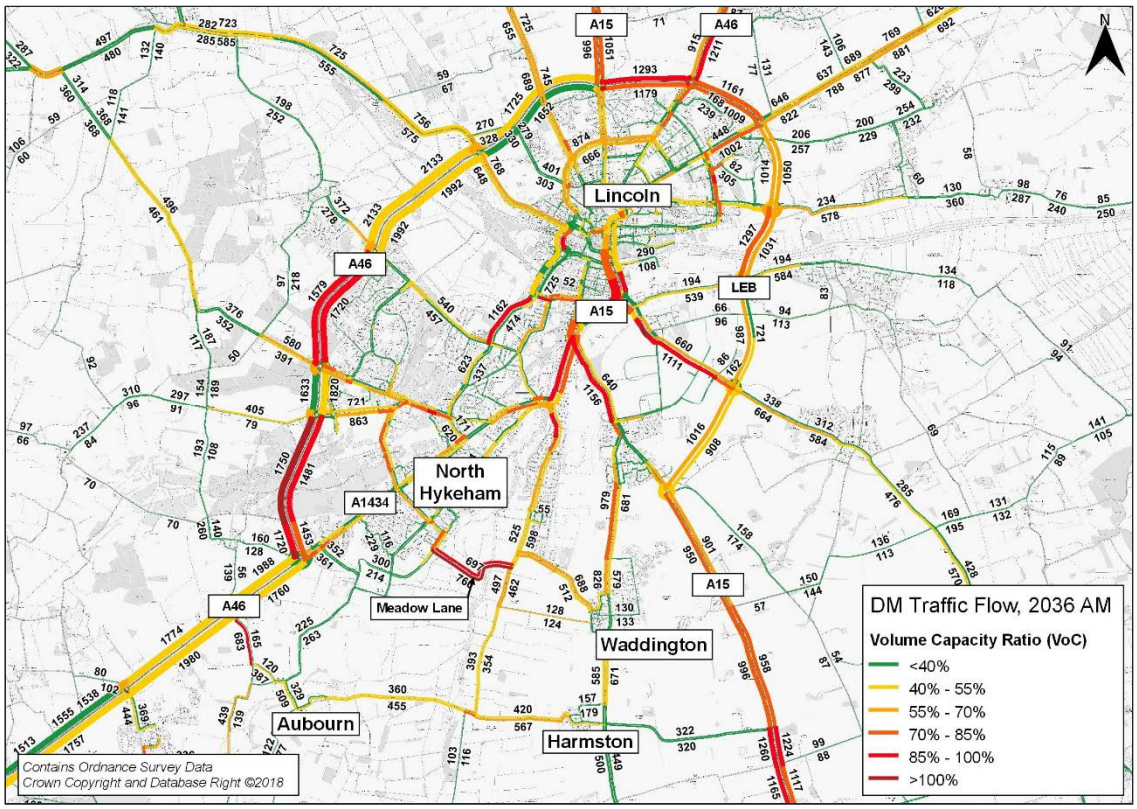



**Figure 10 – Link Volume to Capacity Ratio - Do-Minimum - 2036 - AM Peak**

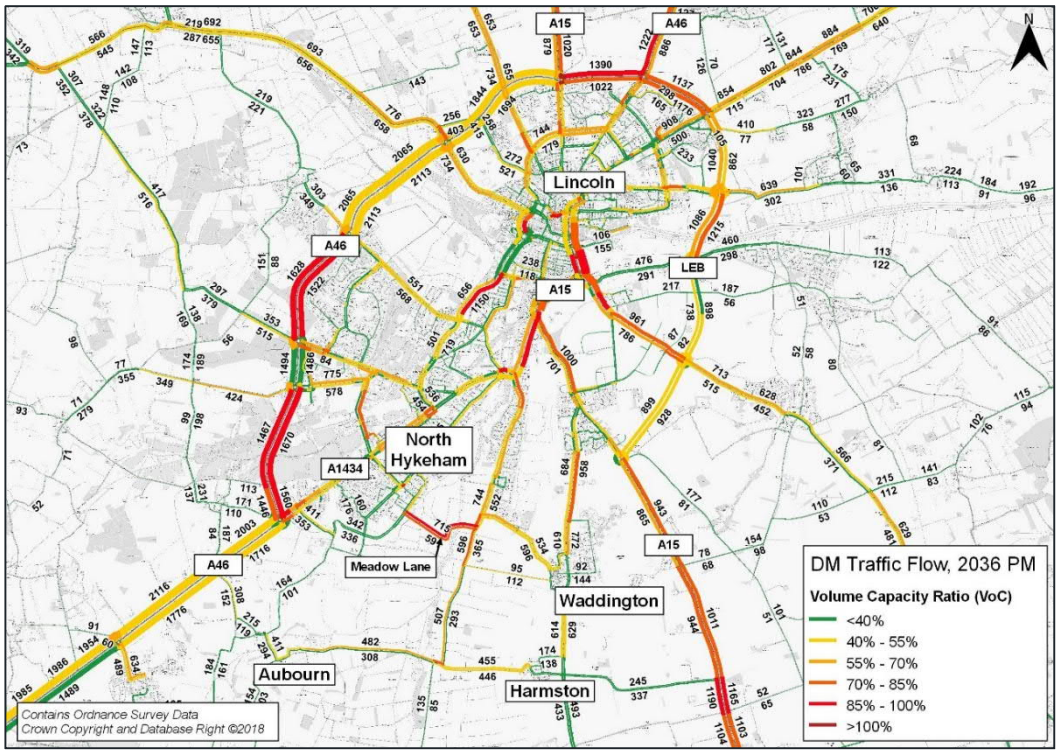



**Figure 11 – Link Volume to Capacity Ratio - Do-Minimum - 2036 - PM Peak**

### 4.4.2. Junction Volume Capacity Ratio

Forecast volume to capacity ratios on the approaches to key junctions in the Lincoln city area have been analysed to show the level of congestion at junctions in the AM and PM peaks in 2026 and 2036. Table 6 shows the maximum VoC forecast at each peak of the assessed junctions for the future years 2026 and 2036.

Figure 12Figure 12, Figure 13, Figure 14 and Figure 15Figure 15 below present the junction VoC results spatially. As can be seen in the figures and table, the vast majority of the most congested routes in 2026 are located on the A46 orbital route with similar situations forecast for both peaks. The A1434 city centre radial route has a particularly congested junction with Newark Road / Moor Lane / Station and another within the city centre on the junction with the A15. Low VoC ratios forecast at the A15/A607 junction at Bracebridge Heath are due to the relief offered in this part of the network by the LEB.

## Table 6 – Lincoln Junctions Max. VoC, 2026, 2036

| Ref | Junction | 2026 AM VoC | 2026 PM VoC | 2036 AM VoC | 2036 PM VoC |
|---|---|---|---|---|---|
| 1 | A46/Newark Rd | 83% | 84% | 85% | 91% |
| 2 | A46/Whisby Rd | 100% | 83% | 102% | 85% |
| 3 | A46/Doddington Rd | 100% | 82% | 100% | 95% |
| 4 | A46/Lincoln Rd | 90% | 93% | 92% | 95% |
| 5 | A46/Saxilby Rd | 60% | 64% | 43% | 72% |
| 6 | A46/A15 | 74% | 71% | 85% | 73% |
| 7 | A46/A158 | 90% | 96% | 93% | 100% |
| 8 | A1434 Newark Road / Moor Lane / Station Road | 95% | 90% | 98% | 91% |
| 9 | A1434 Newark Road / Doddington Road | 75% | 65% | 80% | 66% |
| 10 | A1434 Newark Rd/Hykeham Rd | 46% | 56% | 53% | 50% |
| 11 | A1434 Newark Rd/Rookery Lane | 69% | 64% | 74% | 70% |
| 12 | A1434 Newark Rd/Brant Rd | 52% | 46% | 66% | 48% |
| 13 | A1434 Newark Rd/A15 | 86% | 75% | 80% | 74% |
| 14 | A15/A607 | 33% | 37% | 38% | 40% |
| 15 | A15/Canwick Rd | 62% | 48% | 71% | 58% |
| 16 | Wragby Rd/A158 | 80% | 80% | 84% | 82% |
| 17 | A15/Lee Rd/Queensway | 49% | 43% | 54% | 47% |
| 18 | A15/Greetwell Rd | 69% | 84% | 69% | 88% |
| 19 | Greetwell Rd/Queensway | 50% | 50% | 52% | 54% |
| 20 | Greetwell Rd/ St Annes Rd | 69% | 47% | 79% | 53% |
| 21 | Greetwell Rd/Ocd | 74% | 67% | 79% | 76% |
| 22 | B1273/B1308 | 44% | 25% | 47% | 32% |
| 23 | Lindum Rd/Monks Rd | 44% | 40% | 51% | 43% |
| 24 | Station Rd/Whisby Rd | 64% | 54% | 69% | 63% |
| 25 | B1190/Whisby Rd | 51% | 43% | 57% | 58% |
| 26 | Skellingthorpe Rd/Tritton Rd | 49% | 43% | 56% | 48% |
| 27 | Brayford Way/Carholme Rd | 44% | 50% | 50% | 51% |
| 28 | Skellingthorpe Rd/Birchwood Ave | 36% | 46% | 41% | 48% |
| 29 | Tritton Rd/Doddington Rd | 40% | 43% | 47% | 46% |
| 30 | Doddington Rd/Birchwood Ave | 51% | 52% | 60% | 62% |
| 31 | Lincoln Rd/Moor Ln/Chapel Ln | 60% | 81% | 43% | 87% |
| 32 | Meadow Lane/Brant Road | 84% | 76% | 93% | 95% |
| 33 | Brant Road/Station Road | 53% | 61% | 63% | 75% |

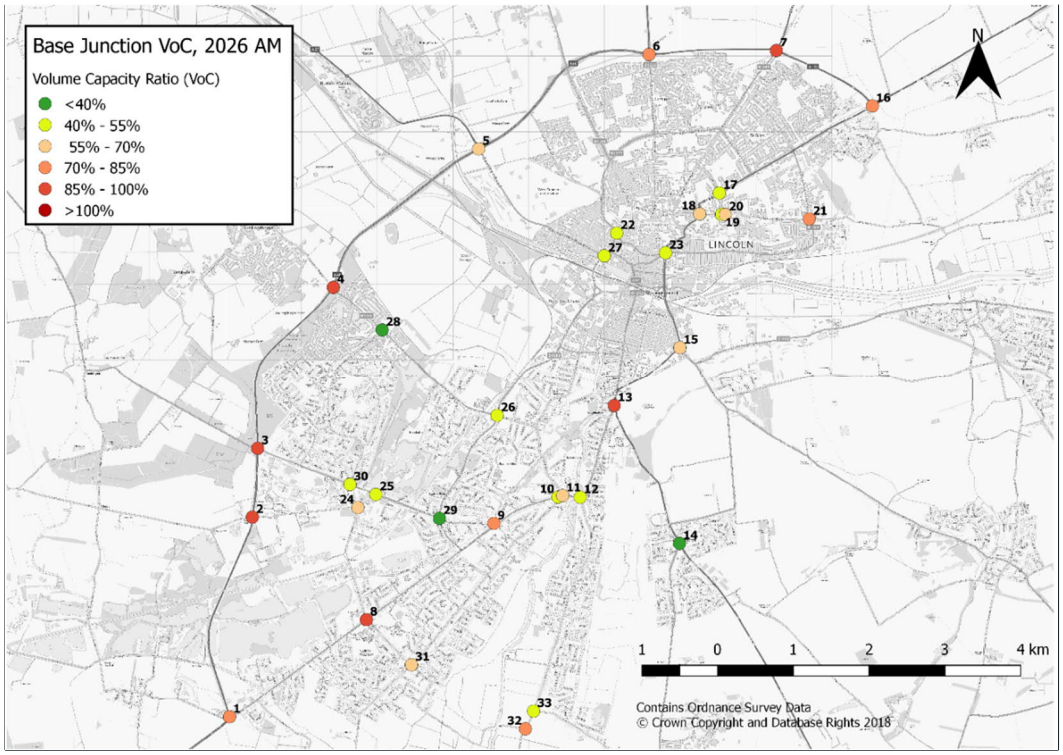



**Figure 12 – Max Junction VoC, 2026 AM**

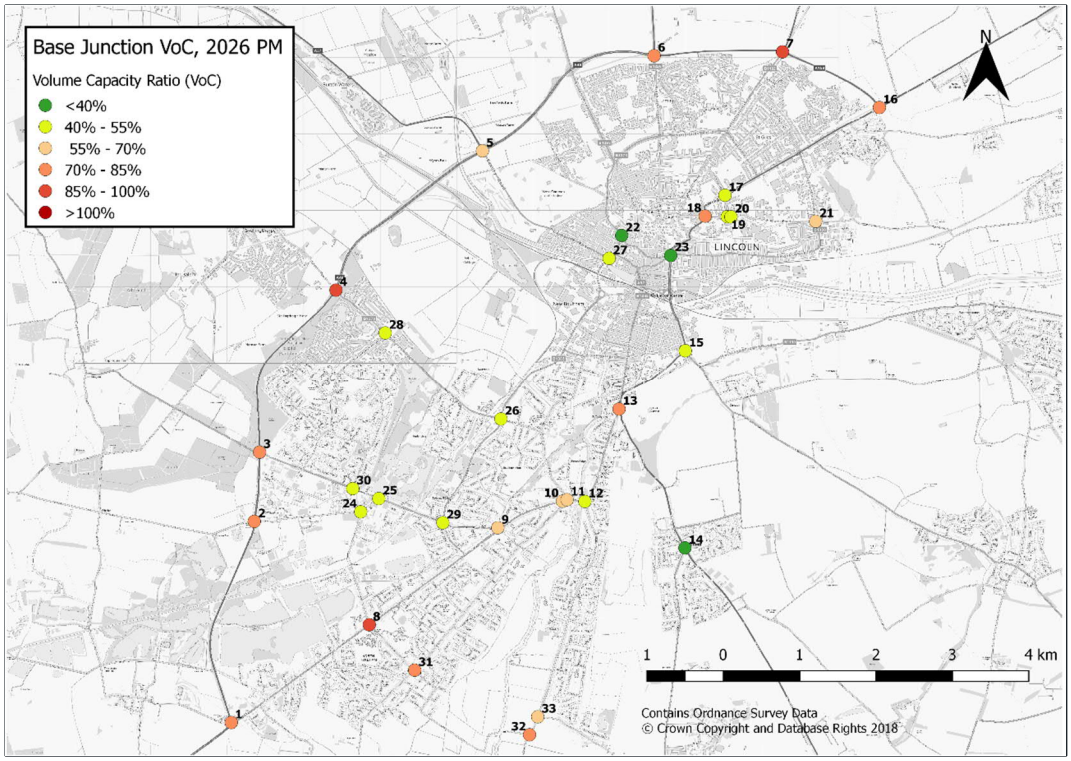



**Figure 13 – Max Junction VoC, 2026 PM**

In 2036, congested junctions are again present on the A46 orbital route and the A1434 junction with Newark Road / Moor Lane / Station. In addition congestion at junctions on local roads to the south of Lincoln are also forecast to be considerably more congested including the junctions of Meadow

Lane / Brant Road in both peak periods and Lincoln Road / Moor Lane / Chapel Road  in the PM Peak.

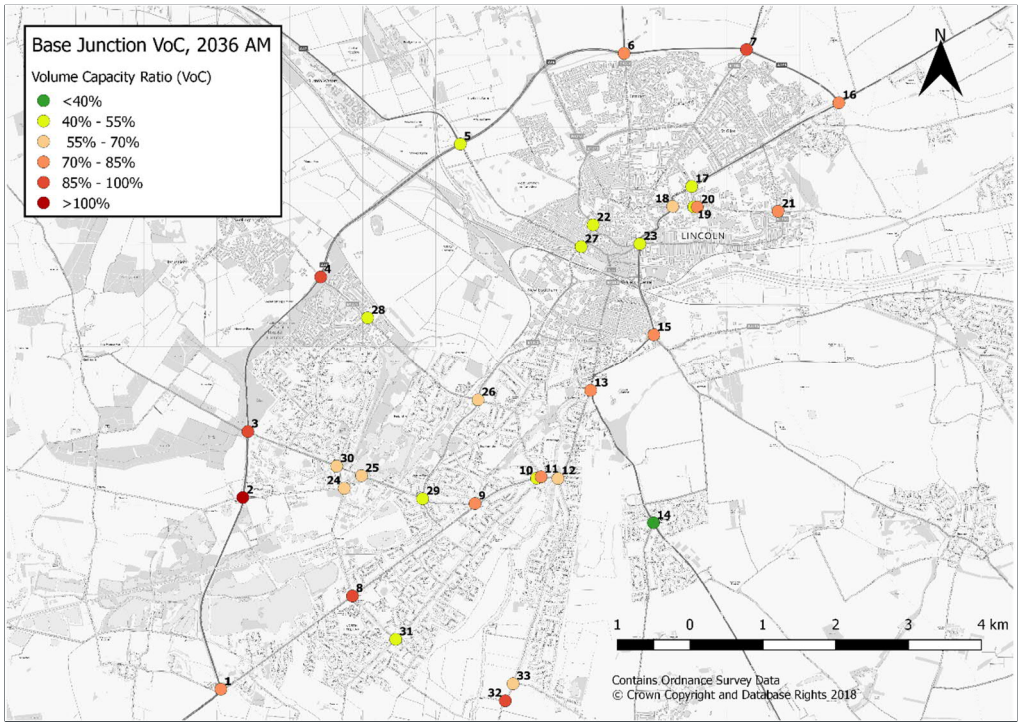



**Figure 14 – Max Junction VoC, 2036 AM**

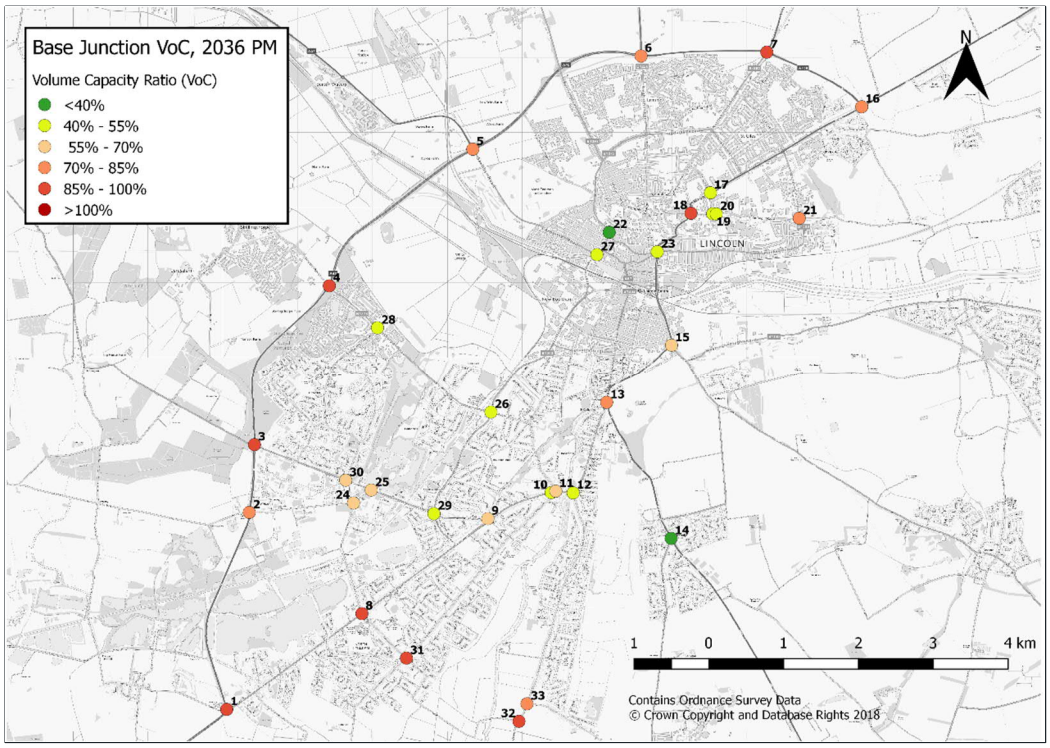



**Figure 15 – Max Junction VoC, 2036 PM**

### 4.4.3. Average Speed

Average speeds give an indication of how well traffic moves on the network. Analysis of the forecast speeds has identified a number of locations shown below where the forecast average AM and PM peak vehicle speed is expected to be significantly lower than the current free flow conditions observed from 2016 Trafficmaster data between the hours of 19:00pm and 07:00am. This provides an indication of how conditions are forecast to continue to deteriorate along the following major routes:

- A46 Lincoln Western Relief Road (WRR);
- A46 Welton Road;
- A46 (Between Newark and Lincoln WRR);
- A607 Grantham Road/Lincoln Road;
- A158 Ring Road; and
- A15 (Riseholme)

***Average Speeds 2026***

Table 7 and Figures 16 and 17 show the average speeds forecast during AM and PM peaks (2026) and the difference to those recorded during free flow conditions in 2016 for the key major routes that fall within the study area.

The analysis shows that average speeds are forecast to decrease along most routes in Lincoln, the exception being the section of the A15 south of the city where 2026 peak time traffic speeds are forecast to be greater than 2016 off peak traffic speeds. The delivery of the LEB will remove significant numbers of vehicles from the A15 between Lincoln city centre and Bracebridge Heath resulting in less congestion and therefore increased traffic speeds when compared to the existing situation.

Of particular note is northbound traffic on the A46 Lincoln Road during the PM peak where average speeds are forecast to be 15.6mph slower than those during the existing off peak as traffic heads out of the city centre. Traffic speeds along the southbound (inbound) stretch of this road are even slower during the AM peak where average speeds are forecast to fall to 27.3mph, which is 22.4mph slower than average free flow speed.

Other notably slow sections of the network include the northbound lane of the Pennell's Roundabout approach on the A46 during the AM peak where average speed is forecast to be 14.8mph slower than the average free flow speed. Average speeds on the A46 WRR are forecast to be over 9mph slower than average free flow speed during the AM peak and around 9mph slower during the PM peak. The A57 is forecast to be around 10mph slower than free flow traffic in both directions approaching the A46 roundabout in both the AM peak and PM peak.

## Table 7 – Average Speed (2026)

| Route | Details | Direction | Free Flow (2016) | Speed Limit (mph)* | Average Speed (mph) | | | Difference to Free Flow Speed (mph) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AM Peak | Inter Peak | PM Peak | AM Peak | Inter Peak | PM Peak |
| A15 | North | NB | 42.7 | 50 | 34.9 | 37.5 | 35.7 | -7.9 | -5.2 | -7.1 |
| | | SB | 39.4 | | 28.5 | 32.1 | 30.1 | -10.9 | -7.3 | -9.3 |
| | South | NB | 32.8 | 60 | 43.9 | 46.4 | 44.8 | 11.1 | 13.5 | 12.0 |
| | | SB | 35.6 | | 45.2 | 47.3 | 45.0 | 9.6 | 11.7 | 9.4 |
| | City Centre | NB | 24.6 | 30 | 20.1 | 21.6 | 20.9 | -4.5 | -3.0 | -3.7 |
| | | SB | 24.8 | | 21.3 | 21.8 | 21.1 | -3.5 | -3.0 | -3.7 |
| A46 | North | NB | 50.2 | 60 | 41.8 | 43.2 | 34.6 | -8.3 | -6.9 | -15.6 |
| | | SB | 49.7 | | 27.3 | 37.7 | 35.1 | -22.4 | -12.0 | -14.6 |
| | South | NB | 62.8 | 70 | 48.0 | 57.1 | 53.3 | -14.8 | -5.7 | -9.5 |
| | | SB | 62.4 | | 62.5 | 63.2 | 62.7 | 0.1 | 0.8 | 0.3 |
| | Western Relief Road | NB | 41.0 | 60/70 | 31.3 | 35.9 | 30.8 | -9.7 | -5.1 | -10.2 |
| | | SB | 41.5 | | 32.2 | 35.9 | 33.6 | -9.2 | -5.6 | -7.9 |
| A57 | North | NB/WB | 46.2 | 60 | 45.3 | 44.4 | 42.4 | -0.9 | -1.8 | -3.8 |
| | | SB/EB | 42.5 | | 32.2 | 34.4 | 32.4 | -10.2 | -8.1 | -10.1 |
| | City Centre | NB/WB | 26.9 | 30/40/ 60 | 17.3 | 17.5 | 17.0 | -9.6 | -9.5 | -9.9 |
| | | SB/EB | 24.6 | | 19.1 | 20.4 | 20.4 | -5.5 | -4.3 | -4.2 |
| A607 | South | NB | 33.2 | 30/40 | 30.0 | 32.2 | 31.6 | -3.1 | -1.0 | -1.6 |
| | | SB | 33.6 | | 29.2 | 29.8 | 26.9 | -4.4 | -3.8 | -6.7 |
| A158 | East | EB | 46.5 | 40 | 36.2 | 35.5 | 33.4 | -10.3 | -11.0 | -13.1 |
| | | WB | 44.2 | | 33.3 | 36.0 | 35.3 | -10.9 | -8.2 | -8.9 |
| | Ring Road | EB | 47.7 | 60 | 41.6 | 43.2 | 42.4 | -6.1 | -4.5 | -5.3 |
| | | WB | 44.6 | | 45.6 | 46.4 | 42.5 | 1.0 | 1.8 | -2.1 |
| A1434 | City Centre | NB | 28.6 | 40 | 21.1 | 22.1 | 20.8 | -7.5 | -6.6 | -7.9 |
| | | SB | 29.4 | | 20.3 | 21.4 | 20.0 | -9.1 | -8.0 | -9.4 |

**Some sections have more than one speed limit and therefore a figure for each individual limit is provided.*

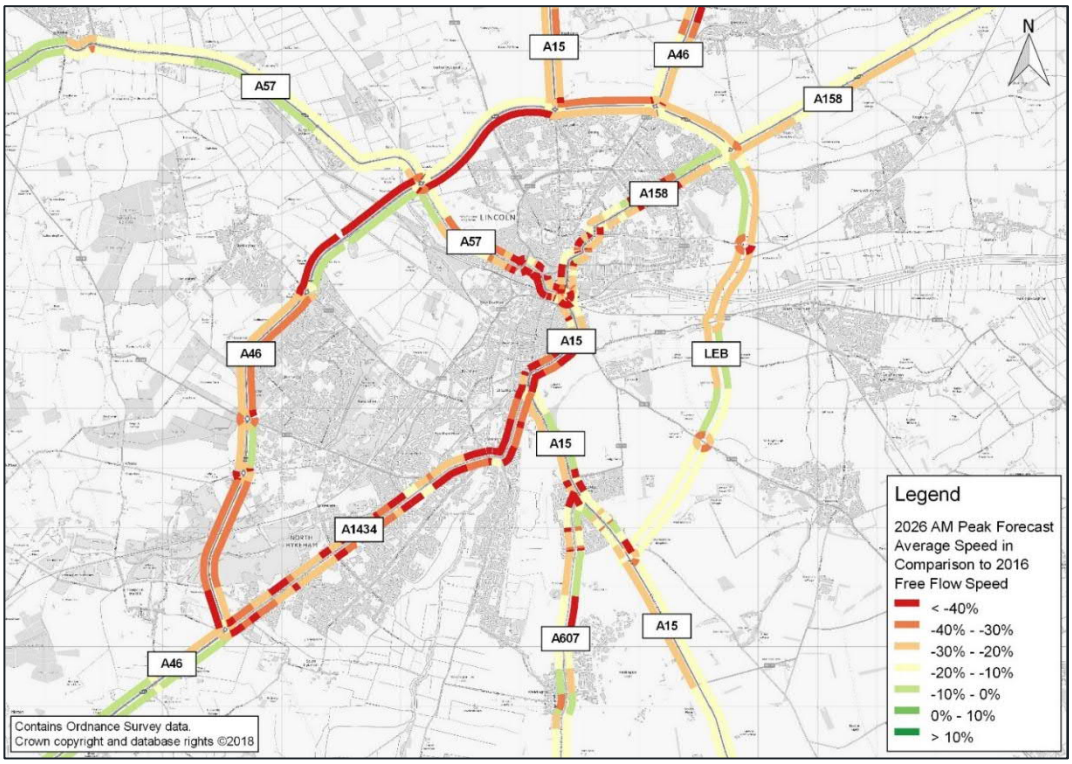



**Figure 16 - Average Speed, 2026 AM (Compared to observed 2016 Free Flow Speed)**

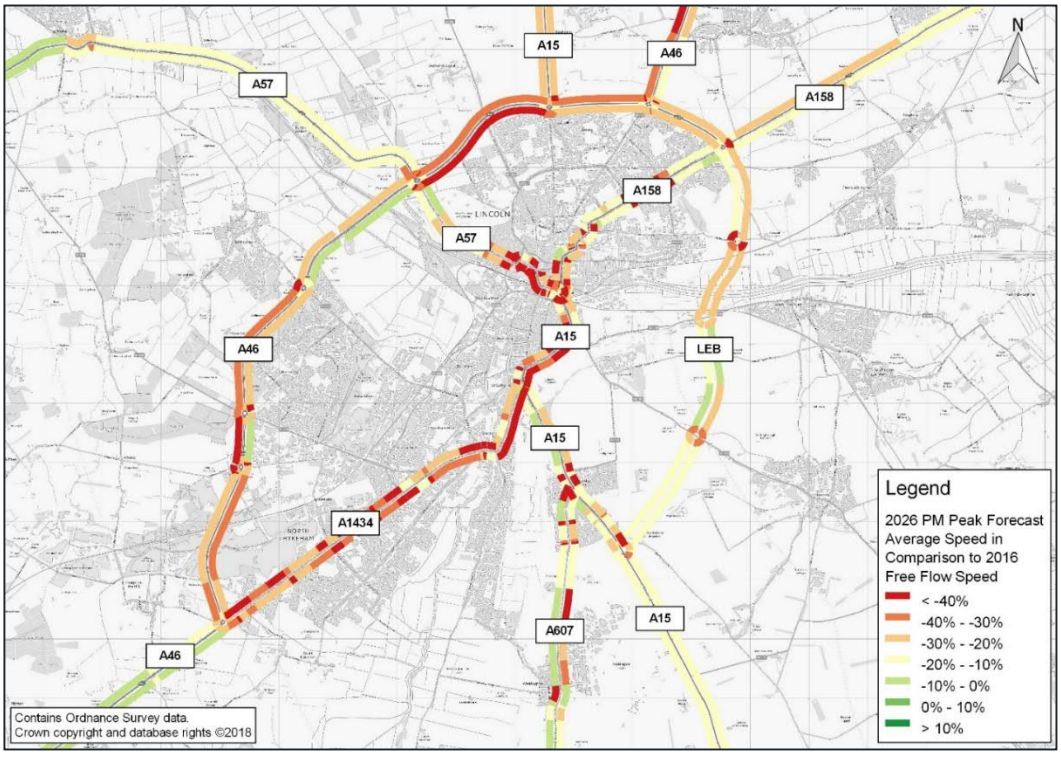



**Figure 17 - Average Speed, 2026 PM (Compared to observed 2016 Free Flow Speed)**

### *Average Speeds 2036*

By 2036, average speeds are predictably even slower along most links, exacerbated by the levels of growth in the city, as shown in Table 2023 and Figures 52 and 53. The routes affected most in the 2026 forecasts are still evident here. The average speed for northbound traffic on the A46 approach to the Hykeham roundabout during the AM peak is forecast to be 18.1mph slower than the average free flow speed. The southbound carriageway of the A46 Lincoln Road is 23.9mph slower than the average free flow speed during the 2036 AM peak and in the PM peak the northbound carriageway is 18.6mph slower than the average free flow speed.

Other routes that are experiencing significantly slower average speeds compared to those during the off peak by 2036 include the northern section of the A15 where southbound average speeds are around 12mph slower during both the AM peak and PM peak; the A46 WRR where average speeds are around 11mph slower in both directions on both peaks compared to the off peak; the A57 which is forecast to be around 10mph slower than free flow traffic in both directions approaching the A46 roundabout in both the AM peak and PM peak; and, the A158 which is between 9mph and 13mph slower in both directions across the whole daytime period compared to the off peak.

**Table 8 – Average Speed (2036)**

| | Details | Direction | Free Flow (2016) | Speed Limit (mph)* | Average Speed (mph) | | | Difference to Free Flow Speed (mph) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AM Peak | Inter Peak | PM Peak | AM Peak | Inter Peak | PM Peak |
| A15 | North | NB | 42.7 | 50 | 33.0 | 37.3 | 34.7 | -9.7 | -5.4 | -8.0 |
| | | SB | 39.4 | | 27.0 | 31.4 | 28.1 | -12.4 | -8.0 | -11.2 |
| | South | NB | 32.8 | 60 | 40.9 | 44.3 | 42.3 | 8.1 | 11.5 | 9.4 |
| | | SB | 35.6 | | 42.7 | 44.7 | 42.8 | 7.1 | 9.1 | 7.1 |
| | City Centre | NB | 24.6 | 30 | 19.1 | 21.1 | 20.3 | -5.5 | -3.5 | -4.3 |
| | | SB | 24.8 | | 20.6 | 21.3 | 20.2 | -4.2 | -3.6 | -4.6 |
| A46 | North | NB | 50.2 | 60 | 40.6 | 40.5 | 31.6 | -9.5 | -9.7 | -18.6 |
| | | SB | 49.7 | | 25.8 | 34.9 | 33.6 | -23.9 | -14.8 | -16.2 |
| | South | NB | 62.8 | 70 | 44.7 | 55.9 | 52.4 | -18.1 | -6.9 | -10.3 |
| | | SB | 62.4 | | 62.3 | 62.9 | 62.4 | -0.1 | 0.5 | 0.0 |
| | Western Relief Road | NB | 41.0 | 60/70 | 29.8 | 33.6 | 29.3 | -11.1 | -7.4 | -11.6 |
| | | SB | 41.5 | | 29.3 | 34.2 | 32.6 | -12.2 | -7.3 | -8.9 |
| A57 | North | NB/WB | 46.2 | 60 | 44.8 | 44.6 | 41.7 | -1.4 | -1.7 | -4.5 |
| | | SB/EB | 42.5 | | 31.6 | 33.2 | 32.6 | -10.9 | -9.3 | -9.9 |
| | City Centre | NB/WB | 26.9 | 30/40/ 60 | 17.5 | 17.6 | 17.0 | -9.4 | -9.3 | -9.9 |
| | | SB/EB | 24.6 | | 18.9 | 20.4 | 20.1 | -5.7 | -4.3 | -4.5 |
| A607 | South | NB | 33.2 | 30/40 | 29.8 | 31.8 | 30.9 | -3.4 | -1.3 | -2.3 |
| | | SB | 33.6 | | 28.4 | 29.6 | 26.5 | -5.3 | -4.1 | -7.1 |

| | Details | Direction | Free Flow (2016) | Speed Limit (mph)* | Average Speed (mph) | | | Difference to Free Flow Speed (mph) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AM Peak | Inter Peak | PM Peak | AM Peak | Inter Peak | PM Peak |
| A158 | East | EB | 46.5 | 40 | 36.4 | 35.3 | 33.3 | -10.2 | -11.2 | -13.2 |
| | | WB | 44.2 | | 33.0 | 35.8 | 35.1 | -11.2 | -8.4 | -9.1 |
| | Ring Road | EB | 47.7 | 60 | 40.9 | 40.8 | 41.3 | -6.8 | -6.9 | -6.4 |
| | | WB | 44.6 | | 43.9 | 44.9 | 40.7 | -0.7 | 0.3 | -3.9 |
| A1434 | City Centre | NB | 28.6 | 40 | 20.7 | 21.3 | 19.8 | -7.9 | -7.3 | -8.8 |
| | | SB | 29.4 | | 19.8 | 20.7 | 19.4 | -9.6 | -8.7 | -10.0 |

**Some sections have more than one speed limit and therefore a figure for each individual limit is provided.*

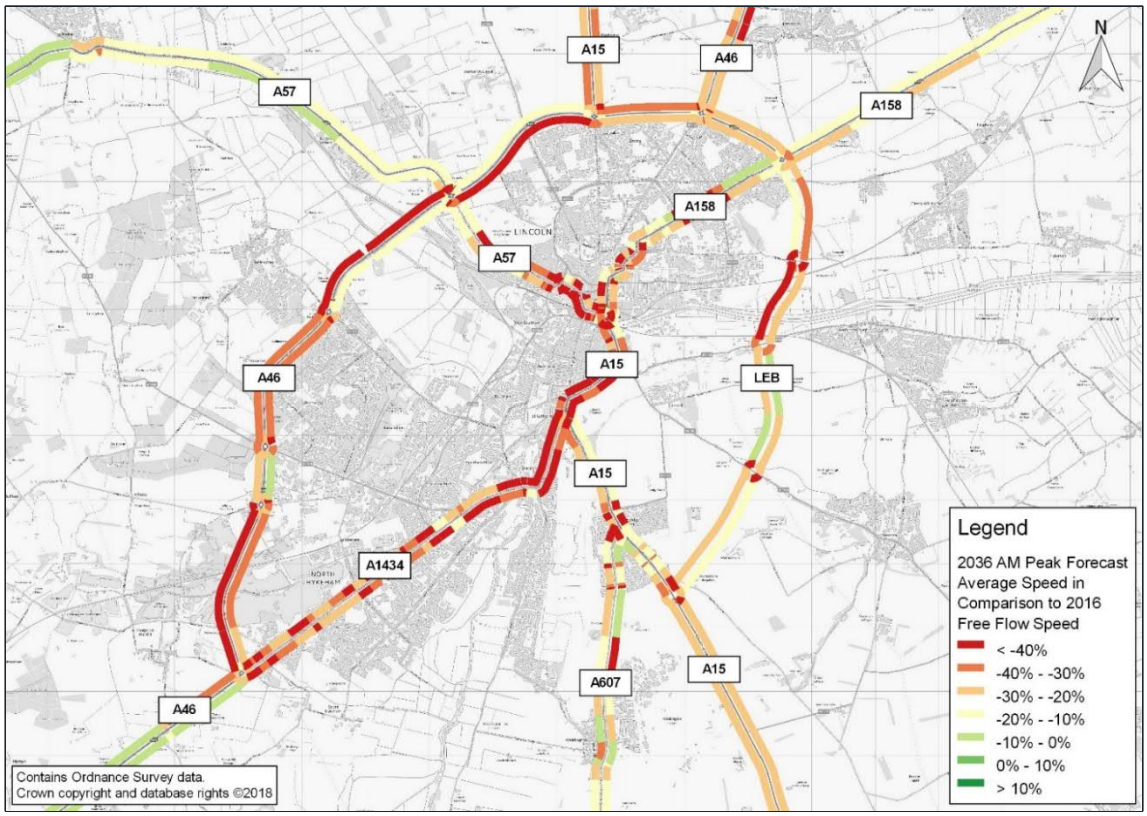



**Figure 18 - Average Speed, 2036 AM (Compared to observed 2016 Free Flow Speed)**

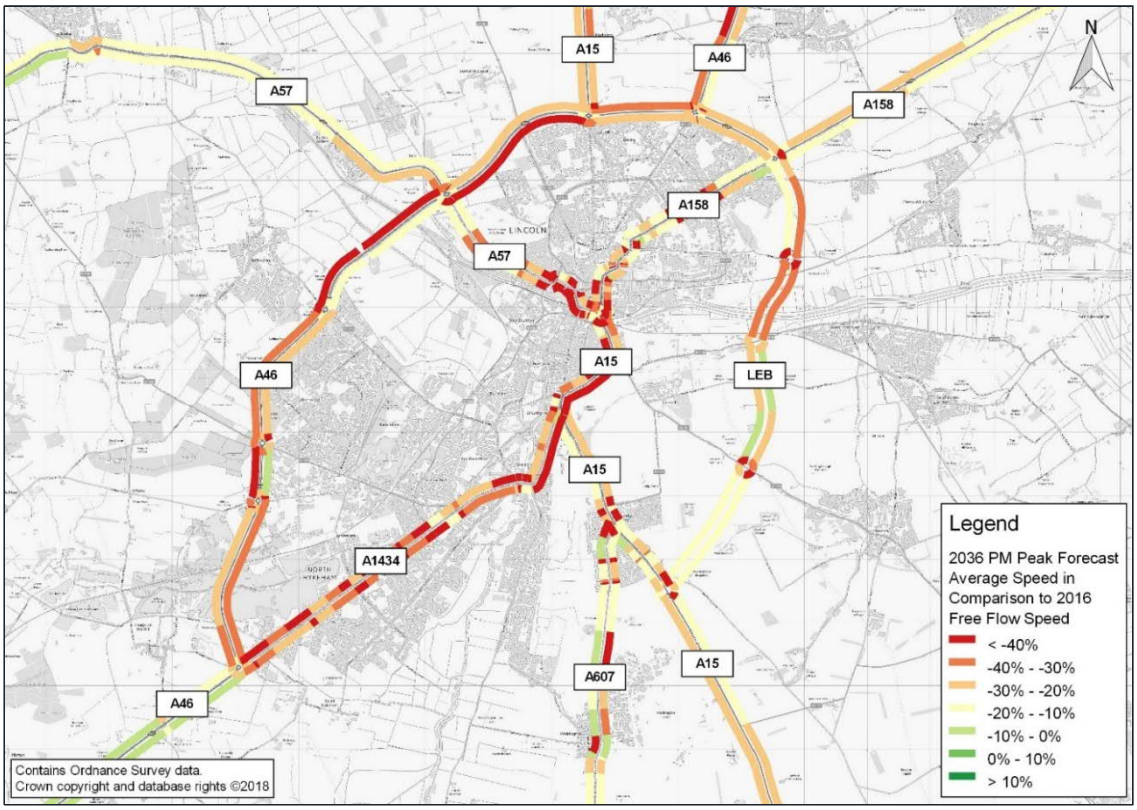



**Figure 19 - Average Speed, 2036 PM (Compared to observed 2016 Free Flow Speed)**

## 4.5. UNDERSTANDING THE FUTURE SITUATION SUMMARY

The findings of this section can be summarised as follows:

- Future land-uses and policies identify significant levels of planned growth up to 2036. Forecast development includes four SUEs which contribute to a 50% increase in dwellings in Lincoln by 2036.
- Future changes to the transport system are outlined within LITS. Major schemes include LEB which is currently under construction and the proposals for the NHRR.
- The LEB will provide welcome and much needed mitigation for the traffic and transport problems affecting Lincoln but once open several residual issues will remain. In particular the lack of east west connectivity will remain a significant problem which will continue to exacerbate the existing congestion problems on radial routes and routes into Lincoln.
- Travel demands are forecast to increase substantially over the next 20 years within the Lincoln urban area. Increases of up to 20% by 2036 are forecast. The LEB will provide a significant improvement to the transport network and conditions in the centre of Lincoln.
- However, the forecast traffic growth will result in a deterioration in conditions on key areas of the network particularly on the western side of Lincoln including the A46 WRR, A1434 Newark Road and sections of the A15.
- The forecast impact of the future level of travel demand on infrastructure illustrated by link capacity, junction capacity and average speed indicates issues of congestion and poor speeds on the key route network including A46 WRR and A1434 Newark Road and on local routes in the South of Lincoln and North Hykeham area. This includes the Meadow Lane and Brant Road – the main east west crossing of the River Witham in the south of Lincoln

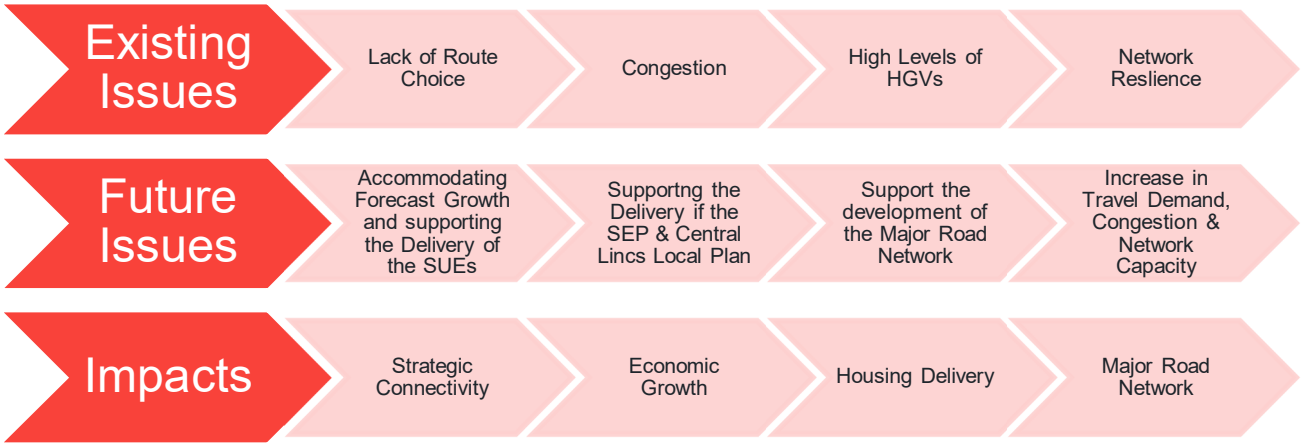
# 5. ESTABLISHING THE NEED FOR INTERVENTION

## 5.1. INTRODUCTION

The previous sections have demonstrated that there are a number of problems on the existing road network. This stems from a number of issues including a lack of route choice which contributes to a high level of congestion and delay on key orbital and radial routes, with the latter resulting in a high proportion of strategic traffic being forced to travel through the historic centre of Lincoln. Furthermore, Lincoln is planned to be the focus of significant development in the future which will further exacerbate the existing problems and issues.

The increase in development and population will result in additional demand on the network and without further investment result in a deterioration of existing conditions. Therefore a failure to implement an intervention is likely to significantly impede LCC's and stakeholder's ability to deliver the development plans and economic growth aspirations for the city now and in the future.

The diagram below highlights key issues as identified in the previous sections as well as the resulting impact if these issues are not addressed. LCC will have to address the existing and future issues highlighted below to achieve aspirations and objectives of the area. The subsequent text within this section is structured around the diagram below.




## 5.2. EXISTING ISSUES

As described in Chapter 2 'The Current Situation', there are a number of existing issues affecting the transport network in Lincoln and these are:

- Lack of route choice for east west traffic;
- Congestion and a lack of network capacity on the orbital network, key routes through Lincoln and the local road network;
- The proportion of HGVs on the existing orbital and through routes in excess of that expected on similar routes; and
- Lack of network resilience.

These issues are having a significant impact on Lincoln and conditions are expected to deteriorate further in the future affecting Lincoln's growth and development aspirations.

### 5.2.1. Route Choice

The existing road network in Lincoln consists of a number of regionally important routes through and around the city, as well as key routes into the city centre and local roads. However the principal network has a number of limitations which impacts on north south, east west, strategic and local traffic.

Key limitations of the existing network which have been highlighted in the previous sections include:

- North south traffic has limited route choice, especially in the south east of the Lincoln urban area, with traffic forced to use the A46, or A1434 and A15 to pass through and around the city. This results in significant volumes of traffic having to use routes through existing residential areas particularly in the south of the city as well as the historic centre of Lincoln;
- The A46 / A15 route is a key alternative route from the A1 through to the Humber Ports of Grimsby, Immingham and Hull. It provides a more direct route to the ports and carries a significant volumes of local and strategic traffic. This route is currently operating at capacity and without any further investment it will continue to be affected by congestion.;
- East west connectivity in the southern section of Lincoln for strategic and local traffic is poor with available crossing points of the River Witham limited to Meadow Lane and the A1434 Newark Road. The lack of connectivity restricts access to settlements such as Hykeham, Waddington and Branston; and
- There is a missing connection from the A46 Western Relief Road to the A15 resulting in traffic forced to take overly complicated and protracted routing along local roads.

A failure to address a lack of route choice will result in traffic continuing to take existing routes contributing to an increase in the volume of traffic on the A46 orbital route, key radial routes and unsuitable local routes which already suffer from congestion. The additional demand and subsequent delay impacts on economic growth aspirations of the area. Furthermore, strategic traffic taking inappropriate routes through residential areas and the historic centre of Lincoln affects the liveability and quality of life for residents, workers and visitors. The resulting impact of a lack of route choice will be exacerbated in the future as demand on the network is forecast to increase. Indeed a lack of route choice has been recognised as a key issue within the strategy and policy documents as well as the need to resolve this issue.

In summary, the evidence highlights that unless an appropriate intervention is implemented a lack of route choice will remain an issue.

**A lack of route choice has led to congestion on a number of key orbital and radial routes as well as strategic traffic taking inappropriate routes. This will remain an issue and will be exacerbated in the future as demand grows unless a suitable intervention is implemented.**

### 5.2.2. Congestion and Network Reliability

As highlighted previously, a number of sections on the network are currently operating close to or exceeding capacity and suffer from variability in average speeds. This is affecting several important routes around and though Lincoln including the A46, A1434 and A15.

Failure to intervene will result in continued congestion on the network which will be exacerbated in the future by the forecast growth. It will continue to affect access to central Lincoln, the strategic connectivity around Lincoln and the key north south routes to the Humber ports and severely limit

the ability to accommodate future growth. Furthermore, failing to address congestion issues within the historic centre of Lincoln and the urban area will result in a negative impact on the liveability and attractiveness for residents, workers and visitors. Congestion on key parts of the network may also impact on the area's ability to deliver future development such as the SWQ given that this may add additional traffic on an already congested network. It is also important to note that congestion impacts on all users of the road network, including public transport as they will be subject to the same delays as other vehicles and therefore this reduces the attractiveness of buses as a viable transport option. Congestion may also create a barrier to movement, severance, for pedestrians and cyclists.

Whilst reducing congestion on key routes remains a priority for the Local Plan and Economic Plans of the area there is also an aspiration to reduce congestion on more local roads within North Hykeham which evidence has shown suffers from congestion and has been highlighted as an area where 'rat running' occurs within the Hykeham Neighbourhood Plan (2013).

In summary, the evidence highlights that unless suitable intervention is found, congestion will remain an issue within Lincoln on orbital, radial and some local roads.

**Congestion and in parts severe congestion is present on key orbital, radial and local roads. Without intervention congestion will remain an issue and will be exaccerabted in the future. Congestion impacts on all transport users and has an impact on development and economic growth aspirations of the area.**

### 5.2.3. HGVs

The limited north south and east west connectivity in and around Lincoln results in significant proportions of HGVs using a small number of routes. This results in a higher proportions of HGVs than on similar routes on:

- The A46;
- A number of roads within the Lincoln urban area; and
- A number of residential roads in the North Hykeham area.

The high numbers of HGVs passing through Lincoln and the residential areas will continue to impact on the quality of life of residents. It will contribute to existing severance issues particularly for communities in the North Hykeham area as well impact on noise and air quality.

This document has previously highlighted a number of policy objectives within Lincoln which aim to reduce the adverse impact of HGVs. Consequently, on the existing network, where there is a lack of route choice, this objective will be difficult to achieve as HGVs will continue to take the same limited routes available.

The current levels of congestion on the network particularly on the A46 WRR also has an impact on the movement of HGVs. The journey time reliability issues along the major routes impacts movements between the midlands and the Humber Ports. The analysis shows that conditions along the strategic routes around Lincoln will continue to deteriorate which will continue to impact the accessibility of the ports and affect HGV journeys along these routes.

In summary, the evidence highlights that unless suitable intervention is found, HGVs using unsuitable routes within the urban area of Lincoln and the resulting impact on communities along these routes will remain an issue. The A46 will continue to carry a high proportion of HGVs which is in excess of what would be expected for an 'A' road and these journeys will becoming increasingly affected by congestion and poor journey time reliability. This will continue to affect access to the Humber Ports which will have a significant impact on trade.

**A lack of route choice has resulted in a disproportionately high percentage of HGVs on the A46, routes through the city centre and local roads within residential areas. This has an adverse impact on the communities along the routes as well as economic growth aspirations.**

**The current levels of congestion on the network including on the A46 WRR will continue to impact on the movement of HGVs.**

**It will continue to affect access to the Humber Ports which will have a significant impact on trade.**

### 5.2.4. Network Resilience

This report has provided evidence to show that the network resilience of the A46 and A15 principal routes is poor and in that in the event of a road closure there is no option but to divert traffic via narrow, unsuitable local routes including through the urban area of Lincoln. Specifically:

- The limited number of strategic and major routes through and around Lincoln means that there is no alternative but to use diversionary routes through the urban area or rural villages when incidents occur.
- On average there are 3 to 4 incidents per year on the A46 and the same number on the A15 resulting in closures which require traffic to be diverted. As traffic volumes increase the impact of these diversions on existing urban areas will become more significant.
- The A46 is also a diversionary route for the A1. As demonstrated the A46 already experiences significant congestion problems which will be further exacerbated by diversions from other strategic route. Conditions along the A46 will continue to deteriorate with the continued traffic growth within Lincoln which will affect the viability of the A46 as a suitable diversion route.
- Without any intervention the incidents on principal routes through and around Lincoln will continue have a significant impact on local communities and there will continue to be no option but to divert traffic via unsuitable routes. This will become increasingly problematic with the continued growth of traffic and Lincoln.

**Existing diversion routes for the A46 and A15 mean a high volume of traffic is forced to use inappropriate routes through residential areas when a serious incident occurs. This impacts on communities living along the diversion route and journey travel times.**

## 5.3. FUTURE ISSUES

This section presents issues which the network will face in the future. It demonstrates that without intervention existing conditions will deteriorate resulting in a negative impact on the area's ability to deliver development and growth aspirations. These issues are within the context of a network which has considered planned and unplanned transport improvements as described in detail within Chapter 3 Future Changes to the Transport System. This section looks at:

- Accommodating forecast growth;
- Supporting the delivery of the SUEs;
- Supporting the delivery of the SEP;
- Supporting the delivery of Central Lincolnshire Local Plan;
- Supporting the Major Road Network development;
- Increase travel demand;
- Congestion; and
- Network capacity.

### 5.3.1. Accommodating Forecast Growth & Increase in Travel Demand

The previous sections have shown that current levels of growth will result in traffic levels increasing significantly on many of the strategic orbital and radial routes as well as on the local road network in North Hykeham. Significant development growth is a large contributor to the increased traffic demand in the future. The evidence has demonstrated that while the key committed transport improvements such as the LEB will make significant improvements to the network, they are not sufficient to mitigate all of the impacts of the forecast level of growth particularly in the south and south west of Lincoln.

The forecast traffic growth will exacerbate the existing congestion problems on the network particularly on the A46, A1434 and local roads within the North Hykeham area. This will result in deteriorating journey reliability problems within Lincoln and around the city for residents, businesses and visitors.

These negative impacts have been highlighted within the previous section and will only deteriorate with additional growth.

**Planned transport improvements will not be sufficient to mitigate the impacts of forecast growth particularly in the south and south west of Lincoln.**

### 5.3.2. Supporting the delivery of the Sustainable Urban Extensions

One of the key objectives development proposals for Lincoln is to deliver four Sustainable Urban Extensions (SUEs) which have been identified to accommodate a significant proportion of Central Lincolnshire's planned growth in new homes and employment land in Lincoln. The SUEs will contribute to a significant increase in demand on the network which will result in additional congestion on key routes. Of particular note to the study area is the SWQ, where the local road network around the proposed location is shown to be suffering from congestion particularly at peak times. The addition of the SWQ without any further investment or changes to the network is expected to compound existing congestion issues and in doing so adversely impact on communities living along these roads. Consequently a suitable transport intervention will be necessary to serve

the SWQ, improve its accessibility for all modes and ensure that it does not have an unsustainable impact on the local transport network.

**The SUEs will compound existing congestion issues on the network. The deliverability of the SWQ in particular will need to be supported by a suitable transport intervention to ensure it does not have an unsustainable impact on the local road network.**

### 5.3.3. Supporting the Delivery of the SEP and CLLP

The SEP and Central Lincoln Local Plan set ambitious growth targets fo Lincolnshire for new homes and jobs. As such, it is expected that the transport network will be under considerable strain unless significant transport improvements are made.

The growth of Lincoln is a vital contributor to the economy of the whole of the Greater Lincolnshire area and it is therefore crucial that this is achieved in a sustainable way to prevent it being undermined by traffic and transport problems. Continued growth in housing and employment needs to be accompanied by improved connectivity for all modes to ensure the additional movement generated by development does not deteriorate existing traffic conditions further. If improved connectivity is not implemented it will reduce the area's attractiveness for investors and may also impact on the area's ability to deliver the planned quantum of developmen. Therefore suitable transport intervention is necessary in order to ensure an efficient transport network and support economic growth ambitions of the area.

**Failure to implement a suitable transport intervention will impede growth ambitions of the area.**

### 5.3.4. Support the Major Road Network

The DfT has stated that the MRN will consist of the most strategic local routes in England with the A15 and A46 being identified as part of the indicative MRN. They are recognised as being a connectivity priority to the South Humber Bank and Ports by TfN as well as improving access to the Lincolnshire Coast.

They are also an important part of meeting the wider economic priorities relating to agglomeration, the North's productivity gap, the ability to better connect current and future Important Economic Centres (IECs) to the SRN, MRN and rail networks and reducing the cost of exporting goods to national and international markets and time, reliability and resilience benefits.

However, as demonstrated previously, the forecast traffic growth on these strategic routes will result in a further deterioration of traffic conditions along the strategic and major routes across and around Lincoln including the A46 and A15. These will inhibit any proposal to develop a programme of work along these routes and the effectiveness of the MRN through Lincoln. Therefore suitable intervention is necessary to ensure these routes operate with greater efficiency to ensure they function effectively as part of the MRN.

**Suitable intervention is necessary to ensure that the A46 and A15 operate more efficiently and effectively as part of an indicative proposal to be part of the MRN.**

### 5.3.5. Congestion & Network Capacity

As highlighted within the Future Situation section, although the introduction of the LEB will improve conditions in the centre of Lincoln, forecast congestion on the western and southern side will continue to increase and conditions on the orbital and radial route network will continue to deteriorate.

A number of key sections of the network are forecast to be operating above 85% or over capacity by 2036 including:

- A46 Western Relief Road between:
  - A1434 Newark Road and Whisby Road
  - B1190 Doddington Road and B1378 Skellingthorpe Road
  - A15 and A46 Lincoln Road
- A15 Cross O'Cliff Hill between A1434 Newark Road and B1131 Canwick Avenue
- B1188 Lincoln Road between B1131 Lincoln Road and Lincoln Eastern Bypass
- Meadow Lane between Brant Road and Russell Avenue – this provides a crossing of the River Witham in the south of Lincoln

In addition several key junctions are expected to be operating at or over capacity by 2036 these include the A46 / Newark Road, A46 / Whisby Road and A46 / Doddington Road on the orbital network and Meadow Lane / Brant Road, Lincoln Road / Moor Lane / Chapel Lane in North Hykeham. All of these issues will affect the ability to deliver the necessary housing and achieve the growth targets, impact on the movement of strategic traffic around Lincoln and result in high levels of traffic on local and urban routes, increasing rat running and severance.

Without any additional transport intervention, forecast increases in congestion on the aforementioned areas will affect the growth and development aspirations of the area including the delivery of the SUEs.

**Congestion is forecasted to grow in the future and the LEB alone will not sufficiently improve conditions in south and south west Lincoln which is expected to have a negative impact on the the growth amibitions of the area; liveability and attractiveness for residents, workers and visitors; impacts on the attractiveness of sustainable transport modes using the network; and delivery of the SUEs.**

## 5.4. IMPACTS

This section summarises the wider impact of existing and future traffic conditions. These impacts include:

- Strategic connectivity;
- Economic growth;
- Housing targets; and
- Major road network.

### 5.4.1. Strategic Connectivity

A key challenge identified within the SEP is the need to focus on the delivery of goods to market which may be destined beyond the wider Lincoln area. This is reflected in a key objective within the

plan which highlights a need to improve connectivity between Lincoln, Central Lincolnshire and the Humber area, which are experiencing significant growth.

In order for the above to be realised, it is important to recognise that the A46 / A15 is a key alternative route from the A1 through to the Humber Ports of Grimsby, Immingham and Hull. As stated previously, this key route has significant congestion delay and these conditions are expected to deteriorate in the future. Therefore a failure to implement an intervention which provides efficient strategic movement between Lincoln and wider economic areas, such as the Humber ports, will impact on Lincoln's ability to deliver sustainable economic growth.

**Strategic connectivity is being compromised by congestion delay particularly on the A46/A15. Without a transport intervention which provides efficient strategic movement between Lincoln and wider economic areas, such as the Humber ports, traffic conditions will deteriorate resulting in a limited capacity to deliver sustainable economic growth.**

### 5.4.2. Economic Growth

It is widely recognised that improved transport technology and transport networks, through effects on transport costs, access and connectivity, are major factors which underpin economic growth. On a national level, the Action for Road – A Network for the 21st Century (2013) cites that an inclusive, integrated and innovative transport system and well-connected road infrastructure with sufficient capacity as a vital component of economic success. However continued growth of the economy and population means that traffic levels in many areas will rise in the coming decades.

This is echoed within Lincoln and has been demonstrated within the previous sections of this document which showed that the existing traffic conditions result in congestion delays on the network, particularly at peak times, and this will be exacerbated in the future given the scale of planned growth in the Lincoln area. It has also demonstrated that although the LEB will make a substantial improvement to the transport network within Lincoln it will not improve the east west connectivity or the congestion problems on the A46 and in the North Hykeham area. This will inhibit and impact on the economic growth aspirations and investment within Lincoln.

**There is an intrinsic link between an efficient transport network and economic growth. Within Lincoln the transport network is forecasted to face increasing congestion which may impact on the areas ability to deliver sustainable economic growth.**

### 5.4.3. Housing Targets

The previous sections have highlighted that significant housing development is planned within the Lincoln area. This includes SUEs which have been identified to accommodate the majority of the planned housing and employment development within Lincoln.

- The CLLP identifies a need for an additional 36,960 dwellings and 11,894 jobs across the period 2012-2036, with much of that growth to be concentrated in the Lincoln urban area; and
- This includes the SWQ SUE in the south of Lincoln, comprising of around 2,000 dwellings and 5ha of employment land.

The additional traffic generated by planned housing will have a detrimental impact on a network which is already suffering from congestion. The LEB alone will not sufficiently mitigate congestion issues particularly to the south and south west of Lincoln and therefore without additional transport intervention, the ability to deliver housing targets will be compromised.

**Without suitable transport intervention the ability to deliver the areas housing targets will be compromised.**

### 5.4.4. Major Road Network

As mentioned previously the A46 and A15 have been identified to be part of the indicative route for the MRN. However without suitable transport intervention to mitigate existing issues on these routes the ability for these routes to operate as part of the MRN is compromised.

**Existing and future congestion on the A15 and A46 may hinder the potential of these routes to operate as part of the MRN without suitable transport intervention.**

## 5.5. UNDERLYING CAUSES

There are a number of underlying causes for the problems and issues. As outlined within this and the earlier sections of this report these relate to the existing transport provision within and around Lincoln, the existing and forecast future demands and the challenges that this presents.

### 5.5.1. Provision

The main issues relating the transport provision within Lincoln can be summarised as follows:

**Transport Network & Capacity**

- There are few strategic and major routes through and around Lincoln. This currently consists of the A46 WRR providing an orbital route around Lincoln and a limited number of major radial routes which pass through existing urban areas and the centre of Lincoln.
- The principal routes also are of variable standard. The existing orbital route is a mixture of single and dual carriageway and major radial routes are predominantly single carriageway.
- The LEB is currently under construction and this will improve connectivity and capacity on the eastern side of the city but there remains no strategic orbital route in the south of Lincoln.

**Constraints**

- Lincoln is bisected by the River Witham and Fossdyke Navigation which cut through the city in both east west and north south direction.
- These act as a significant constraint to transport network as there are limited crossing opportunities of the both the river and the Fossdyke Navigation.
- There are very few opportunities to cross the river in the south of Lincoln and these are confined to a number of relatively minor routes that are particularly unsuited to strategic traffic.
- In addition railway lines also bisect the city. There are again limited opportunities to cross the rail infrastructure and the location and number of level crossings also has a further constraining effect on the network for both strategic and local movements across Lincoln.

**Route Choice & Resilience**

- The limited number of principal routes has a significant impact on route choice for traffic wishing to travel around and through Lincoln. At present north-south traffic is forces to use either A46 or A1434 and A15 to pass by or through the city. Some of these routes run through existing residential areas and results in significant volumes of traffic using a small number of routes.
- There are also very few east west routes in the south of Lincoln. Traffic wishing to travel east west between the existing major routes including the A46 and A15 is limited to using a small number of rural routes which pass through existing villages and communities. These are unsuitable for strategic traffic.
- The limited route choice also affects network resilience as there is a limited availability of appropriate alternative routes around and through Lincoln. The current diversion routes involve using local routes unsuited to strategic traffic.

### 5.5.2. Demand

The demand issues are as follows:

**Strategic and Major Routes**

- The existing strategic and major route network currently carry significant volumes of traffic.
- The existing network limitations result in significant volumes of traffic having to use a limited number of strategic and major routes or unsuitable routes through Lincoln residential areas.
- In addition significant volumes of east west traffic in the south of Lincoln is forced to using minor rural routes to the south of Lincoln;
- There are routes and sections of the network which are carrying levels of HGV traffic in excess of that expected for these types of routes. Again some of these sections of the network are within existing urban and residential areas.
- Traffic volumes have increased on a number of strategic and major routes over recent years including the A46 WRR and the A4134 Newark Road which provides a major radial route into central Lincoln. The expectation is that they will continue to increase putting the network under further pressure.
- Several parts of the existing network are already at or close to capacity including the A46, with congestion resulting in poor average speeds, variable journey times and delay in both peak periods and to some extent also in off peak conditions.
- Significant traffic growth is forecast for Lincoln and this will increase the pressure on the network and result in more routes operating close to or over capacity.

**Local Route Network**

- The traffic data shows that a number of local routes that are currently carrying significant volumes of traffic on a daily basis.
- These routes pass through built up residential areas, often with housing immediately adjacent to the highway. Settlements affected by significant levels of traffic include Bracebridge Heath, Bracebridge/Low Fields Swallow Beck, Boultham and North/South Hykeham.
- They are unsuitable for high volumes of traffic and are the result of limited route choice for both traffic travelling east west across the southern part of Lincoln and north south towards the city centre.

- The forecast increase in traffic will also impact on these routes and continue to affect the villages and residential areas which these routes pass through.

### 5.5.3. Challenges

The key challenges are as follows:

- Future land-uses and policies identify significant levels of planned growth up to 2036.
- Forecast development includes four SUEs which contribute to a 50% increase in dwellings in Lincoln by 2036.
- An analysis of future travel demands within the study area has revealed that total trips are expected to increase substantially over the next 20 years. Traffic levels are forecast to increase in the region of 11% up to 2026 and up to 20% by 2036.
- The opening of the LEB will improve conditions in the centre of Lincoln. However traffic is expected to continue to grow on a number of major routes including the A46 WRR, A1434 Newark Road, A607 Grantham Road and local routes in the south Lincoln area. These routes already experience congestion and conditions are expected to deteriorate.
- Traffic flows on the existing rural east west routes to the south of Lincoln are also expected to increase substantially. This will have a detrimental impact on the existing villages and communities within this area affecting air quality and noise and increasing severance.
- The forecast traffic growth will result in a deterioration in conditions on key areas of the network particularly on the western side of Lincoln including the A46 WRR, A1434 Newark Road, sections of the A15 and on local routes in the South of Lincoln and North Hykeham area. This includes the Meadow Lane and Brant Road – the main east west crossing of the River Witham in the south of Lincoln.
- Lack of suitable routes leads to rat-running through existing residential areas affecting quality of life and increasing severance.
- Demand will continue to exceed the available capacity impacting on strategic and local traffic. The key strategic and major routes are not designed to accommodate future traffic levels and this will affect the economic growth aspirations and objectives as well as the delivery of housing.
- Additional capacity and route choice will help to support the forecast and planned growth, improve reliability and resilience.

## 5.6. THE NEED FOR INTERVENTION SUMMARY

**Existing issues**

The existing road network suffers from a number of issues and unless a suitable transport intervention is implemented they will remain an issue. These include:

- Lack of route choice: resulting in congestion and rat-running on local roads particularly to the south of Lincoln and on key orbital and radial routes with the latter resulting in a high proportion of strategic traffic being forced to travel through the historic centre of Lincoln;
- Congestion: congestion on the road network impacts on development and economic growth aspirations of the area through slow journey times. It also impacts on public transport as they are subject to the same delays as other vehicles and it also makes other sustainable travel modes less attractive;
- HGVs: limited north-south and east-west connectivity in and around Lincoln results in significant proportion of HGVs using the A46; and inappropriate routes within the City Centre and residential roads in North Hykeham; and
- Network resilience: when a serious incident occurs on the A46 or A15 diversion routes force a high volume of traffic through residential areas which impacts on journey times and communities living along.

**Future Issues**

Without a suitable transport intervention traffic conditions in the future will deteriorate and the road network will struggle to:

- Accommodate forecast growth;
- Support the delivery of SUEs;
- Support the delivery of the Central Lincolnshire Local Plan;
- Support the Major Road Network development;
- Accommodate the increase travel demand;
- Accommodate increased congestion; and
- Suffer from network capacity issues.

**Impact**

If a suitable transport intervention is not implemented existing and future conditions will result in:

- A lack of strategic connectivity: the A46/A15 currently provide strategic connectivity to wider economic areas such as the Humber ports. Congestion which will be exacerbated in the future which will inhibit efficient movement on this route and therefore wider strategic connectivity;
- Constrained economic growth: the transport network is forecast to face increasing congestion which may impact on the areas ability to deliver sustainable economic growth;
- An impact on housing targets: the ability to deliver housing targets will be compromised; and
- An impact on the indicative Major Road Network: existing and future congestion on the A15 and A46 may hinder the potential of these routes to operate as part of the MRN.

# 6. IDENTIFYING OBJECTIVES

## 6.1. INTRODUCTION

With the need for intervention established, a set of objectives also need to be defined to steer the development of potential transport interventions. This section presents a set of objectives for the intervention.

## 6.2. APPROACH

Defining objectives plays a key role in steering the development of transport schemes and assessing whether they have been successful once delivered. Essentially, objectives set out what a scheme, or indeed transport strategy, is designed to achieve.

The development of objectives for this project has been informed by Transport Appraisal Process guidance from WebTAG.

What a scheme should achieve can be expressed at a very high level, in terms of an aim and strategic objectives, or in much more detail including very specific objectives associated with detailed problems and issues. At this stage of the scheme development process, objectives should be higher level, avoiding indications of preferred solutions but enabling more specific objectives to be developed as the project proceeds and options identified. Objectives at this stage should also be consistent with specific challenges identified.

Objectives should be based on a realistic understanding of the issues and context of a project, reflecting the opportunities and constraints identified. While objectives should be consistent with wider local, regional and national objectives, they should focus on addressing identified need rather than seeking to contribute to all these higher level objectives. Where appropriate, objectives may focus on the five 'cases' used to development business cases (strategic, economic, financial, management and commercial).

As stated in WebTAG, consideration should be given to developing a hierarchy of objectives, which clarifies the reasoning behind interventions and provides a framework for future appraisal and evaluation. WebTAG states that a three level hierarchy may consist of:

- **High level or strategic outcomes** – These express the desired end state, and reflect the aims and ambitions for the area or population. These are generally objectives to which transport contributes, but not always in a direct manner;
- **Specific or intermediate objectives** – These represent the intermediate effects of the transport intervention, including the direct and short term objectives which need to be achieved for the high level or strategic outcomes to be realised; and
- **Operational objectives** – These represent the desirable outputs which are necessary for the intermediate objectives to be achieved.

Where possible intermediate and operational objectives should be SMART (Specific-Measurable-Accepted-Realistic-Time defined) and capable of quantification into specific targets as the scheme development process proceeds. It is likely that high level or strategic outcomes will be expressed in broader terms and be more qualitative.

## 6.3. NHRR OBJECTIVES AND OUTCOMES

The strategic outcomes, specific objectives and operational objectives for the intervention are summarised below and a more in-depth description of the processused to develop the objectives is presented within Appendix F.

The strategic outcomes have been derived following a review of high level objectives of the DfTs Transport Investment Strategy, Greater Lincolnshire SEP, the CLLP, the Lincolnshire LTP, and the LITS. As a result the strategic outcomes broadly align with the key themes which emerged from the policy review as presented within Section 2.2.4.

The specific / intermediate objectives represent the emerging impacts including the direct and short-term objectives which need to be achieved for the high level or strategic outcomes to be realised. In developing the specific / intemediate objectives it was regognised that a significant level of development is proposed for the Lincoln area up to 2036 and it is critical that this is supported by the delivery of new transport infrastructure. The intervention would also need to support the delivery of the LITS and its aims and objectives. This includes ensuring that the transport infrastructure meets the needs of existing and proposed developments, and that continued investment and development in infrastructure reduces congestion on key strategic and local routes within and around the Lincoln urban area.

Finally, the operational objectives were developed and provide further detail regarding the outputs that will enable the specific objectives to be achieved.

Figure 1 presents the operational objectives, specific objectives and strategic outcomes together with an illustration of the relationship between them.

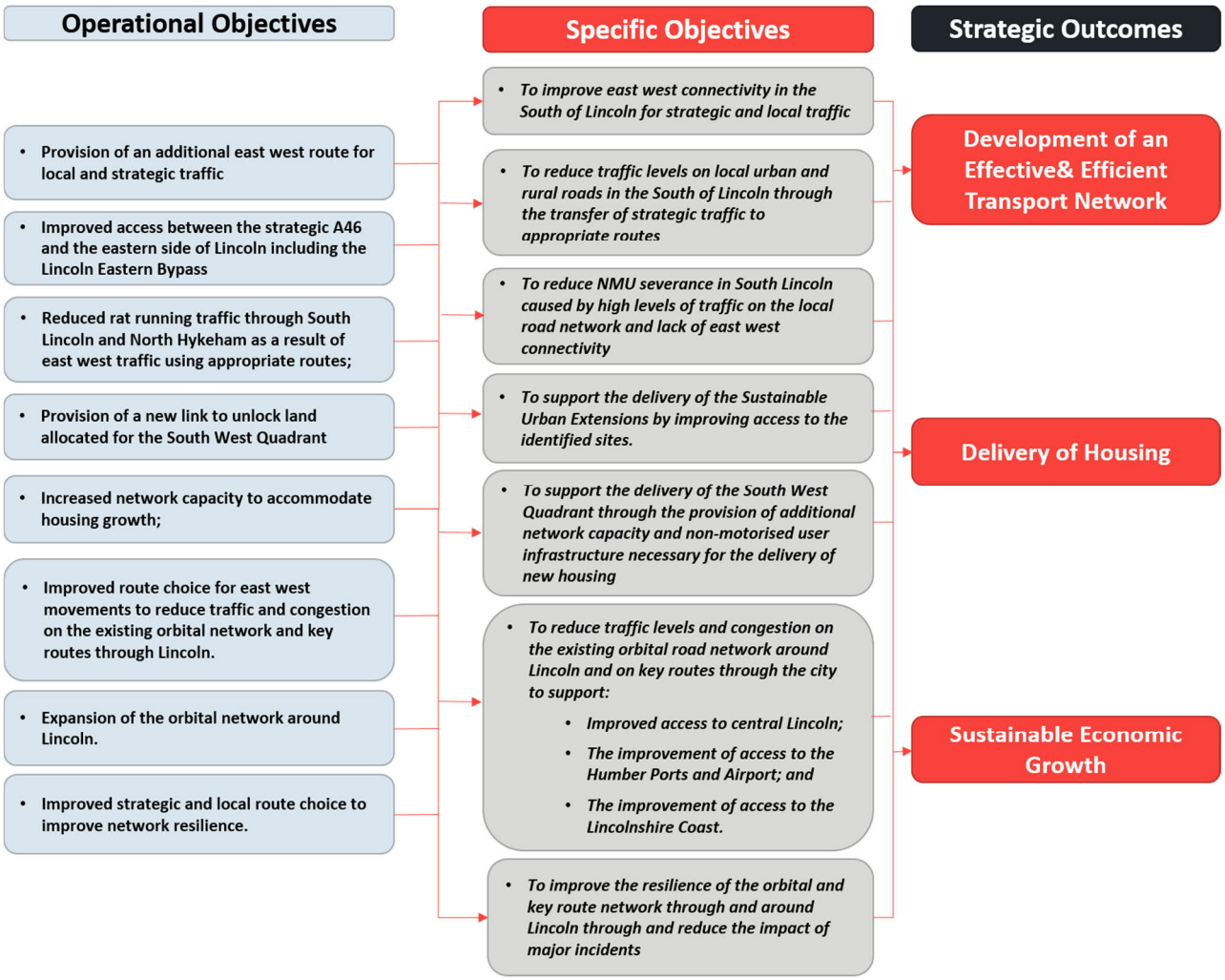



**Figure 1 - Relationship between Outcomes and Objectives**

# 7. GEOGRAPHICAL AREA OF IMPACT

## 7.1. OVERVIEW

This section of the report defines the geographical area of impact to be addressed by the intervention, i.e. the area it should be bounded by. DfT WebTAG guidance sets out that the geographic area of impact for a study should be based on:

- Understanding of the geographical scope of the travel market and key origins and destinations; and
- Analysis of the geographical extent of current and future transport problems and underlying drivers.

In the case of the NHRR scheme, two areas of impact have been developed:

- Intervention Area – determining the geographical extents for the development of options, focussed on the key current and future transport problems; and
- Wider Area of Impact – illustrating the anticipated geographic extent of the key travel market anticipated to be impacted by the scheme, including the communities located along the official diversion route.

## 7.2. INTERVENTION AREA

The intervention area will set the geographical scope for the development of options and has been defined based on the key current and future transport problems.

***Key Current Transport Problems***

These have been well defined in the Chapter 2 The Current Situation and also in Chapter 4 The Need for Intervention. The existing issues derive the limitations of the existing network, existing and forecast demand exceeding available capacity and from a lack of route choice and connectivity including in the south Lincoln. The network limitations result in congestion, delays, poor journey times, an unsuitable level of HGVs, and poor network resilience on the localised routes. These current transport problems are felt by the residential settlements of North and South Hykeham, located to the south west of Lincoln. Settlements to the south east of Lincoln, i.e. Waddington and Bracebridge Heath currently have a relatively poor level of connectivity and accessibility to Lincoln and services and amenities.

***Key Future Transport Problems***

The forecast transport problems have been presented and analysed in Chapter 3 The Future Situation and also in Chapter 4 The Need for Intervention. Current transport issues are expected to be exacerbated by future transport growth which can be seen as an upward trend based on a range of traffic data. The high level of planned economic and housing growth in the CLLP will contribute additional pressure in the south Lincoln area, identified as currently experiencing congestion and network capacity issues. The CLLP specifically has allocated 3,200 dwellings in period to 2036; 20ha employment land. as part of the WGC and approximately 2,000 dwellings and 5ha of employment land, as part of the SWQ. These SUEs will increase demand in the south Lincoln area and without a suitable transport intervention economic growth may be constrained and unsustainable, indeed the ability to deliver planned growth may be compromised. The lack of

connectivity in the south of Lincoln will impact on the nationally significantly wider strategic connectivity agenda of the MRN and increasing port connectivity.

Based on the summary of the transport issues, which are set out in detail in previous chapters, an area in the south of Lincoln has been identified as the intervention area, and can be seen in Figure 1.

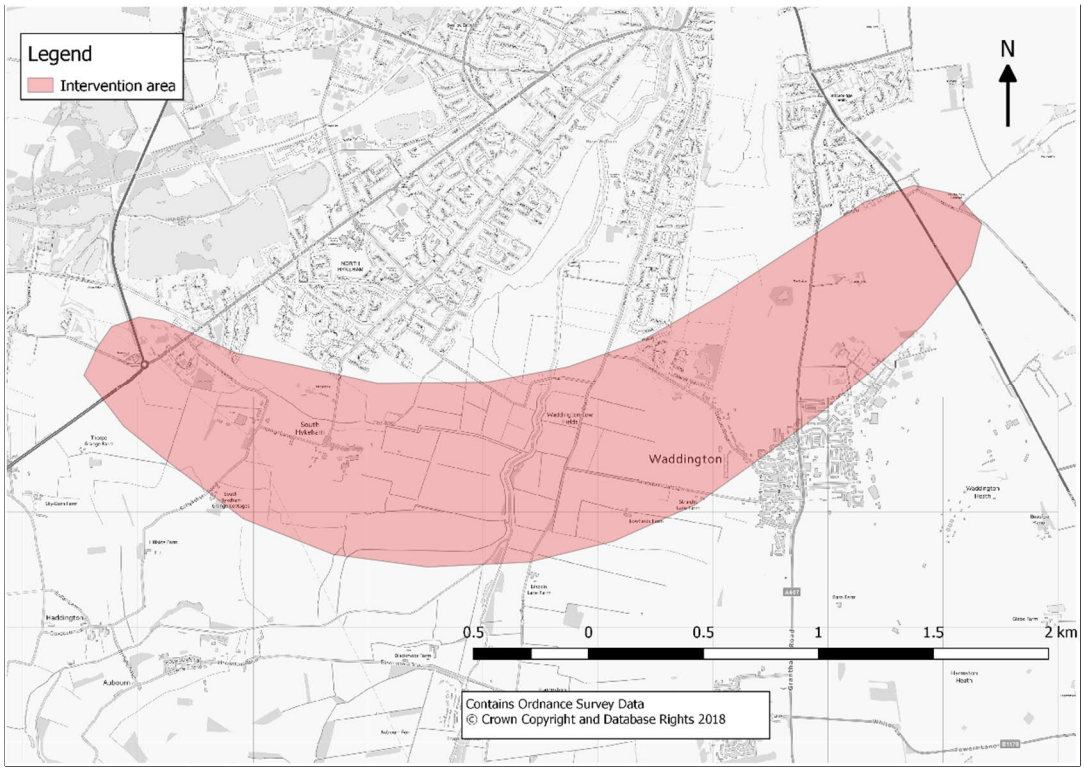



**Figure 1 – Intervention Area**

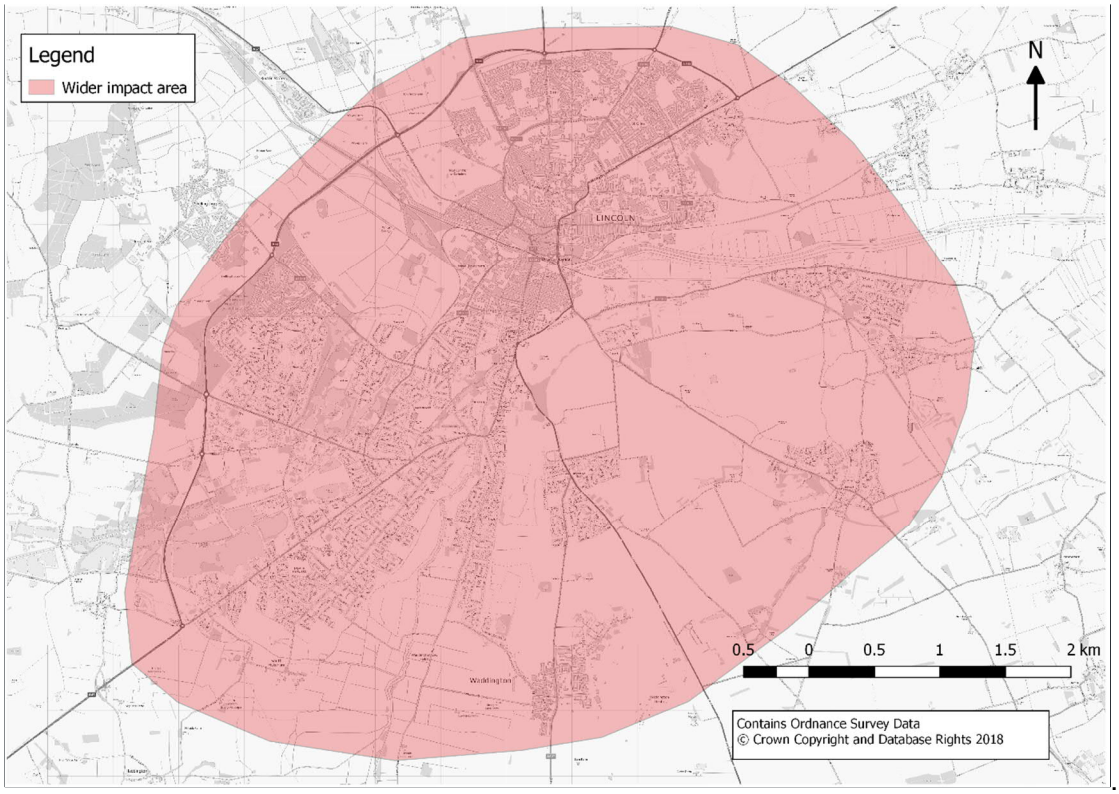
## 7.3. WIDER AREA IMPACT

The wider area impact has been defined based on the anticipated geographic extent of the key travel market anticipated to be impacted by the scheme, including the communities located along the major routes. In setting this scope, an understanding of the geographical scope of the travel market and key origins and destinations is required.

An analysis of travel patterns and key origins and destinations has been undertaken in previous chapters of this report. The GLTM has been used as a key tool throughout the development of this OAR. Travel data has identified that Lincoln acts as a local service centre for the wider hinterland, and also strategic traffic utilises Lincoln's transport network to access the Lincolnshire coast via the A46 and A158, the Humber Ports and Airport and as a route to the A1 via Newark.

The analysis of the scope of transport issues in the Lincoln area has illustrated congestion and capacity issues on the A46 western and northern relief roads and also on the A15 viathe Lincoln urban area. An intervention in the south Lincoln area would impact on the journeys of transport users of Lincoln's relief roads and also in the Lincoln urban area. The communities in south Lincoln including North & South Hykeha, Waddington and Bracebridge Heath would be most directly impacted by the scheme.

For the reasons above, the wider area impact has been defined and can be seen in Figure 56




. This covers the urban area of Lincoln, as an intervention within the south of Lincoln would impact on communities and journeys of transport users in this scope.

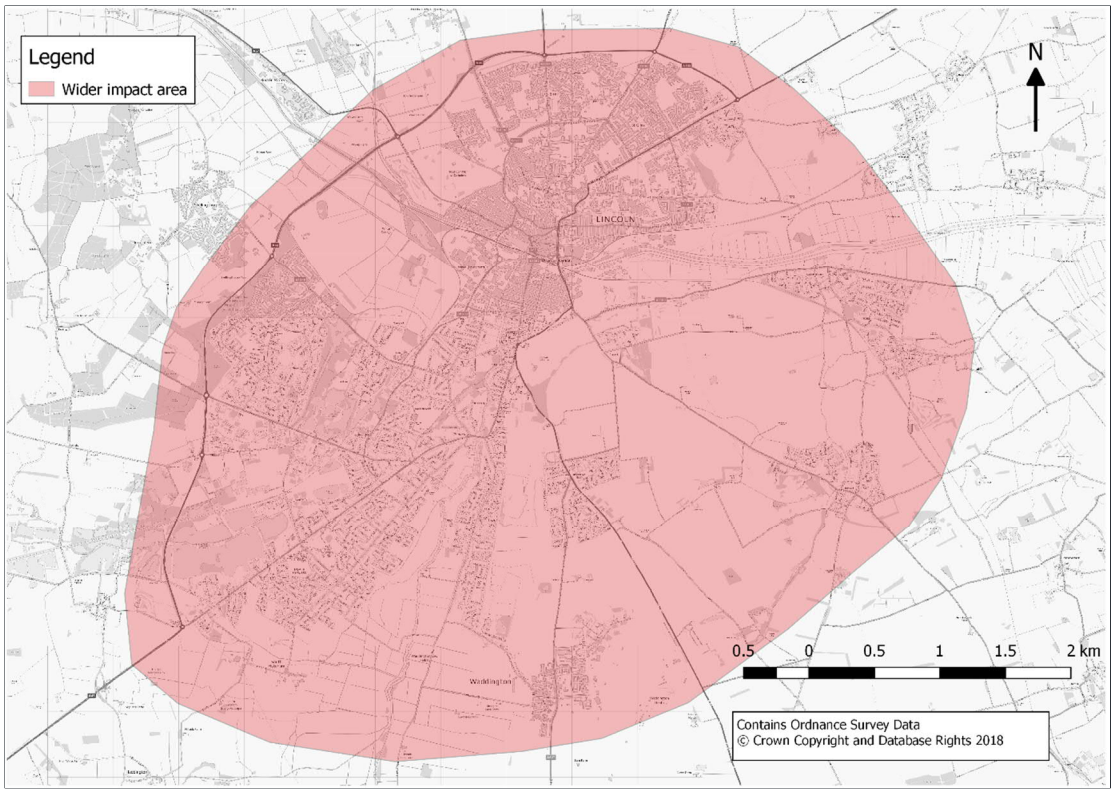



**Figure 2 – Wider Area Impact**

# 8. GENERATING OPTIONS

## 8.1. CONTEXT AND PURPOSE

This section of the OAR sets out the range of options considered to address the problems and meet the objectives set out in the previous sections of the report. The purpose of option generation is to develop a wide range of alternative measures or interventions focussed on addressing the identified problems, and opportunities, as well as the constraints. DfT guidance[5] states that 'analysts should start with a wide range of possible measures, and then narrow these down in a robust, transparent and auditable manner.'

In accordance with the guidance, the option generation process will capture broad options, including all modes, infrastructure, regulation, pricing and other ways of influencing behaviour. Options generated should include those that reduce or influence the need to travel, as well as those that involve capital spend. Revenue options should be considered with the aim of creating behavioural change and meeting the Government's climate change goal.

## 8.2. OVERVIEW & STRUCTURE

Historically, there has been a significant amount of work undertaken in identifying options, consulting on them and preparing a shortlist. An assurance process has been followed each time LCC has reviewed transport intervention options in order to ensure that the options remain relevant. The overall approach to the options generation and development is summarised in Figure 1 from the identification of initial options that make up LITS as a whole strategy to the development of the NHRR as a component of LITS.

This section initially provides a summary of the historic LITS work undertaken and then provides detail on the latest phase of development. A more in-depth description of the LITS historic work undertaken is presented within Appendix G.

The remainder of this chapter includes:

- Histroric LITS approach:
  - Identification of Initial Options – this section presents the LITS initial concepts/options and describes the development of these into confirmed options for appraisal;
  - Consultation & Refinement – this describes the process which was followed to refine the LITS options into short and longer term schemes; and
  - Development of the Route Corridor Options – this section presents the process to progress to a preferred corridor.

The latest phase of development which includes:

[5] Transport Analysis Guidance, The Transport Appraisal Process, DfT, January 2014

- Design Development – Highways, Structures, NMU and Drainage options of the preferred route corridor are reviewed in this section;
- Indicative Option Costs – Provide details of high level cost estimates; and
- Consultation & Engagement – Contains details of the consultation & engagement which has taken place.

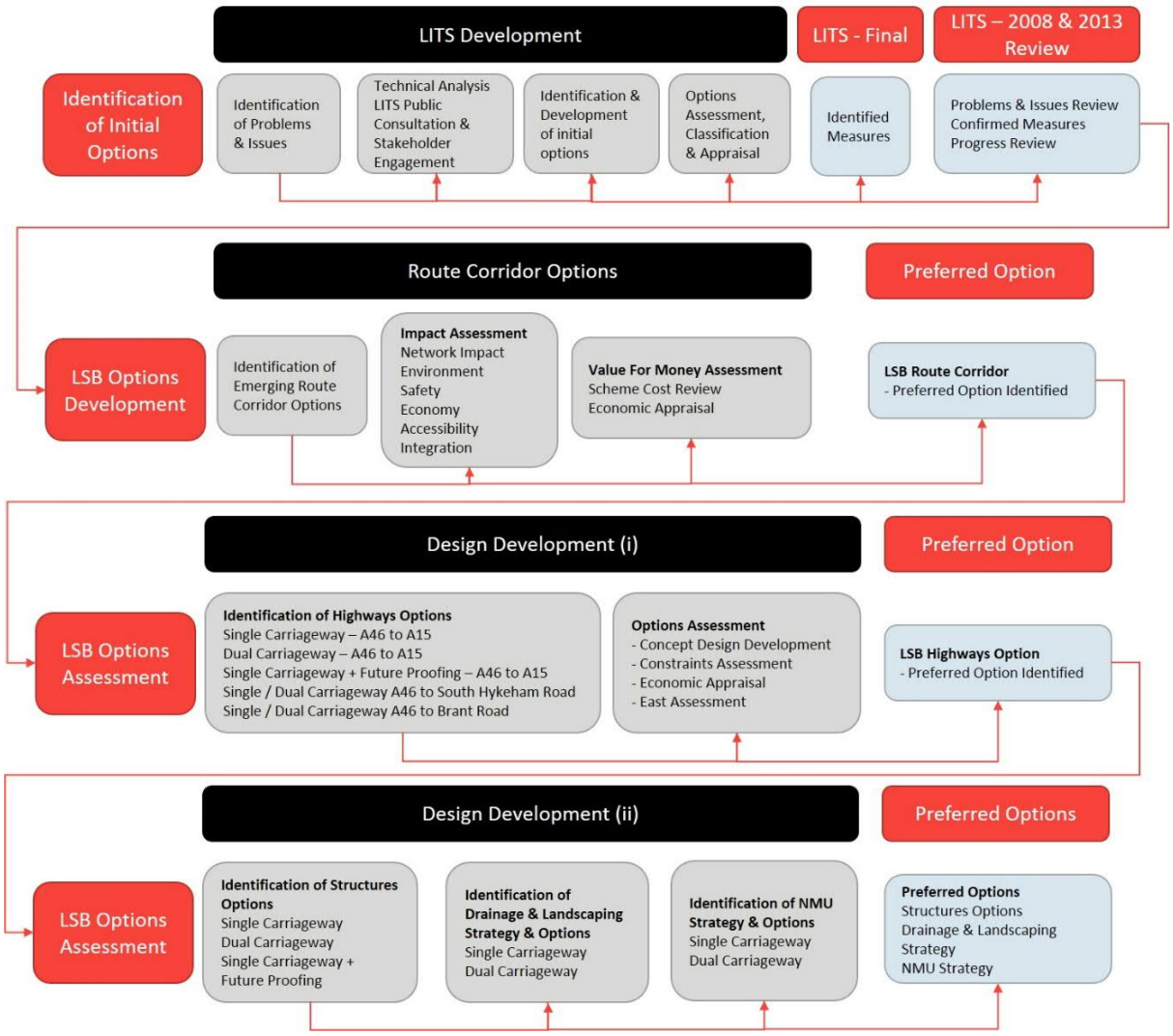



**Figure 1 - Options Generation Approach**

## 8.3. HISTORIC LITS APPROACH

### 8.3.1. Identification of Initial Options

Following an initial identification of key problems and objectives an option development process was undertaken between 2004 and 2006 resulting in intial concepts / options. Following an initial appraisal of these options which resulted in the discounting of options and inclusion of others, the initial options were developed in more detail. The remaining options under consideration were then appraised against their impact on the LITS objectives, cost, environment, safety, economy, accessibility and integration resulting in the discounting of options. The remaining options were then prioritised and the results have been summarised in Table 24.

**Table 9 – Prioritised Options for LITS**

| Category | Priority (within Category) | Option Name | Appraisal Position (out of 19) | Compatibility | Risk | Cost |
|---|---|---|---|---|---|---|
| Highways Options | 1 | Lincoln Eastern Bypass | 1st | High | Low | High |
| | 2 | North Hykeham Relief Road | 2nd | Medium | Medium | High |
| | 3 | East-West Link | 18th = | High | High | High |
| | 4 | Uphill Traffic Management | 12th | High | Medium | Low |
| Public Transport Options | 1 | Quality Bus Corridors | 8th = | High | Medium | Medium |
| | 2 | High Street Level Crossing Closure | 5th = | High | High | Medium |
| | 3 | Public Transport Interchange | 3rd = | Medium | Medium | High |
| Parking Options | 1 | Park and Ride | 5th = | High | Medium | Medium |
| | 2 | City centre Parking Strategy | 14th = | High | High | Medium |
| Softer Modes | 1 | Improved Pedestrian Facilities | 8th = | High | Low | Medium |
| | 2 | Improved Cycle Network | 10th = | Medium | Medium | Medium |
| | 3 | School Travel Plans | 3rd = | High | Medium | Low |
| | 4 | Business Travel Plans | 7th | High | Medium | Low |

### 8.3.2. Consultation and Refinement

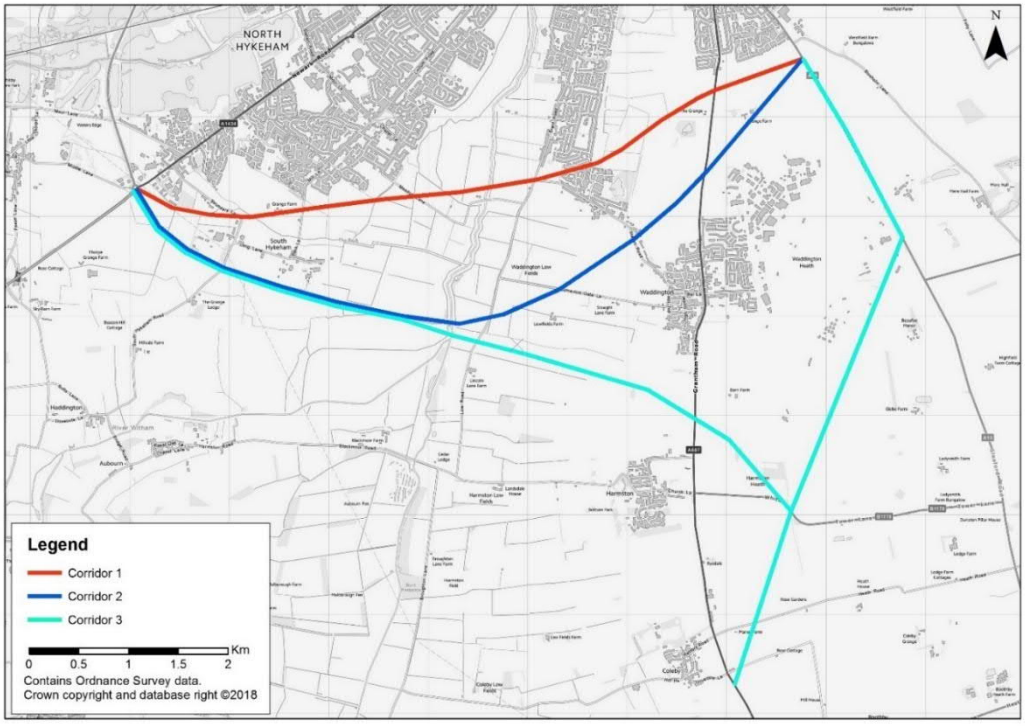
Following the identification of prioritised options subsequent stages of the LITS took steps to develop NHRR and this includes:

- Stakeholder and public consultation as part of LITS (January 2005) which confirmed NHRR was to be considered amongst the transport improvement priorities for the future;
- In 2008 LITS was reviewed and revised and the options refined and classified into short and longer term schemes in which NHRR was confirmed as a longer term scheme (2016 -2026+);
- The LITS 2013 Progress Report categorises the majority of options previously highlighted within the LITS 2008 review as established transport improvements. It also identified emerging imrpvoements and included additional schemes to the list. A description of all identified schemes and progress to date is included within Appendix G.

### 8.3.3. Development of the Route Corridor Options

Although the NHRR has emerged from the development of LITS, the principle of such a scheme has also been developed as part of a number of strategies and policy plans covering the Lincoln area for many years and includes a number of strategies in the 1990's which included an assessment concluding that NHRR was not considered economically justifiable at the time. However land was safeguarded for the route of NHRR in the North Kesteven Local Plan adopted in 1996.

Following an OAR in September 2003 which concluded that no option stood out as a preferred solution due to the expected environmental impacts, a workshop was held in April 2004 which identified three corridor options all connecting the A15 at the terminus of the proposed LEB and the A46 at the terminus of the existing WRR (see Figure 58




).

In 2005 a Route Assessment Report was produced where corridor 3 was ruled out for scoring significantly a lower BCR and having a greater impact on the natural and built environment compared to the other corridors. Corridors 1 and 2 were progressed and refined to four options (1, 2A, 2B and 2C) on the basis of a combination of engineering, economic and environmental factors (see Figure 59**Error! Reference source not found.**).

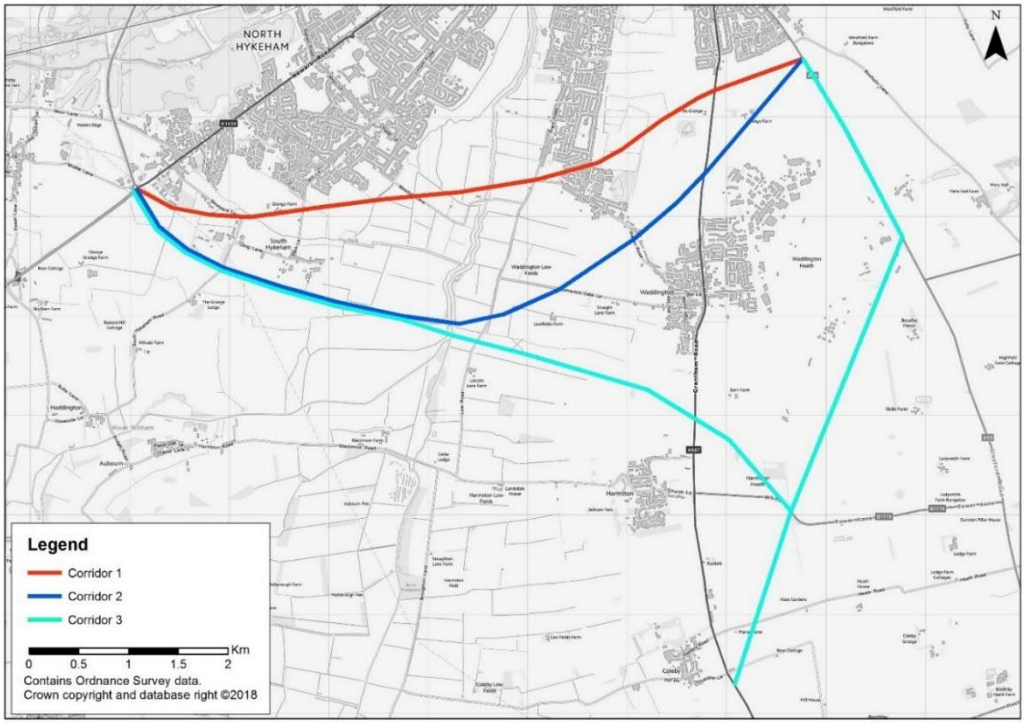



**Figure 2 – NHRR Corridor Options**

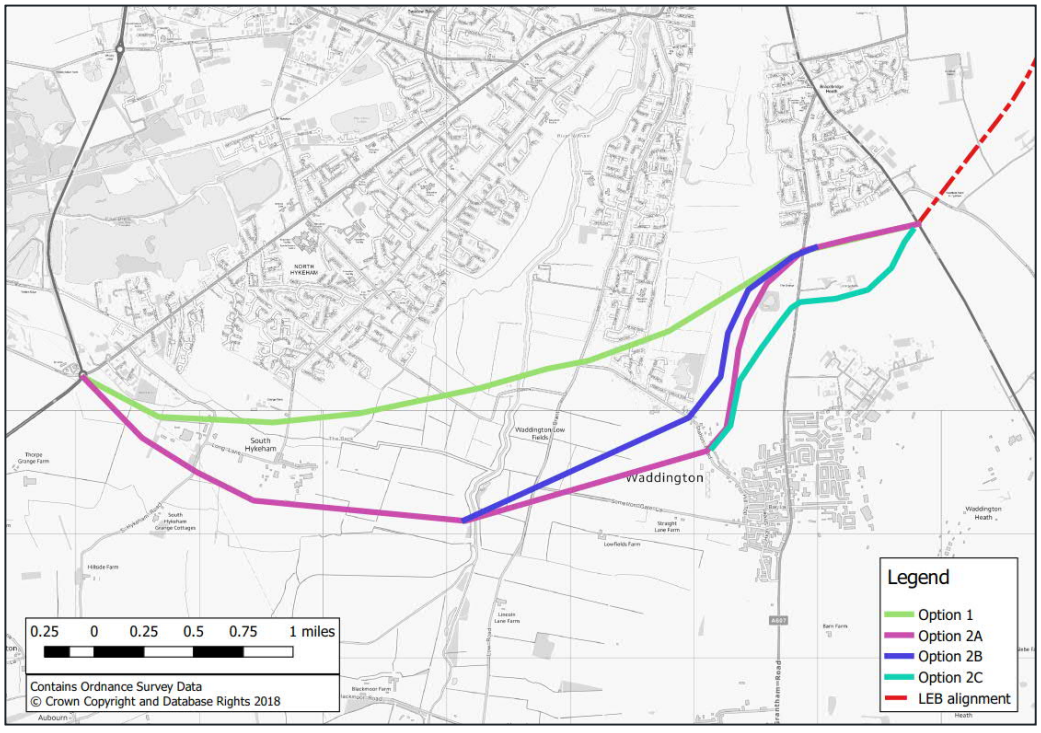



**Figure 3 – NHRR Route Options**

A public consultation was then undertaken in October 2005 and it showed that there was general support for NHRR and the recommended corridor (corridor 2) with the exception of residents in Waddington and the fringes of Bracebridge Heath (that are directly affected by the route). Support

was also shown for corridor 3. As a result a route corridor appraisal was undertaken in 2006 to assess the strategic impacts of Route Corridors 2 and 3 against LITS and NHRR problems and objectives. This identified Corridor 2 as the preferred option, primarily because it offered a 'point to point' strategic route to the south of Lincoln and therefore being a more attractive alternative to which through traffic would transfer. A Strategic Value for Money appraisal was also undertaken and concluded Route Corridor 2 was recommended for further investigation.

In April 2006 LCC's Executive Councillor for Highways requested that a preferred route option be developed and based on previous work and consultation Route 2C was developed in further detail. A second public consultation was undertaken in October 2006 and concluded that there was overwhelming support for a NHRR throughout the Lincoln area with the majority of respondents supporting the Emerging Preferred Route. However, there continued to be some opposition to the route, particularly from respondents living in the Waddington and Waddington Low Fields areas.

On the 5th December 2006 the County Council Executive Committee made the decision to endorse the Preferred Route option for the NHRR. This option is illustrated in the figure below and the initial design incorporates the following:

- A highway link between the LEB and the A46 WRR;
- A new bridge over the River Witham; and
- Junctions with the A607 Grantham Road, Brant Road and South Hykeham Road.

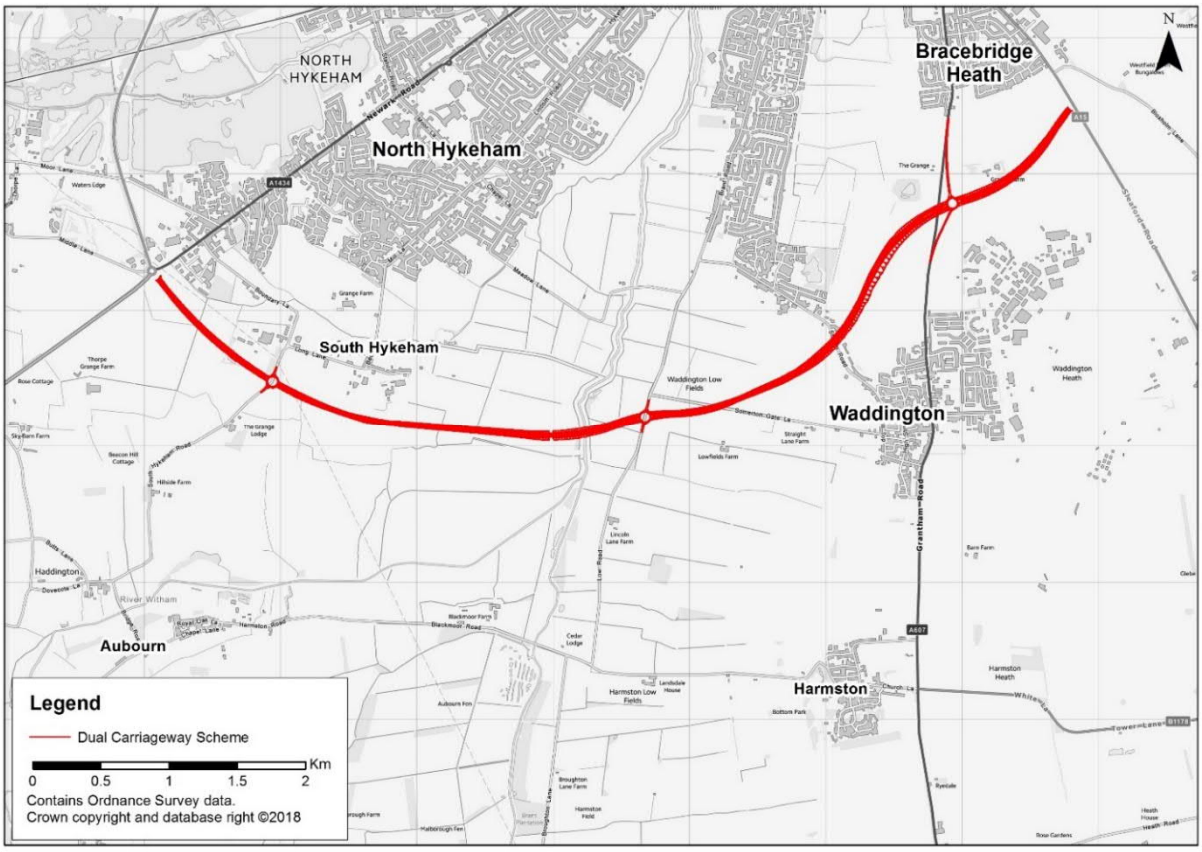



**Figure 4 - Alignment of Proposed North Hykeham Relief Road**

## 8.4. DESIGN DEVELOPMENT

The next stage of design and options development focused on the following:

- Highways Options
- Structures Options
- Non-Motorised User Strategy (NMU) & Options
- Drainage & Landscaping Strategy & Options

The following sections of the report summarise the options development process and considerations relating to the highways, structures, NMUs, drainage and landscaping options. Each of these options described in the following sections have also formed the basis of the latest phase (May 2018) of stakeholder and public engagement. The outcome of the consultation is described in Section 7.12 has been used to inform the decision making process in identifying the preferred option and approach.

### 8.4.1. Highway Options

Following the prefered route assessment process the next stage involved assessing and developing the carriageway standard options for the NHRR. A number of alternative options have been developed in line with the preferred route corridor and consideration has been given to whether shorter schemes would deliver benefits. The highways options are summarised in Table 10, the location of these are shown in Figure 5 and concept drawings are provided in Appendix G. The development of the concept designs considered key challenges, issues and opportunities for each option and were taken forward to the stakeholder and public engagement stage.

**Table 10 – Highway Options Summary**

| Option | Summary | Description | Considerations / Issues |
|---|---|---|---|
| 1 | Single Carriageway – whole route | This option would provide a single carriageway link between the A46 and the A15. | Alignment differs from dual carriageway layout but is compliant with design standards<br>Straighter alignment from South East improves visibility for overtaking<br>The single carriageway alignment between Station Road and A607 will increase the distance between the scheme and Waddington.<br>Station Road section to have crawling lane up to the escarpment<br>Grade separated structures not recommended for single carriageway alternative junction layouts likely to be required<br>RAF Waddington: Horizontal alignment closer to RAF base, scheme lighting potentially conflicts with landing aircraft<br>Location of the South West Quadrant and stats on the western side of the scheme has the potential to constrain the alignment |
| 2 | Dual Carriageway – whole route | This option would provide a dual carriageway link between the A46 and the A15. | The alignment will follow the initial alignment developed as part of the 2006 corridor options process<br>A revised access to RAF Waddington has the potential to alter the 2006 alignment assumptions<br>The addition of the access to the SWQ is an amendment to the 2006 alignment assumptions |

| Option | Summary | Description | Considerations / Issues |
|---|---|---|---|
| | | | There are potential land constraints relating to the western section of the scheme and the emerging South West Quadrant development / masterplan. |
| 3 | Single Carriageway (whole route) + Future Proofing | This option would provide a single carriageway link between the A46 and the A15 but would include enlarged junctions. | The future proofed single carriageway option would be expected to include dual carriageway standard junctions and structures. The key opportunities and issues are identified below:<br>The junctions could potentially be developed to accommodate a dual carriageway. This was the approach adopted for the Lincoln Eastern Bypass<br>The NMU structures could be developed to accommodate the expansion to a dual carriageway<br>The drainage design (attenuation ponds and swales) could be developed to a dual carriageway standard<br>Landscaping and planting strategy could be designed to include space for an expansion to a dual carriageway<br>Additional land would need to be acquired for future proofing the future proofing measures<br>This may be difficult to justify in the event of a CPO inquiry. The CPO process will only allow land necessary for the single carriageway to be acquired |
| 4 | Single Carriageway (A46 to South Hykeham Road) | This option would provide a single carriageway link between the A46 and South Hykeham Road. This shorter option would support the development of the South West Quadrant. | It would be expected that this would serve the SWQ<br>The impact on the orbital and local road network is expected to be limited<br>This option would have a limited impact on east west connectivity<br>There is potential for this option to form Phase 1 of the full NHRR scheme |
| 5 | Dual Carriageway (A46 to South Hykeham Road) | This would provide a dual carriageway link between the A46 and South Hykeham Road and would support the development of the South West Quadrant. | It would be expected that this would serve the SWQ<br>The impact on the orbital and local road network is expected to be limited<br>This option would have a limited impact on east west connectivity<br>It is unlikely that a dual carriageway would be appropriate over a short section<br>There is potential for this option to form phase 1 of the full NHRR scheme |
| 6 | Single Carriageway (A46 to Brant Road) | This option would provide a single carriageway link between the A46 and Brant Road. This shorter option would support the development of the South West | It would be expected that this would serve the SWQ and local traffic in the North Hykeham area<br>The impact on the orbital network is expected to be limited but it would provide an alternative route for local traffic accessing the North Hykeham area<br>This option would have a limited impact on east west connectivity |

| Option | Summary | Description | Considerations / Issues |
|---|---|---|---|
| | | Quadrant and provide traffic relief to South Hykeham. | There is potential for this option to form phase 1 of the full NHRR scheme |
| 7 | Dual Carriageway (A46 to Brant Road) | This would provide a dual carriageway link between the A46 and Brant Road and would support the development of the South West Quadrant and provide traffic relief to South Hykeham. | It would be expected that this would serve the SWQ and local traffic in the North Hykeham area;<br>The impact on the orbital network is expected to be limited but it would provide an alternative route for local traffic accessing the North Hykeham area<br>This option would have a limited impact on east west connectivity<br>It is unlikely that a dual carriageway would be appropriate over a short section<br>There is potential for this option to form phase 1 of the full NHRR scheme |

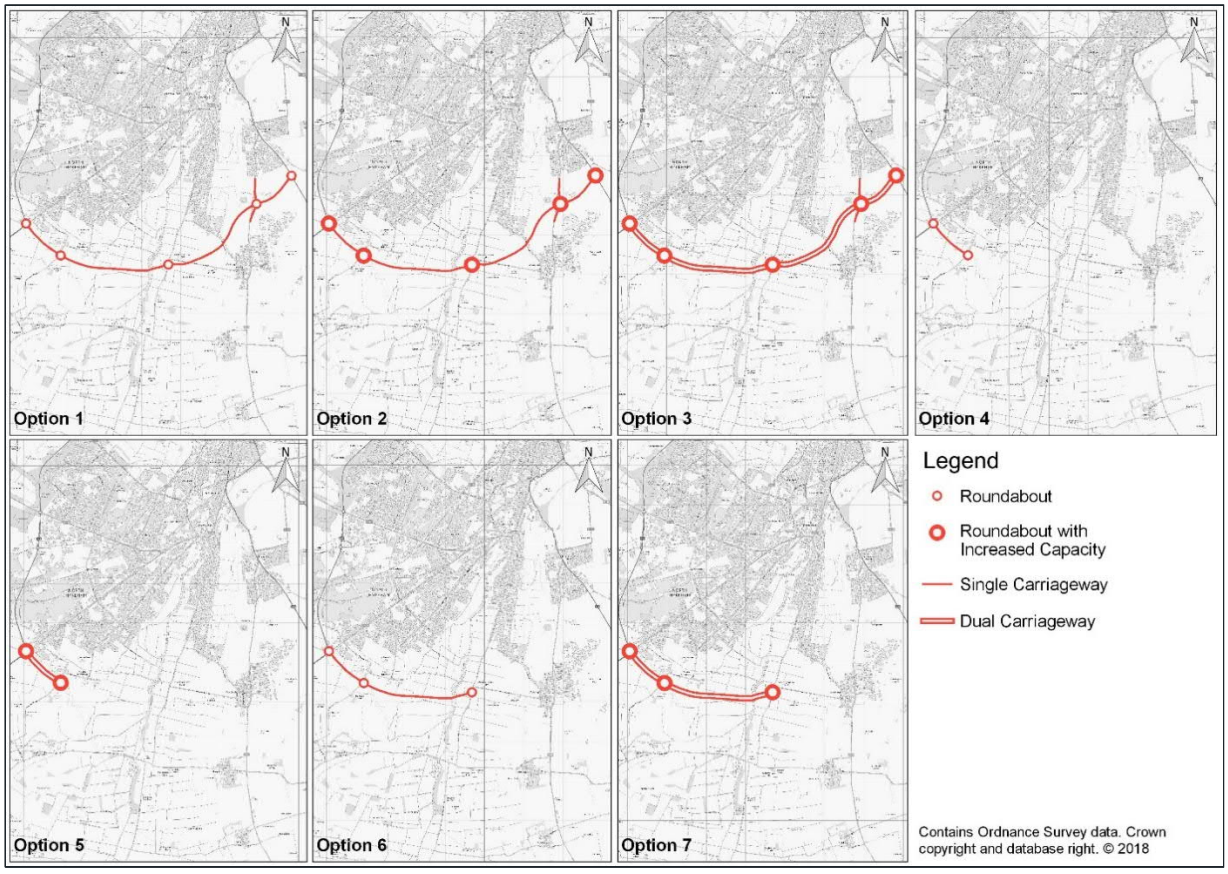



**Figure 5 – Highway option locations**

### 8.4.2. Highway Options – Junctions

Alongside the development of the highways options and concepts, the junction strategy and assumptions were also reviewed. As part of the wider design development the earlier assumptions

and concepts developed as part of the route corridor development were reviewed in line with the following areas:

- The key access requirements along the route;
- The junction type and function; and
- The links to the radial routes.

Figure 6 shows the key intersections with the existing network and Table 11 summarises the outcome of the junction strategy review.

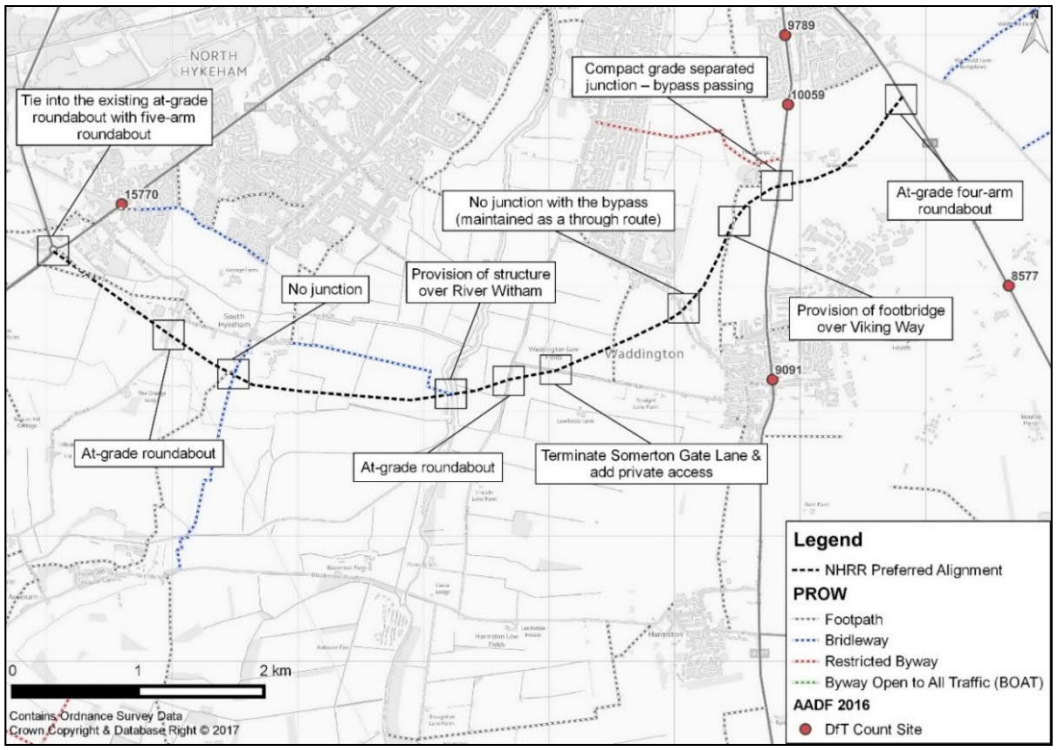



**Figure 6 - Existing Intersections**

**Table 11 – Junction Strategy Review**

| Ref | Junction | Initial Options | 2006 Preferred Option | Outcome of review |
|---|---|---|---|---|
| 1 | A46 Western Relief Road / A1434 Newark Road / A46 (T) / Middle Lane | Tie into the existing at-grade roundabout with five-arm roundabout | ✓ | This is still deemed as the preferred option given that: double roundabout would not be operationally effective given the likely imbalance in traffic flows; and Access to Middle Lane via a separate junction would have an impact on several businesses which rely on links to the highway network via Middle Lane. |
| | | Double roundabout | | |
| | | Access to Middle Lane via a separate junction on either or both the A46 Western Relief Road and the A46 (T) | | |
| 2 | SWQ Access | Roundabout | ✓ | This has been recognised as necessary to facilitate the delivery of the SWQ. However further assessment of the scope and requirements is required as well as traffic model inputs. |
| 3 | Wath Lane | No junction | ✓ | This is still considered the preferred option as Wath Lane is a track at its intersection with the proposed |

| Ref | Junction | Initial Options | 2006 Preferred Option | Outcome of review |
|---|---|---|---|---|
| | | | | scheme and it is therefore not considered that a junction with the bypass would be appropriate. Furthermore, it is recognised that there are a lot of stables nearby and so retaining the bridleway over the NHRR may be required. |
| 4 | Boundary Lane / South Hykeham Road | Retain as a through route by means of a structure | | This is still considered the preferred option as an at-grade roundabout maintains access onto the local road network without the need for a structure and will provide access to the SWQ. |
| | | At-grade roundabout | ✓ | |
| 5 | Brant Road | At-grade roundabout | ✓ | This is still considered the preferred option given that:<br>Previous traffic forecast has indicated that traffic flows on the bypass in the vicinity of Brant Road would be unlikely to warrant a compact grade separated junction according to DMRB guidance;<br>The stopping up of Brant Road is not considered feasible as it currently acts as an important transport link through the study area; and<br>If a junction is provided it should allow traffic flow in all directions.<br>However, despite the evidence provided above, alternative options will be modelled given the close proximity of River Witham Bridge which may dictate that a compact grade separated junction is a more suitable option. |
| | | A compact grade separated junction | | |
| | | Restricted movements junctions (e.g. access to and from the north only, priority junctions, left in left out junctions, etc.) | | |
| | | No junction with the bypass (Brant Road maintained as a through route) | | |
| | | No junction with the bypass (Brant Road closed to vehicular traffic) | | |
| 6 | Somerton Gate Lane | Divert Somerton Gate Lane to meet Brant Road further to the south and introduce turning restrictions at its junction with Brant Road or | | Somerton Gate Lane carries low traffic flow and is not deemed an appropriate standard to use for traffic from the NHRR. Furthermore, whilst the restricted movement at a junction between a diverted Somerton Gate Lane and Brant Road would prevent general access via Somerton Gate Lane, it may also constrict movement of agricultural traffic and make their access to the bypass difficult. It is therefore considered that curtailment of Somerton Gate Lane is still the preferred option at this stage. |
| | | Terminate Somerton Gate Lane & add Private Access | ✓ | |
| 7 | Station Road | No junction with the bypass (Station Road closed to vehicular traffic) | | This is still deemed as the preferred option given that:<br>Station Road is generally accepted to be an integral link between Upper Waddington and Waddington Low fields and so severance to either vehicular or non-vehicular users is not considered to be a sustainable option<br>The bypass would pass in close proximity to residential properties and so regardless of what junction type is selected it would have a negative impact on accessibility, visual impacts and noise and vibration to properties in the area<br>At-grade roundabout with Station Road on its existing alignment would result in significant land-take from adjacent properties |
| | | No junction with the bypass (Station Road maintained as a through route) | ✓ | |
| | | An at-grade roundabout. | | |
| 8 | Viking Way | Diversion of route to A607 crossing the bypass via at-grade crossing/bridge | | Further investigation required due to:<br>Maintaining the existing alignment will result in a larger structure being required<br>A diversion could generate objections from NMU groups and the public<br>A balanced approach is required |
| | | Provision of a footbridge along the existing line of the path | | |
| | | A short diversion of the route and provision of a footbridge | ✓ | |
| 9 | | At-grade roundabout | ✓ | |

| Ref | Junction | Initial Options | 2006 Preferred Option | Outcome of review |
|---|---|---|---|---|
| | | Compact grade separated junction – bypass passing beneath Grantham Road | | |
| | A15 Sleaford Road | At-grade four-arm roundabout | ✓ | This is still considered the preferred option given that if the NHRR is to link into the LEB at its proposed junction with the A15 Sleaford Road to the south of Bracebridge Heath this would require a four-arm roundabout. |

### 8.4.3. Structures Options

The location and type of highways structures along the NHRR have also been considered. Options were developed for the crossing of the River Witham and the Station Road overbridge and the concept design development considered dual and single carriageway structures. No specific future proofed design options were developed as the dual carriageway structures would provide this function if a single carriageway scheme was progressed. In addition initial concepts were considered for the NMU bridges at Viking Way and Wath Lane but these will be considered in further detail during the next stage of design. The development of the concept designs also considered a number of factors, these were as follows:

- The location of the structure;
- The known constraints and risks;
- The complexity of construction
- Specialist site preparation
- The scale and scope of any temporary works
- The design life and maintenance costs
- Aesthetics

The options development process resulted in the identification of viable options for the bridge structures. The resulting concept design options will be further developed during the next stage of feasibility design. The options considered are summarised below, further details alongside the concept design plans are provided in Appendix H.

**Table 12 – Structures Design Options Summary**

| Location | Highways Option | Structures Option | Details |
|---|---|---|---|
| River Witham Overbridge | Single Carriageway | Option 1 | 4 Span – prefabricated weathering steel beams with in-situ concrete deck |
| | | Option 2 | 4 Span – Precast concrete beams with concrete infill |
| | Dual Carriageway | Option 1 | 3-Span - Prefabricated weathering steel beams with in-situ concrete deck |

| Location | Highways Option | Structures Option | Details |
|---|---|---|---|
| | | Option 2 | 3 Span – Precast concrete beams with concrete infill |
| A607 Overbridge* | Single Carriageway | Option 1 | 20m Span - Precast pre-stressed concrete beams with in-situ slab and concrete infill |
| | | Option 2 | 20m Span - Weathering steel beams with in-situ reinforced concrete slab |
| | Dual Carriageway | Option 1 | 41m Single Span - precast pre-stressed concrete beams with in-situ slab and concrete infill |
| | | Option 2 | 41m Single Span - Single span weathering steel I beams with in-situ reinforced concrete slab |
| Station Road Overbridge | Single Carriageway | Option 1 | 23m Span - Precast pre-stressed concrete beams with in-situ slab and concrete infill |
| | | Option 2 | 23m Span - Weathering steel I beams with in-situ reinforced concrete slab. |
| | Dual Carriageway | Option 1 | 47m Span Precast pre-stressed concrete beams with in-situ slab and concrete infill |
| | | Option 2 | 47m Weathering steel I beams with in-situ reinforced concrete slab |

* This option was discounted following the decision to provide an at-grade roundabout junction with the A607

### 8.4.4. NMU Strategy & Options

In addition to the highways and structures options the NMU provision has also been considered. This has included developing a high level strategy, identifying the key concepts to be taken forward to the next stage of design development as well as identifying the primary NMU provision options. As part of the phase of the options development the following was considered:

- The existing rights of way and network;
- The key issues, challenges and opportunities affecting the NMU network within the South Lincoln;
- The wider NMU strategy for Lincoln and the wider area; and
- The key users within the area.

**Existing Network Review**

The existing NMU routes that intersect or cross the proposed alignment of the NHRR are shown in Figure 7. The review identified a number of issues and opportunities, these were as follows:

- There are few east / west NMU routes within the study area and limited orbital rights of way;
- The route of the NHRR crosses a number of north / south rights of way including the Viking Way which is a prominent long distance footpath;
- There is an opportunity to improve the connections between the villages located within the NHRR study area, this includes North Hykeham, South Hykeham, Auborn and Waddington; and
- There is an opportunity to improve access into the open country side from the Lincoln urban area.

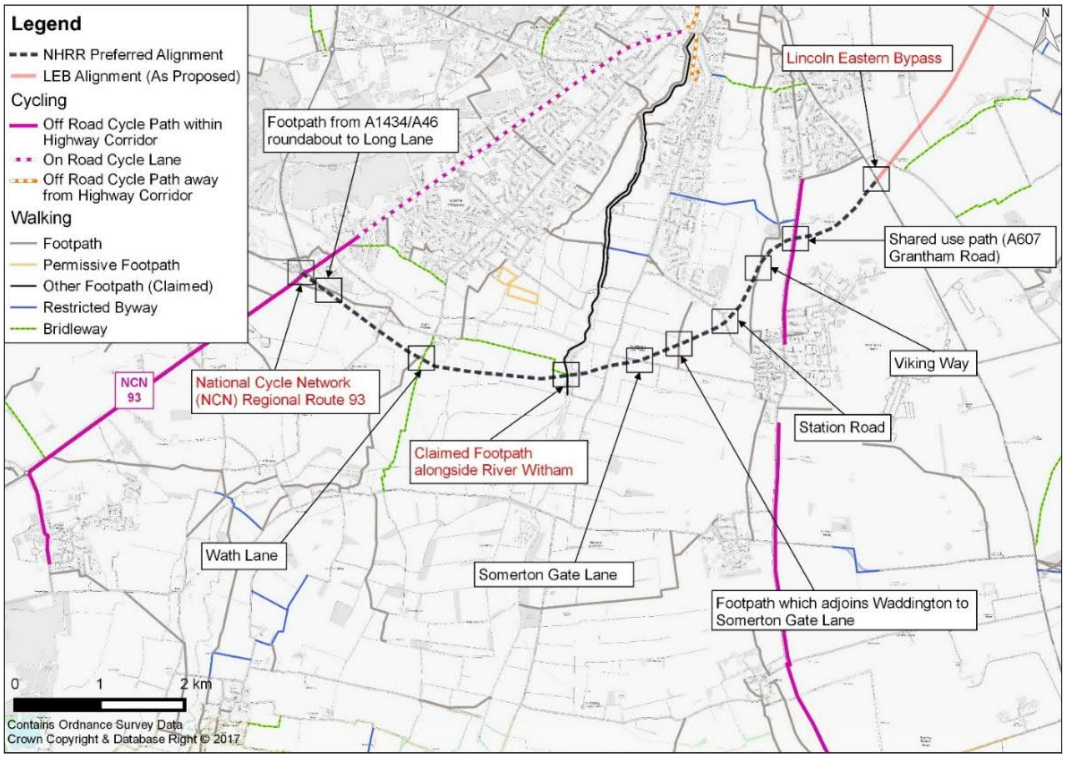



**Figure 7 - PROW Network**

**NMU Provision - Objectives**

The initial review also considered the aspirations and key objectives relating to the provision of new NMU infrastructure as part of the NHRR scheme. The emerging objectives for the NMU provision are summarised below and the NHRR NMU provision should look to:

- Provide high quality NMU infrastructure that maintains and improves connectivity across the PROW network in and to the south of the Lincoln urban area;
- Improve orbital connectivity for NMUs and provide safe green routes in the south of Lincoln;
- Support the delivery of the sustainable urban extensions including the South West and South East Quadrants;
- Support the objectives of the LTP:
  - To improve access to employment and key services by widening travel choices, especially for those without access to a car;
  - Providing sustainable and healthy transport options such as walking, cycling, using public transport, and car sharing;
  - To improve the quality of life and health of residents and visitors by encouraging active travel;
  - Promotion of public transport and other sustainable modes for the journey to work; and
  - To build on the existing transport strategy, policies and plans within the draft Core Strategy and seek to ensure that opportunities for journeys to be made by a range of modes are maximised.

The next stage considered the level and type of provision across the following areas:

- Orbital route provision
- NHRR NMU crossing provision

- Radial route NMU crossings

**Orbital route provision - Options**

The type and level of orbital NMU provision was considered in detail, summarised here and provided in full in Appendix I. Three orbital concepts were considered, these were:

- A shared pedestrian and cycle route;
- A segregated pedestrian and cycle route; and,
- A bridleway route suitable for pedestrians, cyclists, and equestrians.

A full summary of the key considerations, challenges and issues is provided in the Appendix I. This stage resulted in the following being taken forward:

- The provision of a shared pedestrian and cycle route on the north side of the NHRR. This will:
  - Link the A46 on the western side of the scheme to the LEB on eastern side; and
  - Link into the LEB route and be consistent with the LEB design principles.
- The provision of a bridleway on the south side of the NHRR, this will:
  - enhance NMU connectivity across this part of Lincoln and provide a facility that can be used by equestrians; and
  - link into existing PROW network on the southern side of the NHRR and improve access to the open countryside to the south.

**NHRR and Radial Routes Crossing provision – Options**

The locations and types of crossing provision over the NHRR has also been considered. As stated above the NHRR will insect with and cross several existing rights of way and roads, as a result the nature of the crossings, NMU requirements and challenges have been considered. The key options considered included:

- Provision of NMU bridges over the NHRR
- Rights of way diversions
- Stopping up of rights of way
- At grade crossings – controlled and uncontrolled

Appendix I provides full details of the options considered and the following options will be taken forward to the feasibility design stage:

## Table 13 – NHRR Crossing Options

| | Location / Existing Route | Outcome |
|---|---|---|
| 1 | A46 / NHRR Roundabout (NCN93) | NMU Bridge over NHRR |
| 2 | Footpath from A1434/A46 to Long Lane | Divert the footpath to the crossing point adjacent to the A46 roundabout |
| 3 | South Hykeham Road / Long Lane | Divert NMUs to an alternative crossing point. |
| 4 | Bridleway and Footpath from Wath Lane | NMU Bridge over NHRR |
| 5 | Bridleway along Meadow Lane leading to the River Witham | NMU Bridge over NHRR |
| 6 | Claimed footpath along the River Witham | Review status of the claimed footpath. |
| 7 | Brant Road | Divert NMUs to alternative crossing |
| 8 | Somerton Gate Lane | Divert NMUs to alternative crossing |
| 9 | Footpath from Somerton Gate Lane north towards Waddington | The status should be reviewed with PROW officer. |
| 10 | Station Road | Further assessment of the options for the links from the NMU orbital routes and Station Road. |
| 11 | Viking Road (pedestrian) | A short diversion of the route and provision of a footbridge crossing the bypass perpendicularly. |
| 12 | A607 Grantham Road: Off highway shared pedestrian and cycle route | NMU provision to be further assessed once the junction strategy has been refined. |
| 13 | A15 | Further assessment of the most suitable location for the bridge crossing and diversion implications. |

## Table 14 – Radial Route Crossing Options

| Ref | Route | Options |
|---|---|---|
| 1 | A46 / A1434 | There are no existing crossings of the A46 or A1434 at the junction. It is not proposed to add any crossings at this location. |
| 2 | South Hykeham Road / NHRR Roundabout | South Hykeham Road Northern Arm: The orbital cycle/pedestrian route will cross South Hykeham Road and depending on the level of traffic two options may be appropriate:<br>Toucan Crossing: Signalised Crossing for pedestrians and cyclists.<br>Uncontrolled crossing<br>South Hykeham Road Southern Arm: The orbital NMU route will cross South Hykeham Road, if this is to be adopted as a bridleway two options may be appropriate:<br>Toucan Crossing: Signalised Crossing for pedestrians, cyclists and equestrians.<br>Uncontrolled crossing |
| 3 | Brant Road/ Roundabout | Brant Road Northern Arm: The orbital cycle/pedestrian route will cross Brant Road and depending on the level of traffic two options may be appropriate:<br>Toucan Crossing: Signalised Crossing for pedestrians and cyclists.<br>Uncontrolled crossing<br>Brant Road Southern Arm: The orbital NMU route will cross Brant Road, if this is to be adopted as a bridleway two options may be appropriate:<br>Toucan Crossing: Signalised Crossing for pedestrians, cyclists and equestrians.<br>Uncontrolled crossing |
| 4 | Somerton Gate Lane | Somerton Gate Lane will be stopped up become a 'No Through Road' for vehicles.<br>No further crossings required |

| Ref | Route | Options |
|---|---|---|
| 5 | Station Road | Station Road will cross the NHRR via an underbridge. The NMU orbital routes could pass under Station Road alongside the NHRR carriageway or be diverted north and south to Station Road. |
| 6 | A607 Grantham Road | The junction options for the NHRR and A607 are being reviewed as part of the junction strategy. Once this is defined the crossing provision can be determined. |
| 7 | A15 / NHRR | An at grade crossing to be provided on the northern side of the route linking into the LEB NMU route. |

### 8.4.5. Drainage & Landscape Strategy Options

The aspirations, high level objectives and concepts for the landscaping and drainage design have also been considered. These will be subject to further assessment and feasibility design but the process resulted in the following being agreed:

- **Local Policy Objectives:** The landscape design will need to reflect the designated Green Wedge and Great Landscape Value areas which are located along the Lincoln Edge. These are sensitive areas and the landscape design will need to reduce the impact of the scheme at this location and look for opportunities to enhance the landscape in this area;
- **Visual Impact:** The landscaping and planting should be targeted to reduce the visual impact of the scheme at key points along the route. These will be determined through the environmental assessments and development of the landscape strategy;
- **Landscape Integration:** Integrate the design of the NHRR route into the existing environment reflecting the different existing and future landscape character along the route. This will take into account the development of the SWQ, the rural open sections adjacent to the River Witham, the approach to the Lincoln Edge and Waddington;
- **Sustainable Design:** Identify opportunities for new habitat creation and enhancement. There are opportunities to integrate this with the SuDS design;
- **Drainage Design:** The conceptual drainage design will aim to mimic the natural drainage of the greenfield site on which the bypass alignment is proposed. To this end, it will incorporate the principles of Sustainable Drainage Systems (SuDS);
- **Connectivity:** Retain and enhance existing rights of way and support the provision of connections to new communities (SWQ and SEQ);
- **Design Consistency:** Provide a consistent design and approach with the LEB;
- **Future Ready**: Adopt a SuDS approach to help manage flood risk and manage excess volumes during extreme weather events; and
- **Maintenance:** Consider / adopt a low maintenance design.

## 8.5. INDICATIVE OPTION COSTS

The outturn scheme costs have been estimated using the concept designs produced for the options assessment stage and stakeholder and public engagement. The scheme base costs include the construction, statutory undertaker / third part costs, land and design and preparation costs for each option. The risk and inflation allowances have also been calculated to inform the outturn costs.

The risk allowance has informed by the current NHRR risk register and the quantified using the Palisade @RISK analysis software. This performs risk analysis using Monte Carlo simulation and is considered robust and is recommended by DfT.

The initial outturn scheme cost estimates range from £100m for the single carriageway option to £148m for the dual carriageway.

| Cost Element | Single Carriageway | Single Carriageway Future Proofed | Dual Carriageway |
|---|---|---|---|
| Base Cost* | £60,620,560 | £72,168,966 | £91,040,330 |
| Risk Allowance | *£17,900,000* | *£20,324,000* | £25,440,000 |
| Inflation | £21,508,792 | £25,339,031 | £32,043,039 |
| **Total Outturn Cost** | **£100,029,352** | **£117,831,997** | **£148,523,369** |

**Does not include any sunk costs*

## 8.6. CONSULTATION & ENGAGEMENT

Stakeholder and public engagement was undertaken in June 2018 with a focus on the primary options and shorter schemes. The engagement process included a number of events comprising two stakeholder workshops and four public drop-in exhibitions. In parallel to the events a questionnaire was released on the LCC website with hard copies also available at the exhibitions. A full summary report of the engagement exercise, including the results of the questionnaire has been produced to support the OAR and is presented in Appendix N

In total, 1,023 people completed the questionnaire, of which 950 were members of the public, 29 were landowners affected by the scheme, 13 were public sector officers and 10 were representatives of businesses.

The following table presents the overall level of support for the NHRR. Some 73% of respondents strongly supported the scheme and 89% either supported or strongly supported the scheme. Only 8% of respondents opposed or strongly opposed the scheme with 2% either not knowing/having no opinion.

| Level of Support | % |
|---|---|
| Strongly Support | 73 |
| Support | 16 |
| No opinion | 1 |
| Oppose | 2 |
| Strongly Oppose | 6 |
| Don't Know | 1 |

The following table presents the level of support for each of the individual options. Some 87% of respondents preferred a scheme between the A46 and the A15 with 75% of respondents preferring the dual carriageway option. Only 1% of respondents preferred any version of the A46 to South Hykeham Road option with 8% preferring the A46 to Brant Road option.

| Option | % |
|---|---|
| A46 to A15 – Dual carriageway | 75 |
| A46 to A15 – Single carriageway | 3 |
| A46 to A15 – Single Carriageway + Future Proofing | 9 |
| A46 to South Hykeham Road – Dual Carriageway | 1 |
| A46 to South Hykeham Road – Single Carriageway | 0 |
| A46 to Brant Road – Dual Carriageway | 6 |
| A46 to Brant Road – Single Carriageway | 2 |
| None of the above | 5 |

The following table presents how frequently different issues were ranked as the most important in designing the new road. It can be clearly seen that the most important issue was improving congestion, journey times and reliability, with reducing traffic levels on the existing network being a distant second. Maximising the use of technology was also important to respondents while the least important were maximising opportunities for housebuilding, reducing the schemes visual impact and provision for pedestrians, cyclists and equestrians.

| Answer | Frequency of being ranked No.1 |
|---|---|
| Reducing congestion, improving journey times and improving the reliability of journey times | 435 |
| Reducing traffic levels and associated impacts on the existing road network | 188 |
| Maximising the use of technology to improve the efficiency of the new road | 107 |
| Minimising delays for traffic on the new road | 64 |
| Maximising opportunities for economic development | 63 |
| Reducing the environmental impact of the new road | 63 |
| Provision for pedestrians, cyclists and equestrians | 53 |
| Reducing the visual impact of the new road on the landscape | 43 |
| Maximising opportunities for housebuilding | 19 |

## 8.7. GENERATING OPTIONS SUMMARY

The NHRR has been identified as a key scheme through the development of a robust and detailed transport strategy. LITS has been reviewed and updated on two separate occasions since its development ensuring that the strategy remains relevant and current. LITS has provided the basis and framework for tackling the transport challenges and issues for the Lincoln urban area and through this process a number of schemes and interventions have been identified. This includes the NHRR which has been identified as a priority for delivery following completion of LCC's delivery of other LITS schemes.

As part of the development of the NHRR scheme several options and variations have been assessed and considered, this includes:

- **Route corridor:** Three primary corridor options have been considered, assessed in detail and consulted on. The preferred approach provides a link between the A46 and the A15 / LEB Junction.

- **Highways & Junctions:** A number of alternative highways options have been developed, these include single, single + future proofed and dual carriageway options for the whole route. In addition shorter alternatives have been developed, these would provide a link between A46 and South Hykeham Road or Brant Road which could be expanded and extended to complete the full route at a later date.

- **Structures:** In response to the primary highways options single and dual carriageway structures options have also been considered. The options development process resulted in the identification of viable options for the bridge structures.

- **NMU Strategy & Options:** This has included developing a high level strategy, identifying the key concepts to be taken forward to the next stage of design development as well as identifying the primary NMU provision options. The development of the NMU options has considered the existing rights of way and network, the key issues, challenges and opportunities affecting the NMU network within the South Lincoln, the wider NMU strategy for Lincoln and the wider area; and the key users within the area.

# 9. ASSESSMENT & SIFTING OF OPTIONS

## 9.1. OVERVIEW

In order to determine the better performing scheme options, a structured sifting process has been followed. This is closely aligned with 'Step 6: Initial Sifting' and 'Step 7: Development and Assessment of Potential Options' of the DfT's Transport Appraisal Process Guidance (2014).

In line with the guidance three assessment stages have been used:

1. **Initial Sift:** The guidance highlights that an initial shift of options is recommended to identify any significant problems and issues which are likely to prevent an option progressing. Consequently an initial sift against scheme objectives and assessing their deliverability and feasibility has been undertaken. This results in the discounting of options which clearly do not meet these criteria and results in a shorter list of options which can be assessed in further detail.
2. **Early Assessment & Sifting Tool**: In line with 'Step 6: Initial Sifting' of the Transport Appraisal Guidance (2014), the Early Assessment and Sifting Tool (EAST) has been utilised. This was developed by the DfT as a decision support tool to develop, quickly summarise and present evidence on options in a clear manner which is consistent with the DfT's five case transport business structure.
3. **Option Appraisal Framework:** In line with 'Step 7: Development and Assessment of Potential Options' of the Transport Appraisal Guidance (2014), the remaining potential options have been assessed against the Transport Business Case criteria using the Option Assessment Framework. The output of this stage clearly highlights the better performing options which will be taken forward for further appraisal.

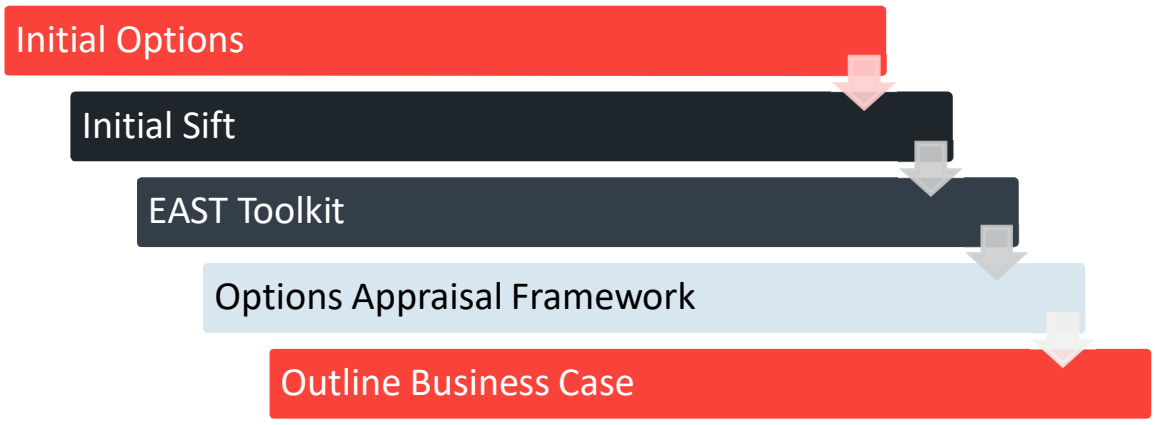



**Figure 1 – Option sifting process**

### 9.1.1. Structure

This section examines the assessment and sifting of options and is structured as follows:

- **Initial sifting;**
- **EAST toolkit; and the**
- **Options Appraisal Framework**

## 9.2. INITIAL SIFT

An initial sifting of options has been undertaken and each option has been considered and scored against categories and criteria detailed in Table 15 below. Full details are provided in Appendix J.

**Table 15 – Initial sifting criteria**

| Category | Criteria |
|---|---|
| Objectives | Specific Objectives: The ability of each option to achieve the following objectives:<br>• To improve east west connectivity in the South of Lincoln for strategic and local traffic;<br>• To reduce traffic levels on local urban and rural roads in the South of Lincoln through the transfer of strategic traffic to appropriate routes;<br>• To reduce NMU severance in South Lincoln caused by high levels of traffic on the local road network and lack of east west connectivity;<br>• To support the delivery of the Sustainable Urban Extensions by improving access to the identified sites;<br>• To support the delivery of the South West quadrant through the provision of additional network capacity and non-motorised user infrastructure necessary for the delivery of new housing;<br>• To reduce traffic levels and congestion around Lincoln and on key routes through the city to support:<br>  • Improved access to central Lincoln;<br>  • The improvement of access to the Humber Ports and Airport; and<br>  • The improvement of access to the Lincolnshire Coast.<br>• To improve the resilience of the orbital and key route network through and around Lincoln and reduce the impact of major incidents. |
| Deliverability | The deliverability of the option was assessed against the following criteria:<br>1. Acceptability:<br>▪ Level of stakeholder/political support for the option under consideration.<br>▪ Level of public support for the option under consideration.<br>▪ Significant environmental impacts resulting from the option under consideration.<br>2. Planning:<br>▪ Is the option acceptable in planning terms and in relation to planning policy<br>▪ Are there any significant impacts that will require mitigation or could result in the scheme being rejected at planning<br>▪ Are there any legal issues/risks?<br>3. Implementation timescales/funding likelihood<br>▪ What are the likely funding sources? Are they time-dependent? Is there likely to be a funding gap?<br>▪ Are there likely to be significant mitigation costs over and above the cost of the option itself?<br>4. Third Party Issues<br>▪ Is Third Party land required? Are there any legal issues e.g. CPO? |
| Feasibility | The feasibility of each option has also considerations used in assessing feasibility include the following:<br>1. Physical constraints: Are there any significant physical or environmental constraints that could have a direct impact on the costs and risks associated with the option under consideration e.g. existing structures (viaducts, bridges, retaining walls etc) or structures required within option design?<br>2. Land ownership / availability: Are there any significant issues relating to land assembly? Will CPO be required?<br>3. Design standards: Is the option under consideration technically possible from an engineering perspective? Is the option under consideration technically appropriate when considering future demand? |

### 9.2.1. Options

The options assessed (See Figure 65) were:

- **Option 1:** This option would provide a single carriageway link between the A46 and the A15.
- **Option 2:** This option would provide a single carriageway link between the A46 and the A15 but would include enlarged junctions.
- **Option 3:** This option would provide a dual carriageway link between the A46 and the A15.
- **Option 4:** This option would provide a single carriageway link between the A46 and South Hykeham Road. This shorter option would support the development of the South West Quadrant.
- **Option 5:** This would provide a dual carriageway link between the A46 and South Hykeham Road and would support the development of the South West Quadrant.
- **Option 6:** This option would provide a single carriageway link between the A46 and Brant Road. This shorter option would support the development of the South West Quadrant and provide traffic relief to South Hykeham.
- **Option 7:** This would provide a dual carriageway link between the A46 and Brant Road and would support the development of the South West Quadrant and provide traffic relief to South Hykeham.

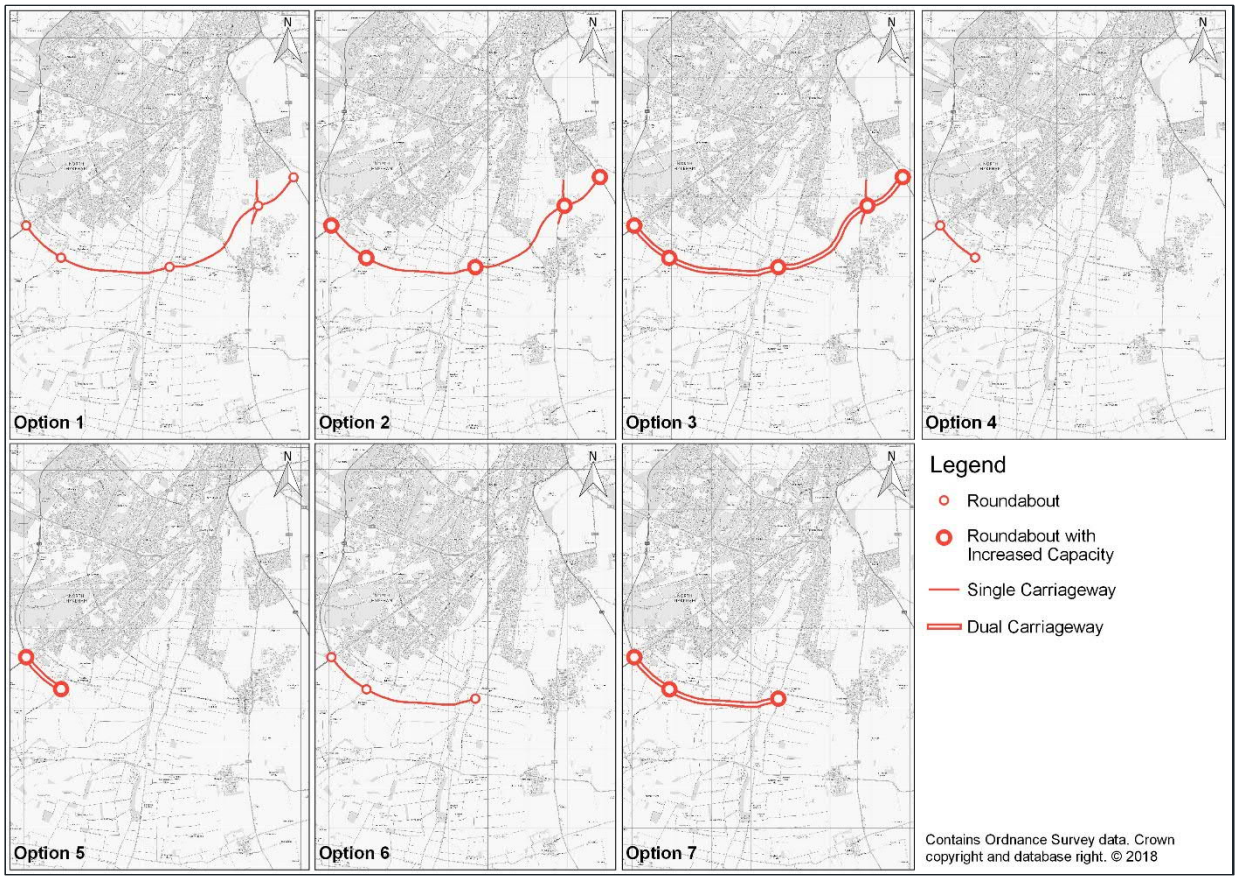



**Figure 2 – Assessed options**

### 9.2.2. Initial Sifting Outcome

The overall sifting result is based on:

| Criteria | Scoring |
|---|---|
| Objectives | ▪ Ranked according to score |
| Deliverability | ▪ Ranked according to score<br>▪ If the option is deemed to be very difficult to deliver for any sub-criteria it will be discounted |
| Feasibility | ▪ Ranked according to score<br>▪ If the option is deemed not feasible or has significant challenges for any sub-criteria it will be discounted |

**Table 16 – Summary of results for initial sifting**

| Option | Objectives score (out of 20) | Ranking based on objectives | Deliverability score (out of 18) | Ranking based on deliverability | Feasibility score (out of 8) | Ranking based on feasibility |
|---|---|---|---|---|---|---|
| **1** | 20 | =1st | 10 | =1st | 8 | =1st |
| **2** | 20 | =1st | 10 | =1st | 8 | =1st |
| **3** | 20 | =1st | 10 | =1st | 8 | =1st |
| 4 | 3 | =6th | 4 | =4th | 4 | =4th |
| **5** | 3 | =6th | 4 | =4th | 4 | =4th |
| **6** | 9 | =4th | 4 | =4th | 4 | =4th |
| **7** | 9 | =4th | 4 | =4th | 4 | =4th |

Table 16 provides a summary of the scoring for each option and their ranking.

Options 4 to 7 score poorly when assessed against scheme objectives. This is due to the options not forming a complete route from the A46 to the A15, which together with the LEB will form a complete orbital route to the east of Lincoln. In the case of options 4 and 5, the carriageway link is between the A46 and South Hykeham Road resulting in only a marginal/neutral impact on a number of objectives. Options 6 and 7 offer a slightly longer alignment from the A46 to Brant Road and is reflected in a slightly higher score. Despite this, options 4 to 7 generally score poorly due to a lack of connectivity when compared to the complete orbital route of options 1 to 3.

Furthermore, options 4 to 7 have been deemed very difficult to deliver in terms of level of stakeholder/political support. This is because the NHRR has been a long term aspiration within the LITS and so delivering only a section of the intended scheme is deemed not acceptable both politically and to stakeholders. As a result, options 4 to 7 have been discounted at this stage regardless of the scores they achieved.

Options 4 to 7 are also very difficult to deliver when assessed against being technically appropriate when considering the future demand on the network. Amongst other issues, they do not provide an

alternative strategic route to the existing A46 orbital route resulting in existing problems on this route being exacerbated in the future.

In summary options 4 to 7 have been discounted at this stage due to:

- Scoring poorly against scheme objectives;
- Not deemed deliverable on the ground that it does not align with long term policy aspirations of a bypass to the south of Lincoln as stated within the LITS; and
- Not deemed feasible as the options are not technically appropriate when considering future demand.

**The options which will progress to the EAST assessment are:**
**Option 1: This option would provide a single carriageway link between the A46 and the A15;**

**Option 2: This option would provide a single carriageway link between the A46 and the A15 but would include enlarged junctions; and**

**Option 3: This option would provide a dual carriageway link between the A46 and the A15.**

## 9.3. EAST ASSESSMENT

EAST is a tool that has been developed to summarise the present evidence on options in a clear and consistent format. This consistent approach supports decision making and aids comparison of how different interventions perform against a wide range of metrics. The EAST is designed to be consistent with the DfT's five case business case structure and considers the impact of the scheme under the following business case headings:

- Strategic;
- Economic;
- Managerial;
- Financial; and
- Commercial.

The EAST adopted Methodology can be found in Appendix K.

## 9.4. EAST RESULTS

The following section provides a summary of the EAST assessment, full details are presented in Appendix K.

### 9.4.1. Strategic Case

**Scale of Impact:** the scale of impact has been assessed based on how each option scored against the specific scheme objectives as detailed in Table 30.

All three options are expected to meet the defined objectives, however when compared to the single carriageway and future-proofed options the dual carriageway option is forecast to have a greater impact on traffic relief of the existing network. As a result it will better support the NHRR objectives.

**Fit with wider transport and government objectives and other objectives:** in accordance with guidance this metric was assessed against how well the options complement pre-existing strategies

and proposals. In this instance this included support to the major national strategies such as the Transport Investment Strategy, Road Investment Strategy and National Infrastructure Delivery Plan, the key regional and local strategies including the Greater Lincolnshire SEP, CLLP and delivery of the SWQ, LITS, Local Transport Plan and North Hykeham Local Plan. It also looked at the relationship with the delivery of existing proposals including the LEB

All options would support the key strategies and existing proposals. However, the dual carriageway option is forecast to provide a greater level of relief to the orbital road network on the western side of Lincoln and the local road network in the south of the city when compared to the single carriageway and future proofed options. As a result it will likely better support strategies, schemes and local objectives outlined in the Options Assessment Report through improving access to central Lincoln and strategic connectivity, improving the efficiency of the transport network and supporting the delivery of the SWQ.

**Key uncertainties:** a qualitative assessment has considered the key uncertainties with development of an intervention. It is anticipated that these are equally applicable to all options:

- Funding availability – funding has yet to be identified and secured
- Design – the design is at a concept design stage
- Dependant development – the level of dependant development has yet to be assessed
- Third party land – third party land will be required. If this is not purchased through negotiation a CPO will be required.

**Degree of consensus over outcomes:** The NHRR has been a long term aspiration for the County Council and the concept of a new east west link forms part of a number of strategies including the adopted CLLP and the LITS. The development of the scheme has been informed by stakeholder and public engagement most recently in 2018. The 2018 engagement resulted in the dual carriageway being identified as the preferred approach when compared to the single carriageway and futureproofed options.

### 9.4.2. Economic Case

**Economic Growth:** The assessment identified the following:

- **Connectivity:** Each option will improve east west connectivity across Lincoln with the largest journey time savings being for east west and northeast / southwest journeys. Each option will also increase the average speed on the network with the dual carriageway providing the biggest change. This is reflected in the Transport User Benefits Assessment (TUBA) where the dual carriageway will provide the largest benefits (£307m).
- **Reliability:** Each option will improve the variability of journey times on the existing orbital, radial and local road network and lead to a reduction in traffic on the A46, A1434 and on a number of local roads in North Hykeham (including Moor Lane, Mill Lane and Meadow Lane).The provision of the dual carriageway option is forecast to result in the largest decreases in traffic on these routes.
- **Resilience:** All three options will improve the resilience of the transport network through the expansion of the orbital network and increase in capacity.
- **Deliver of housing**: All three options will facilitate the delivery of new housing and will support the development of the SWQ.

**Carbon emissions**: Appendix K sets out the factors and scores for all three options for the carbon emissions assessment. The improvements in journey times and reduction in congestion will result in a reduction in greenhouse gas emissions. This is forecast to be marginally greater for the dual carriageway option.

**Socio-distributional impacts and the regions**: Appendix K sets out the factors and scores for all three options for the socio-distribution impacts and the region assessment. All three options will improve accessibility by providing additional east west connectivity to the south of Lincoln, reduce severance caused by the high levels of traffic and result in improvements in air quality and noise in existing urban areas. However, the dual carriageway scheme would be expected to have a marginally bigger impact on these areas due to additional traffic relief that it will provide.
This provides benefits for:

- Local residents particularly those living in villages to the south of Lincoln and North Hykeham;
- Strategic traffic which currently use radial routes through the city centre;
- Businesses within the city centre through improved access due to a reduction in traffic on the radial routes; and
- Strategic traffic wishing to access the Humber ports.

**Local environment:** Appendix K sets out the factors and scores for all three options for the local environment assessment. All three options will result in the construction of a new carriageway through a predominantly rural area which will affect the natural environment. Due to the scale of the dual carriageway option it would be expected to have a bigger impact than both the single carriageway and future proofed options. However, the dual carriageway would also be expected to have more of an impact on air quality and noise in existing urban areas due to the higher level of traffic relief forecast to result from this option.

**Well-being:** Appendix K sets out the factors and scores for all three options for the well-being assessment. Overall the RAG score was assessed as amber / green for all three options. Key points include:

- Severance will be reduced by providing an east west link to the south of Lincoln and the reduction of traffic on local routes in the south of Lincoln;
- NMU infrastructure provided as part of the development of the route, this will link into existing rights of way, increase the NMU infrastructure in the south of Lincoln and improve the accessibility of existing and new communities for non-vehicular modes. ;
- Stats 19 data shows that there are higher than average levels of KSI on several sections of the A15 and A57 and the number of accidents/rate per billion vehicle miles is significantly higher than the national average on sections on the A57, A15 and A46.The reduction in traffic on these routes as a result of the scheme is likely to lead to accident benefits; and
- The scheme will improve accessibility to services by providing an additional route in the south of Lincoln and reducing congestion on the existing network.

**Expected VfM Category:** The assessment of TUBA benefits shows that they are forecast to range from £272m for the single carriageway to £308m for the dual carriageway. The Present Value of Costs are expected to range from £82m for the single carriageway up to £112m for the dual carriageway option. This places each option in the high value for money category.

| Transport User Benefits (TUBA) | Single Carriageway | Single Carriageway + Future Proofing | Dual Carriageway |
|---|---|---|---|
| Benefits | £272,200,000 | £272,363,000 | £307,500,000 |

### 9.4.3. Management Case

**Implementation Timetable:** Implementation of all three schemes have been assessed to be between 5 -10 years.

**Public acceptability:** . As set out above the NHRR has been a long term aspiration for the County Council and the concept of a new east west link forms part of a number of strategies including the adopted CLLP and the LITS. The development of the scheme has been informed by stakeholder and public engagement, this includes the route selection process (which was consulted on in 2006) and the highways concept designs which formed the basis of the most recent consultation (June 2018). The 2018 engagement resulted in the dual carriageway being identified as the preferred approach when compared to the single carriageway and futureproofed options

**Practical feasibility**: A score of 4 out of 5 for all three options was given. All three options have been subject to a robust concept and feasibility design process and all are considered feasible. All options will require planning permission, land acquisition and detailed design and a risk management strategy has been established and the key risks identified.

**What is the quality of the supporting evidence?** The NHRR has been developed over a long period of time and has been subject to a significant level of feasibility assessment and design. The scheme forms part of the LITS and is part of the adopted CLLP, the initial route options were assessed and developed in 2006 and subject to stakeholder and public engagement. The highways design options are the subject of the latest options assessment process and were the subject of the 2018 public and stakeholder engagement.

**Key risks:** The NHRR risk register has been established and the key risks assessed and quantified. The key risks for each option relates to unforeseen archaeological finds, developer contributions not being agreed and 3rd party property interests cannot be secured by negotiation

### 9.4.4. Financial Case

**Affordability:** The score rating given for all three options for this metrics was ‘don’t know’. This is because the funding sources are yet to be fully scoped out and identified. However, it is anticipated to be a mixture of central and local government as well as private sector.

**Capital Cost:** Regardless of which option is chosen, all three options have been estimated to cost in the region of £100 - 250 million each.

**Revenue cost**: The score rating given for all three options for this metrics was 0 to 5 £m. This is the estimated maintenance cost over 60 years.

**Cost profile:** The cost profile of the scheme has yet to be determined. However each option will be expected to result in a similar profile.

**Overall cost risk:** Each option has been subject to a robust cost assessment exercise based on the concept designs and inflation and risk has been assessed, quantified and incorporated into the outturn cost estimates – as appropriate for this stage of the design. The cost risk has been rated as a 3 out of 5 for the single carriageway and future proofed options and the dual carriageway is judged to represent a slightly higher cost risk rating due to its scale and the increased base costs. The quantification of key risks has been informed by the lessons learnt from the construction of the LEB. In particular an appropriate level of risk has been attached to the archaeological works given the issues encountered with the LEB.

**Other costs:** As stated above there is a chance of unforeseen archaeological finds which has the potential to significantly increase cost. It is anticipated a preliminary excavation will reduce this risk.

### 9.4.5. Commercial Case

**Flexibility of Option:** All three options scored 2 out of 5. This is because the alignment of all options have been determined. However due to the proposals being in concept design stage there remains some flexibility on other aspects including, but not limited to, junction design / location, NMU and SUDs provision.

**Where is funding coming from?** This metric requires a qualitative statement and regardless for which option is chosen funding has yet to be identified but it is anticipated that it will be a mixture of central government, local government and private sector.

**Any income generation?** This was assessed as 'no' for all three options.

### 9.4.6. Outcome

The EAST Assessment identifies the dual carriageway as marginally being the best performing option in relation to the objectives and overall impact. In the main this is due to the level of traffic relief that is expected to result from its implementation. However, each option is likely to deliver a high BCR. All three options shall progress to the Options Assessment Framework (OAF) sifting stage. It is anticipated that the greater in-depth analysis within the OAF will help to further differentiate between the three options. Table 17 provides a comparative summary of the EAST assessment.

Table 17 – EAST Summary

| Option | | Strategic | | | Economic | | | | | | Management | | | | Financial | | | | | Commercial | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name /No. | Desc. | Scale of impact | Fit with wider transport and government objectives | Degree of consensus over outcomes? | Economic Growth | Carbon emissions | Socio-distributional impacts and the regions | Local environment | Well being | Expected VfM Category | Implementation timetable | Public acceptability | Practical feasibility | What is the quality of the supporting evidence? | Affordability | Capital Cost (£m)? | Revenue Costs (£m)? | Cost Profile | Overall cost risk | Flexibility of option | Where is funding coming from? | Any income generated? (Y/N) |
| Option 1 | Single carriage. | 4 | 4 | 4 | 4. Amber /green | 3. Amber | 4. Amber /green | 4. Amber /green | 4. Amber /green | 2. High 2-4 | 6. 5-10 years | 4 | 4 | 5. High | Don't know | 07. 100-250 | 02. 0-5 | Yet to be determined | 3 | 2 | Mixture of central government, local government and private sector. | No |
| Option 2 | Single Carriageway + Future Proofing | 4 | 4 | 4 | 4. Amber /green | 3. Amber | 4. Amber /green | 4. Amber /green | 4. Amber /green | 2. High 2-4 | 6. 5-10 years | 4 | 4 | 5. High | Don't know | 07. 100-250 | 02. 0-5 | Yet to be determined | 3 | 2 | Mixture of central government, local government and private sector. | No |
| Option 3 | Dual carriageway. | 5. | 5. High | 4 | 5. Green | 4. Amber /green | 5. Green | 3. Amber | 4. Amber /green | 2. High 2-4 | 6. 5-10 years | 5. High | 4 | 5. High | Don't know | 07. 100-250 | 02. 0-5 | Yet to be determined | 2 | 2 | Mixture of central government, local government and private sector. | No |

## 9.5. TRAFFIC IMPACT ASSESSMENT SUMMARY

The traffic and economic assessment of the NHRR has been undertaken using the GLTM, first developed in 2006 and updated in 2018. This strategic multi-modal model covers the entirety of Greater Lincoln.Seven different highways intervention options have been considered for testing ('Do Something' scenarios), in addition to a reference 'Do Minimum' case, which only includes the existing highway network and any committed infrastructure schemes. These options are :

**Alignment 1:** full NHRR link between the A46 and the LEB, creating a contiguous orbital route around the city. The 3 infrastructure options are:

- **Do Something Option 1:** Single carriageway (whole route);
- **Do Something Option 2:** Single carriageway + junction capacity upgrades (whole route);
- **Do Something Option 3**: Dual carriageway (whole route);

**Alignment 2:** link between the A46 and South Hykeham Road. While this link would support the development of the South West Quadrant SUE, the route would not connect to the LEB, and therefore leave a gap in a potential orbital route. The two infrastructure options are:

- **Do Something Option 4:** Single carriageway (A46 to South Hykeham Road);
- **Do Something Option 5:** Dual carriageway (A46 to South Hykeham Road);

**Alignment 3:** links the A46 with Brant Road; this option would enable the development of the South West Quadrant SUE, and should create highway capacity in South Hykeham. The two infrastructure options are:

- **Do Something Option 6:** Single carriageway (A46 to Brant Road;)
- **Do Something Option 7:** Dual carriageway (A46 to Brant Road).

The modelling outputs were analysed in order to consider which option offered the most significant benefits to the overall highway network, as well as identify any potential associated operational issues.A full analysis of the results for all options (A is available in *Tech Note 006: Traffic Impact Assessment (WSP, 2018)* in Appendix L. Following on from the EAST assessment below is a summary of the key points and impacts relating to the single, single plus future proofing and dual carriageway options.

### 9.5.1. Traffic Impact Summary

***Design standards***

The NHRR Annual Average Daily Traffic (AADT) flows are summarised in the table below. They show that:

- Traffic flows for the single carriageway option are forecast to range from approximately 22,000 to 25,000 in the opening year (2026) and 24,500 to 27,000 in 2036;
- Traffic flows along the Future Proofed option are similar to the standard single carriageway in both the opening and future years; and
- Traffic flows on the dual carriageway option are forecast to range from 27,000 to 29,000 in the opening year and 30,000 to 32,000 in 2036.

**Table 18 – Opening and 2036 traffic flow ranges**

| Section | Direction | Actual Flows | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2026 AADT | | | 2036 AADT | | |
| | | Single | Single + FP | Dual | Single | Single + FP | Dual |
| Section 1 - Pennell's Roundabout to South Hykeham Road | 2-Way | 25,000 | 25,000 | 29,000 | 27,000 | 27,000 | 31,000 |
| Section 2 - South Hykeham Road to Brant Road | 2-Way | 23,000 | 23,000 | 27,000 | 26,000 | 26,000 | 31,000 |
| Section 3 - Brant Road to A607 Grantham Road | 2-Way | 23,000 | 23,000 | 28,000 | 25,000 | 25,000 | 32,000 |
| Section 4 A607 Grantham Road to A15 / LEB | 2-Way | 22,000 | 23,000 | 27,000 | 24,000 | 25,000 | 30,000 |

The above opening year flows have been compared to the appropriate recommended standards for highway links set out in Design Manual for Roads & Bridges (DMRB) guidance note TA 46/97 - Assessment of Road Schemes Traffic Flow Range (Table 19**Error! Reference source not found.**). It shows that they are consistent with those acceptable for a dual 2 lane all-purpose carriageway.

**Table 19 – Opening years traffic flows**

| Carriageway Standard* | Opening Year AADT | |
|---|---|---|
| | Minimum | Maximum |
| Single 7.3m (S2) | 13,000 | |
| Wide Single 10m (WS2) | 6,000 | 21,000 |
| Dual 2 Lane All Purpose (D2AP) | 11,000 | 39,000 |
| Dual 3 Lane All Purpose (D3AP) | 23,000 | 54,000 |
| Dual 2 Lane Motorway (D2M) | Up to 41,000 | |
| Dual 3 Lane Motorway (D3M) | 25,000 | 67,000 |
| Dual 4 Lane Motorway (D4M) | 52,000 | 90,000 |

**DMRB Volume 5 Section 1 TA 46/97 Assessment of Road Schemes Traffic Flow Ranges for Use in the Assessment of New Rural Roads*

### *Option Performance*

The tables below set out the journey times and average speeds of each option during the modelled AM and PM peak periods in both 2026 and 2036. These show that:

- The journey times along the dual carriageway option are over a minute quicker than the single carriageway and future proofed options in the peak periods both in 2026 and 2036; and
- The average speeds are also forecast to be significantly quicker (approximately 10mph) in the dual carriageway option.

**Table 20 - AM Peak Period Transit Times and Average Speed**

| AM | Route Transit Times (mm:ss) | | | | | | Average Speed (mph) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2026 | | | 2036 | | | 2026 | | | 2036 | | |
| | Single | FP | Dual | Single | FP | Dual | Single | FP | Dual | Single | FP | Dual |
| EB | 06:33 | 06:29 | 05:28 | 06:47 | 06:40 | 05:32 | 45.5 | 45.9 | 54.5 | 43.9 | 44.7 | 53.8 |
| WB | 06:38 | 06:36 | 05:27 | 06:44 | 06:40 | 05:28 | 44.9 | 45.2 | 54.7 | 44.2 | 44.7 | 54.5 |

**Table 21 - PM Peak Period Transit Times and Average Speed**

| PM | Route Transit Times (mm:ss) | | | | | | Average Speed (mph) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2026 | | | 2036 | | | 2026 | | | 2036 | | |
| | Single | FP | Dual | Single | FP | Dual | Single | FP | Dual | Single | FP | Dual |
| EB | 06:31 | 06:29 | 05:26 | 06:47 | 06:43 | 05:29 | 45.7 | 45.9 | 54.9 | 43.9 | 44.4 | 54.3 |
| WB | 06:35 | 06:29 | 05:28 | 06:40 | 06:34 | 05:29 | 45.3 | 46.0 | 54.5 | 44.7 | 45.3 | 54.4 |

The following table presents a Congestion Reference Flow (CRF) analysis for the links on the NHRR for both the single carriageway options and the dual carriageway option, for both 2026 and 2036. The table shows that for both carriageway standards, in both modelled years, the links of the NHRR will be operating below the level (the CRF) at which congestion will start to occur.

**Table 22 – Congestion Reference Flow Analysis**

| Carriageway Standard | Year | Section 1 | Section 2 | Section 3 | Section 4 |
|---|---|---|---|---|---|
| | | A46 to South Hykeham Road | South Hykeham Road to Brant Road | Brant Road to Grantham Road | Grantham Road to A15 |
| Single | 2026 | 73% | 64% | 64% | 62% |
| | 2036 | 79% | 71% | 67% | 66% |
| Dual | 2026 | 28% | 25% | 28% | 25% |
| | 2036 | 31% | 28% | 30% | 25% |

However, there are some significant caveats to this analysis:

- Junctions usually start to become congested before the highway links, therefore, if built to single carriageway standard, the junctions may start to operate close to capacity in 2036.
- The design year for the scheme will be 2041 and with further development and background growth the AADT will be closer to the CRF than in 2036.
- The South West Quadrant development has not been included in the modelling as it is to be part of the wider economic 'dependent development' test. This development is likely to increase AADT by up to 7% by 2036 on Section 1 with smaller increases in the other sections. This will increase overall AADT closer to the capacity of Section 1 by 2036.

- Whilst the modelling has taken account of the allocations up to the end of the plan period in 2036, not all currently planned development will be delivered by that year. For example, the South East Quadrant is programmed to deliver 3,500 new homes by the end of the plan period with a further 2,500 homes to be delivered in later years. It is therefore foreseeable that the NHRR will need to cater for higher levels of development than currently modelled and the road will be getting closer to capacity with these further developments included.

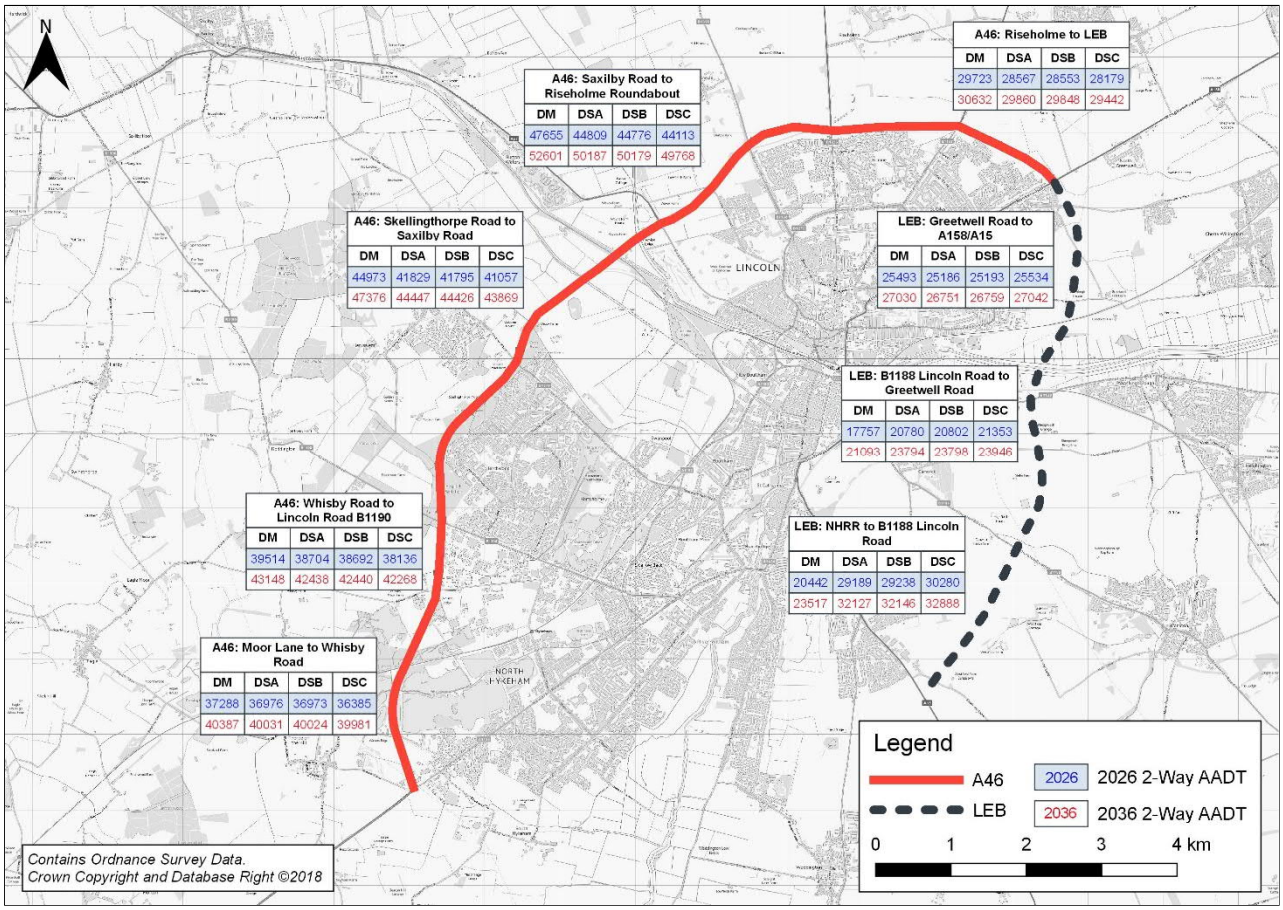
All of the above caveats indicate that the single carriageway links, particularly at the western end of the NHRR, may operate close to capacity by the end of the plan period or at the design year whilst the dual carriageway option should remain well within capacity.

***Strategic Road Network***

The impact of each of the NHRR options on the strategic and major road network has been assessed. Appendix L provides further information regarding the impact across a number of screenlines and the following plan shows the forecast traffic flows on the existing orbital route and the LEB with the NHRR in place. This shows:

- The dual carriageway option is forecast to provide the greatest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road on the sections between Skellingthorpe Road and Riseholme Road.
- The dual carriageway option is also forecast to result in more traffic reassigning to use the eastern bypass with the southern section to the B1188 Lincoln Road expected to see the most significant increases.

**Figure 3 - Forecast AADT on A46 & LEB in 2026 & 2036***




**DSA – Single Carriageway, DSB – Single Carriageway + Future Proofing, DSC – Dual Carriageway*

The following table presents the relative change in traffic flows on key strategic links across the three modelled time periods in 2036. The table again shows that the dual carriageway provides the greatest traffic relief to the A46 but diverts more traffic onto the eastern bypass. However, overall, the impact of NHRR is significantly higher in the inter-peak period, which covers the hours between 10am to 4pm.

**Table 23 – Percentage Difference in Two-way Peak Hour Flow 2036**

| | AM Peak | | | Inter-Peak | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|---|
| | Single | Single + FP | Dual | Single | Single + FP | Dual | Single | Single + FP | Dual |
| A46: Moor Lane to Whisby Road | 1.6% | 1.6% | 2.1% | -2.5% | -2.5% | -2.2% | -0.3% | -0.4% | -1.9% |
| A46: Whisby Road to Lincoln Road B1190 | 0.2% | 0.2% | -0.3% | -4.1% | -4.1% | -4.0% | 1.1% | 1.0% | -0.2% |
| A46: Lincoln B1190 to Skellingthorpe Road | -3.5% | -3.6% | -4.9% | -9.8% | -9.9% | -11.3% | -3.2% | -3.2% | -4.3% |
| A46: Skellingthorpe Road to Saxilby Road | -3.8% | -3.9% | -5.0% | -9.0% | -9.0% | -10.2% | -3.3% | -3.4% | -4.6% |
| A46: Saxilby Road to Riseholme | -2.3% | -2.3% | -3.0% | -7.2% | -7.2% | -8.2% | -2.0% | -2.0% | -2.6% |
| A46: Riseholme to LEB | -2.7% | -2.7% | -3.6% | -3.6% | -3.6% | -5.1% | -0.4% | -0.4% | -2.0% |
| LEB: Greetwell Road to A158/A15 | 0.0% | 0.0% | 1.0% | -1.4% | -1.4% | -0.6% | -1.5% | -1.3% | 0.3% |
| LEB: B1188 Lincoln Road to Greetwell Road | 13.2% | 13.2% | 14.6% | 15.9% | 15.9% | 17.7% | 7.1% | 7.1% | 5.2% |
| LEB: NHRR to B1188 Lincoln Road | 35.5% | 35.7% | 37.7% | 37.7% | 37.8% | 41.7% | 35.7% | 35.6% | 38.5% |

### *Local Road Network*

In addition to the impact on the strategic road network the impact on the local road network has also been assessed. The tables below show the impact across an east west screen line (Table 39) which captures the impact through the centre of Lincoln and a southwest screenline (

Table **25**) which captures the changes across routes in the south west of the city. The corresponding plans are provided in Appendix L and show:

Key points from the assessment include:

- All three options will provide significant traffic relief across a number of routes both within central Lincoln and in the south of the city;
- It demonstrates that the NHRR scheme is expected to result in an improvement in conditions across a wide area and along several routes. It shows that, unlike the eastern bypass which is primarily expected to lead to an improvement conditions in central Lincoln, the NHRR is not limited to resolving a single issue. Instead the benefits can be seen across a wider area and it helps to deal with a number of challenges – including east west connectivity, increasing network

capacity to support growth, improving network resilience as well as dealing with localised congestion and rat running;

- The greatest level of relief is seen in the south of the city through the Hykeham area and along the rural routes to the south of Lincoln;
- The dual carriageway option provides the greatest level of relief although for many routes this is a marginal difference.

**Table 39 - Traffic flow changes East West Screen Line 2026 Opening Year & 2036**

| Location | Direction | 2026 | | | | 2036 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | DM AADT | Traffic Flow Change | | | DM AADT | Traffic Flow Change | | |
| | | | Single | Single + FP | Dual | | Single | Single + FP | Dual |
| A46 | 2-Way | 42,159 | -2,207 | -2,230 | -2,669 | 45,673 | -1,894 | -1,885 | -2,278 |
| | | | (-5.2%) | (-5.3%) | (-6.3%) | | (-4.1%) | (-4.1%) | (-5.0%) |
| Longdales Road | 2-Way | 20,795 | -619 | -615 | -771 | 21,327 | -521 | -523 | -656 |
| | | | (-3.0%) | (-3.0%) | (-6.3%) | | (-2.4%) | (-2.4%) | (-3.0%) |
| B1308 West Parade | One-Way | 5,923 | -188 | -184 | -222 | 6,117 | -129 | -123 | -171 |
| | | | (-3.2%) | (-3.1%) | (-3.8%) | | (-2.1%) | (-2.0%) | (-2.8%) |
| Mint Street | One-way | 5,732 | -103 | -106 | -155 | 6,023 | -65 | -67 | -144 |
| | | | (-1.8%) | (-1.8%) | (-2.7%) | | (-1.1%) | (-1.1%) | (-2.4%) |
| St.Marks Street | 2-Way | 13,181 | -874 | -883 | -1,013 | 15,227 | -674 | -720 | -899 |
| | | | (-6.6%) | (-6.7%) | (-7.7%) | | (-4.4%) | (-4.7%) | (-5.9%) |
| Boultham Avenue | 2-Way | 2,321 | -707 | -726 | -792 | 3,050 | -810 | -981 | -1,259 |
| | | | (-30.5%) | (-31.3%) | (-34.1%) | | (-26.6%) | (-32.2%) | (-41.3%) |
| Dixon Street | 2-Way | 13,545 | -80 | -48 | -150 | 13,569 | -112 | 113 | 301 |
| | | | (-0.6%) | (-0.4%) | (-1.1%) | | (-0.8) | (0.8) | (2.2%) |
| Newark Road | 2-Way | 31,244 | -3,530 | -3,560 | -4,102 | 32,489 | -3,408 | -3,466 | -4,026 |
| | | | (-11.3%) | (-11.4%) | (-13.1%) | | (-10.5%) | (-10.7%) | (-12.4%) |
| Meadow Lane | 2-Way | 9,940 | -1,638 | -1,635 | -1,755 | 11,761 | -1,997 | -1,986 | -2,185 |
| | | | (-16.5%) | (-16.5%) | (-17.7%) | | (-17.0%) | (-16.9%) | (-18.6%) |
| NHRR | 2-Way | | 22,864 | 22,981 | 27,187 | - | 25,936 | 26,084 | 31,125 |
| Blackmoor Road | 2-Way | 7,257 | -5,130 | -5,130 | -5,575 | 8,50 | -6,409 | -6,405 | -6,903 |
| | | | (-70.7%) | (-70.7%) | (-76.8%) | | (-75.4%) | (-75.3%) | (-81.2%) |
| Navenby Lane | 2-Way | 1,528 | -309 | -312 | -413 | 1,178 | -228 | -227 | -260 |
| | | | (-20.2%) | (-20.4%) | (-27.0%) | | (-19.3%) | (-19.2%) | (-22.1%) |
| Broughton Lane | 2-Way | 1,338 | -274 | -273 | -399 | 2,310 | -520 | -521 | -947 |
| | | | (-20.5%) | (-20.4%) | (-29.8%) | | (-22.5%) | (-22.6%) | (-41.0%) |

**Table 25 - Traffic flow changes Southwest Screen Line 2026 Opening Year & 2036**

| Location | Direction | 2026 | | | | 2036 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | DM (AADT) | Traffic Flow Change | | | DM (AADT) | Traffic Flow Change | | |
| | | | Single | Single + FP | Dual | | Single | Single + FP | Dual |
| Thorpe Road | 2-Way | 1,123 | -409 | -418 | -211 | 1,364 | -188 | -191 | -176 |
| | | | (-36.4%) | (-37.3%) | (-18.7%) | | (-13.7%) | (-14.0%) | (-12.9%) |
| A46 (between Pennell's Rdbt and Whisby Road) | 2-Way | 37,288 | -312 | -315 | -903 | 40,386 | -355 | -362 | -405 |
| | | | (-0.8%) | (-0.8%) | (-2.4%) | | (-0.9%) | (-0.9%) | (-1.0%) |
| Station Road, North Hykeham | 2-Way | 14,898 | -1,318 | -1,322 | -1,412 | 15,857 | -1,425 | -1,415 | -1,518 |
| | | | (-8.8%) | (-8.9%) | (-9.5%) | | (-9.0%) | (-8.9%) | (-9.6%) |
| A1434 Newark Road | 2-Way | 17,007 | -1,892 | -1,901 | -2,150 | 17,291 | -1,812 | -1,869 | -2,170 |
| | | | (-11.1%) | (-11.2%) | (-12.6%) | | (-10.5%) | (-10.8%) | (-12.6%) |
| Lincoln Road | 2-Way | 10,446 | -1,128 | -1,131 | -1,264 | 10,770 | -1,149 | -1,164 | -1,262 |
| | | | (-10.8%) | (-10.8%) | (-12.1%) | | (-10.7%) | (-10.8%) | (-11.7%) |
| Meadow Lane | 2-Way | 9,940 | -1,638 | -1,635 | -1,755 | 11,761 | -1,997 | -1,986 | -2,185 |
| | | | (-16.5%) | (-16.5%) | (-17.7%) | | (-17.0%) | (-16.9%) | (-18.6%) |
| Brant Road (approach to NHRR) | 2-Way | 7,469 | 2,822 | 2,831 | 3,305 | 8,669 | 2,856 | 2,902 | 3,386 |
| | | | 37.8% | 37.9% | 44.3% | | 32.9% | 33.5% | 39.1% |
| Station Road, Waddington | 2-Way | 11,014 | -1,948 | -1,955 | -2,419 | 11,889 | -1,848 | -1,884 | -2,132 |
| | | | (-17.7%) | (-17.8%) | (-22.0%) | | (-15.5%) | (-15.8%) | (-17.9%) |
| A607 Grantham Road | 2-Way | 16,082 | -3,546 | -3,510 | -2,794 | 17,468 | -4,096 | -4,035 | -3,557 |
| | | | (-22.0) | (-21.8) | (-17.4) | | (-23.4) | (-23.1) | (-20.4) |
| Sleaford Road (formerly A15) | 2-Way | 12,398 | -2,195 | -2,204 | -2,468 | 15,006 | -2,913 | -2,930 | -4,279 |
| | | | (-17.7) | (-17.8) | (-19.9) | | (-19.4) | (-19.5) | (-28.5) |
| A15 LEB | 2-Way | 20,442 | 8,747 | 8,795 | 9,838 | 23,517 | 8,610 | 8,629 | 9,371 |
| | | | 42.8 | 43.0 | 48.1 | | 36.6 | 36.7 | 39.8 |

### 9.5.2. Summary

The key points from the traffic impact assessment are as follows:

**Single Carriageway**

- The single carriageway option will deliver the scheme objectives. It will improve the east west connectivity in the south of Lincoln, help to reduce traffic levels on local urban and rural roads, support the delivery of the Sustainable Urban Extensions and help improve the resilience of the orbital and key route network through and around Lincoln;
- It will provide significant traffic relief across a number of local routes both within central Lincoln and in the south of the city;
- However, the forecast flows on the single carriageway exceed the opening year flow range for a single carriageway as defined by DMRB; and

- This identifies that a dual carriageway standard is likely to be more economically and operationally acceptable. Congestion Reference Flow analysis also indicates that some sections of a single carriageway scheme may be operating close to capacity at the end of the plan period in 2036 or at the design year in 2041.

**Single Carriageway + Future Proofing**

- The single carriageway with future proofing option is expected to have a similar level of performance to the standard single carriageway and it will deliver the scheme objectives;
- It will provide similar level of traffic relief to the standard single carriageway across a number of local routes both within central Lincoln and in the south of the city; and
- The forecast flows on the scheme are again similar to single carriageway and exceed the opening year flow range for a single carriageway as defined by DMRB.

**Dual Carriageway**

- All three carriageway standard options of the full route deliver the scheme objectives, however, due the greater capacity of the dual carriageway option, it is likely to do so more robustly;
- An analysis of opening year daily traffic flows compared to DMRB guidance for carriageway standards indicates that a dual carriageway standard is most likely to be economically and operationally acceptable;
- The dual carriageway option is forecast to provide the highest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road; and
- The dual carriageway option is also forecast to result in more traffic reassigning to use the eastern bypass with the southern section to the B1188 Lincoln Road expected to see the most significant increases.

## 9.6. OPTIONS ASSESSMENT FRAMEWORK

The Options Assessment Framework (OAF) draws on a greater detail of evidence compared to the previous sifting stages in order to be able to distinguish the relative costs, benefits and impacts of the options under consideration. The OAF has been assessed across four broad categories which include:

- Strategic fit;
- Value for money;
- Financial case; and
- Delivery case.

This stage of the assessment followed on from the EAST stage and considered options 1 (Single), 2 (Future Proofed) and 3 (Dual Carriageway). The OAF adopted methodology and a detailed output of results can be found in Appendix M.

The sections below provide a summary of the results.

### 9.6.1. Strategic fit

The strategic fit assessment utilised a three-point scale (see Table 41) to assess:

- How well the options align against objectives documented within regional policy documents reviewed;
- How well the optios align against objectives documented within local policy documents reviewed; and
- How well the options align agianst the scheme specific objectives.

**Table 41 – Strategic fit scoring mechanism**

| Scale of impact | Score |
|---|---|
| Wholly fulfils policy/objective | 2 |
| Supports policy/objective | 1 |
| Neutral/marginal impact | 0 |

***Regional policy***

All options scored the same for each of the regional policy documents reviewed with a score of 8 from a maximum of 12. The options were primarily marked down for not being specifically mentioned within the following documents despite broadly aligning with their objectives:

- Greater Lincoln Strategic Economic Plan 2014-2030;
- CLLP
- Midlands Engine Strategy;
- Midlands Connect strategy: Powering the Midlands Engine; and
- Highways England North and East Midlands Route Strategy, April 2015 and Evidence Report.

### *Local policy*

All options scored the same for each of the local policy documents reviewed with a score of 14 from a maximum of 16. A maximum score of 16 was not given due to the options having a neutral impact against the objectives of surrounding neighbourhood plans.

*Scheme specific objectives*

The options were scored against the scheme specific objectives for NHRR which are:

- Provision of an additional east west route for local and strategic traffic;
- Improved access between the strategic A46 and the eastern side of Lincoln including the LEB;
- Reduced rat-running traffic through South Lincoln and North Hykeham as a result of east west traffic using appropriate routes;
- Provision of a new link to unlock land allocated for the SWQ;
- Increased network capacity to accommodate housing growth;
- Improved route choice for east west movements to reduce traffic and congestion on the existing orbital network and key routes through Lincoln;
- Expansion of the orbital network around Lincoln; and
- Improved strategic and local route choice to improve network resilience.

Out of a total of 16 both single carriageway options scored 14 and the dual carriageway 16. The single carriageway options were scored down for:

- Improved east west movement to reduce traffic and congestion on the existing orbital network and key routes through Lincoln: All options will reduce demand on key radial routes and most notably the A46 orbital route as traffic re-routes onto the NHRR. However the single carriageway options do not perform as well as the dual carriageway in this respect; and
- Expansion of the orbital network around Lincoln: All options will expand the orbital route around Lincoln with the dual carriageway option providing additional capacity over the single carriageway options.

### *Strategic fit summary*

The table below provides a summary of the scores and ranking for the strategic fit.

**Table 42 – Strategic fit summary**

| Assessment | Single | Single + FP | Dual |
|---|---|---|---|
| Regional policy score | 8 | 8 | 8 |
| Local policy score | 14 | 14 | 14 |
| Scheme objective scores | 14 | 14 | 16 |
| Total | 36 | 36 | 38 |
| Ranking | =2 | =2 | 1 |

### 9.6.2. Value for Money (VFM)

Following the structure of the Transport Business Case the VfM assessment is divided across key impacts including:

- Impact on the economy;
- Impact on the environment;
- Impact on society;
- Public accounts;
- Distributional impacts; and
- Indicative Benefit Cost Ratio (BCR).

***Impact on the economy***

The options were evaluated against two indicators to assess their impact on the economy. This included impact on 'Business Users' and 'Journey Realibility'. For business users TUBA outputs were utilised to determine the better performing option and for journey time reliability a 3-point scale was used (see Table 41).

TUBA output showed that the dual carriageway option offered the greatest benefit in terms of time savings. For vehicle operating costs the largest benefit is for the single carriageway option 1 closely followed by option 2 and finally the dual carriageway option. Overall the dual carriageway option showed the greatest monetised benefit for business users.

For journey time reliability all options provide beneficial impact through providing an additional east west route which can be utilised as a diversion route when there is an incident on the A46. Furthermore NHRR will result in traffic re-routing from the A46, key radial routes and the local road network in North Hykeham which all suffer from, to an extent, unreliable journey times.

***Impact on the environment***

A seven-point scale was used to determine the better performing option (Table 43).

**Table 43 – 7-point scale**

| Scale of impact | Score |
|---|---|
| Large beneficial impact | 3 |
| Moderate beneficial impact | 2 |
| Slight beneficial impact | 1 |
| Neutral/marginal impact | 0 |
| Slight adverse impact | -1 |
| Moderate adverse impact | -2 |
| Large adverse impact | -3 |

The above scale was utilised across 9 categories and a summary of the score and rationale for the score is provided in the talbe below.

## Table 44 – Impact on the Environment Assessment

| Assessment Area | Score | Description/Key Impacts |
|---|---|---|
| Noise | Slight adverse impact (-1) for all options | There is a beneficial impact due to traffic re-routing from the A46 and more significantly the local road network to the south of Lincoln which has a number of receptors in close proximity (mainly housing) to the highway boundary and on to the NHRR where there are fewer receptors due to its rural location. This beneficial impact could reduce traffic in the Noise Action Planning Important Areas in Lincoln. However the NHRR could also introduce traffic impacts to new receptors and change the location of NIAs which may have adverse noise impacts on the surrounding receptors. |
| Air quality | Neutral/marginal impact (0) for all options | The A46 is congested particularly during peak periods and rat running occurs on the local road network within North Hykeham. This results in stop start traffic and consequently more fuel burnt compared to free flow traffic and therefore more pollutants emitted. With the inclusion of the NHRR a proportion of this traffic re-routes onto the NHRR where traffic is more free flowing resulting in less pollutants emitted. This will potentially remove traffic from the Lincoln $PM_{10}$ and $NO_2$ Air Quality Management Areas. The alignment of NHRR is through a rural location where there are less receptors in close proximity to the highway boundary resulting in fewer people being affected by local air quality issues. However this may also introduce air quality impacts to new receptors. |
| Greenhouse Gas | Option 1 (Single Carriageway): -1<br>Option 2 (Single Carriageway + Future Proof: -1<br>Option 3 (Dual Carriageway): -2 | Based on TUBA output for greenhouse gas emissions:<br>Option 1: -£4,526,000<br>Option 2: -£4,381,000<br>Option 3: -£7,494,000 |
| Landscape, and townscape | Option 1 (Single Carriageway): -2<br>Option 2 (Single Carriageway + Future Proof): -2<br>Option 3: (Dual Carriageway) -3 | Given the rural nature of the scheme landscape impacts have been considered. All options will require land resulting in a detrimental impact on the landscape despite suitable mitigation to address the schemes impact. The scale of impact will be more for the dual carriageway option due to the additional land requirement. |
| Historic environment | Slight adverse impact (-1) for all options | No listed buildings, scheduled monuments or registered parks and gardens have the potential to be directly impacted, however there could be adverse impacts from a change in setting or air, dust and noise pollution due to changes and increase in traffic levels of the proposed scheme. All options will include suitable mitigation to address the schemes impact on the historic environment. |
| Biodiversity | Slight adverse impact (-1) for all options | No option through close proximity directly impacts on international, national, regional or local designations. However there are non-statutory designations within the footprint of the proposed scheme which may result in direct loss of land and/or habitat degradation through indirect impacts. In addition, the introduction of a new road into a rural environment would have adverse impacts on habitats, and any associated species. |
| Water environment | Moderate adverse impact (-2) for all options | It is anticipated there will be a negligible change to the volume and quality discharged through suitable mitigation. However approximately 1.5km and 1km of the proposed scheme will travel through areas designated as Flood Zone 2 and Flood Zone 3 respectively. In addition, the River Witham runs directly through the proposed scheme corridor and a crossing of the Witham will be required just after the confluence of the River Brant and River Witham. The Beck stream also flows approximately 500m north and parallel to the proposed scheme north of South Hykeham. |

### *Impact on society*

A seven-point scale (see Table 43) was used to determine the better performing option. The results have been summarised in the table below.

**Table 45 – Impact on society assessment**

| Assessment Area | Score | Description/Key Impacts |
|---|---|---|
| Non-business users | Option 1 (Single Carriageway): 2<br>Option 2 (Single Carriageway + Future Proof): 2<br>Option 3 (Dual Carriageway): 3 | TUBA outputs were utilised and showed:<br>Option 1<br>Commuting benefits £39,936,000<br>Other £92,154,000<br>Option 2<br>Commuting benefits £40,031,000<br>Other £92,613,000<br>Option 3<br>Commuting benefits £44,708,000<br>Other £101,038,000 |
| Physical activity | 1 for all options | It is anticipated that NMU routes will be provided both orbitally and across the scheme.<br>This is expected to improve accessibility for non-motorised users particularly between the new development areas which could encourage physical activity. As a result a slight positive impact is expected.. |
| Journey quality | 2 for all options | The NHRR has a positive impact on driver frustration as it provides a new east west link which better connects a number of villages to the east and west of Lincoln. It also provides an alternative route to the A46 orbital route and the local road network to the south of Lincoln where rat running occurs. It will reduce congestion on these routes resulting in reduced driver frustration for users who continue to use these routes and for those that now choose to use the NHRR by providing a more free-flowing route option. |
| Accidents | Option 1 (Single Carriageway): 2<br>Option 2 (Single Carriageway + Future Proof): 2<br>Option 3 (Dual Carriageway): 3 | Based on COBALT outputs which show:<br>Single carriageway (options 1 and 2): £5.4 m<br>Dual carriageway (option 3): £14.3 m |
| Security and access to services | 0 for all options | No change. |
| Affordability | Option 1(Single Carriageway): -1<br>Option 2 (Single Carriageway + Future Proof): -1<br>Option 3 (Dual Carriageway): -2 | Vehicle operating costs fom TUBA have been tilised which show:<br>Option 1: Business + consumer: -4,151(£000)<br>Option 2: Business + consumer: -3,989 (£000)<br>Option 3: Business + consumer: -14,687 (£000) |
| Severance | 1 for all options | It is anticipated that all three options will have a slight beneficial impact. This is due to traffic re-routing from the local road network south of Lincoln onto NHRR. This results in less traffic on the local road network which acts as a barrier to walking and cycling including at peak times where there is evidence of rat running. |

### *Public accounts*

The cost to the broad transport budget and indirect tax revenues were assessed as part of the public accounts assessment. Key points from the assessment include:

- Cost to broad transport budget: Funding source and profile have yet to be determined
- Indirect tax benefit: TUBA outputs were utilised where positive figures were assessed as dis-benefits:
  - Option 1: -9,315 (£000)
  - Option 2: -9,055 (£000)
  - Option 3: -15,323 (£000)

### *Distribution impact*

The purpose of a social distributional impact assessment is to identify the impact of a transport intervention spatially, socially and economically with particular reference to disadvantaged groups. It provides a high level qualitative assessment across 8 areas:

- User benefits;
- Noise;
- Air quality;
- Accidents;
- Severance;
- Security
- Accessibility; and
- Personal affordability.

The assessment noted that while NHRR is expected to have some positive impacts across the above areas all options were deemed to have the same distributional impact.

### *Indicative benefit cost ratio*

An indicative benefit cost ratio has been calculated and the results presented within the table below.

**Table 46 – Indicative BCR assessment**

| Assessment area | Output |
|---|---|
| Cost to private sector | Cost profile and available budget yet to be identified |
| Present Value of Benefits (PVB) | Option 1: £277,605,000<br>Option 2: £278,263,000<br>Option 3: £321,800,000 |
| Indicative Benefit Cost Ratio (BCR) | Option 1: 3.67<br>Option 2: 3.12<br>Option 3: 2.87 |

The results show that the single carriageway option 1 has the highest indicative BCR.

### *VFM summary*

Table 47 provides a summary of the ranking for each criteria within the VFM assessment based on scores achieved. It also provides an overall ranking.

**Table 47 – VFM ranking summary**

| Criteria | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Impact on the economy | =2 | =2 | 1 |
| Impact on environment | =1 | =1 | 3 |
| Impact on society | =2 | =2 | 1 |
| Public accounts | =2 | =2 | 1 |
| Distributional impact | =1 | =1 | =1 |
| Indicative BCR | 1 | 2 | 3 |
| Overall ranking | 1 | =2 | =2 |

## 9.6.3. Financial case

The OAF requires a monetary assessment of the outturn costs of implementation and the outturn costs of operation and maintenance for each option to determmine the better performing options. TUBA outputs were utilised and showed the dual carriageway as the best perfoming option. The results are shown in the table below.

**Table 48 – Financial case assessment**

| Assessment Area | £outturn – Option 1 | £outturn – Option 2 | £outturn – Option 3 |
|---|---|---|---|
| Outturn cost to implement | 100 (£m) | 118 (£m) | 148 (£m) |
| Operating and maintenance costs | N/A | N/A | N/A |

## 9.6.4. Delivery Case

Table 49 provides a summary of the assessment.

### Table 49 – Delivery case assessment

| Assessment area | Description / Key impacts |
|---|---|
| Likely delivery agent | ▪ Lincolnshire County Council (LCC) is the promoting authority;<br>▪ The scheme is anticipated to be partly funded by the DfT; and<br>▪ A contractor and payment mechanism for the contractor has yet to be determine. |
| Stakeholder acceptability | ▪ Stakeholder and public consultation events showed:<br>• overwhelmingly supported the dual carriageway configuration (option 3) with 75% of respondents preferring this option;<br>• 9% of respondents chose the single carriageway with enlarged junctions (option 2) as their preferred option; and<br>• 3% of respondents chose the single carriageway option as their preferred option (option 1).<br>▪ DfT are a key stakeholder and |
| Public acceptability / interest | ▪ Stakeholder and public consultation events showed:<br>• overwhelmingly supported the dual carriageway configuration (option 3) with 75% of respondents preferring this option;<br>• 9% of respondents chose the single carriageway with enlarged junctions (option 2) as their preferred option; and<br>• 3% of respondents chose the single carriageway option as their preferred option (option 1). |
| Route to market | ▪ A contractor and payment mechanism for the contractor has yet to be determine. |

It is noted that only 3% of respondents chose the single carriageway option 1 in the stakeholder public consultation events and there are aspirations of upgrading the LEB to a dual carriageway resulting in the progression of a single carriageway NHRR being inconsistent with the overall design approach of LEB. As a result the single carriageway option for NHRR is likely to be politically unacceptable.

## 9.6.5. Outcome and Summary

### Table 50 – Ranking summary

| Criteria | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| Strategic fit | =2 | =2 | 1 |
| Value for money | =1 | =2 | =2 |
| Financial case | 1 | 2 | 3 |
| Delivery case | 3 | 2 | 1 |

The OAF assessment shows:

- That all three options will achieve the objectives, they will improve the east west connectivity in the south of Lincoln, help to reduce traffic levels on local urban and rural roads, support the delivery of the SUEs and help improve the resilience of the orbital and key route network through and around Lincoln;
- However the additional traffic relief that afforded by the dual carriageway means that it has been assessed as being the better performing option in traffic impact terms;
- All three options will produce a high level of benefits with the dual carriageway option providing the highest level of benefits;
- However due to the marginal difference in benefits between the options and the lower scheme costs the single carriageway option has a higher BCR;
- The standard single carriageway is the lowest cost option and the outturn costs are expected to be in the region of £48m lower than the dual carriageway;
- The dual carriageway is significantly more expensive than the other two options and has an outturn cost of approximately £148m;
- In terms of public acceptability the dual carriageway is the best performing option;
- Progressing the NHRR as a standard single carriageway could be seen as not being consistent with the overall design approach to the LEB. This is being developed as a future proofed single carriageway and there is a clear aspiration to upgrade the route at a later date; and
- If taken forward to the OBC stage, further work will need to be undertaken to demonstrate that the dual-carriageway option will provide sufficient value for money, wider economic benefits and strategic fit for the DfT to consider funding.

# 10. SUMMARY & CONCLUSIONS

## 10.1. OVERVIEW

A detailed and robust approach has been used to assess and develop the key options for the NHRR scheme. This follows the DfTs Transport Appraisal Guidance (2014) and builds on the earlier options assessment work for the NHRR scheme which established the key scheme requirements and the route corridor.

This report provides has reviewed and assessed the issues currently affecting Lincoln, presented the future challenges and identified the how these are forecast to affect Lincoln and the wider area. The objective of this phase of the project has been to develop the scheme design and the carriageway standard options. The outcome of the assessment is summarised below.

## 10.2. EXISTING & FUTURE PROBLEMS & ISSUES

Lincoln currently suffers from high levels of congestion from local and strategic traffic movements which impacts on the quality of life for local residents, acts as a constraint on the economy and reduces the attractiveness of the city for visitors and investors.

The existing road network in Lincoln consists of a number of regionally important routes through and around the city, as well as major routes into the city centre and local roads. The main orbital and strategic routes include the A46 WRR/Northern Relief Road which forms part of the Highways England (HE) network, the A57 Saxilby Road/Carholme Road on the western side of Lincoln which provides a key east – west route into the City, the A15 which provides a major north south route through Lincoln and provides a link to the Humber Ports and the A1434 which again provides a route into the city from the south west and passes through several residential areas including North Hykeham. There are also a number of other major routes which provide links to the city centre and the surrounding towns and villages.

However, the existing principal road network currently has a number of limitations. There are few major and strategic routes through and around Lincoln and these are further constrained by the location of the rivers, watercourses and rail infrastructure within and around the city. Lincoln is bisected by the River Witham and Fossdyke Navigation which cut through the city in both east west and north south direction. These act as a significant constraint to transport network as there are limited crossing opportunities of the both the river and the Fossdyke Navigation in the centre of the city and very few in the south of Lincoln. In the south of the city these are limited to a number of relatively minor routes that are particularly unsuited to strategic traffic.

In addition the railway lines also bisect the city. These run east west through the centre of Lincoln and in a north south direction through Hykeham. There are again limited opportunities to cross the rail infrastructure and the location and number of level crossings also has a further constraining effect on the network for both strategic and local movements across Lincoln.

This results in a limited route choice for north south and east west traffic, especially in the south of the Lincoln Urban Area, with traffic forced to use either the A46 or A1434 and A15 to pass by or through the city.

These network limitations cause several problems.

- It results in significant volumes of traffic having to use a limited number of strategic and major routes or unsuitable routes through residential areas. East west traffic in the south of Lincoln is forced in to using minor rural routes to the south of Lincoln;
- On the Strategic and Major Road Network there are a several links that are currently carrying significant volumes of traffic. The highest current traffic flows and the largest recent increases have been on Lincoln's orbital and major routes (A46, A15 and A1434) and the expectation is that they will continue to increase putting the network under further pressure.

- On the local network several routes in the Hykeham area experience relatively high traffic volumes for their design standard, this can be attributed to the lack of east-west and north-south connectivity. Key points include:
  - Moor Lane, Mill Lane and Station Road carry circa 10,000 vehicles/day. Critically these routes pass through residential areas, often with housing immediately adjacent to the highway.
  - Meadow Lane currently forms an important east west link between radial routes to the south of Lincoln and is the only crossing point of the River Witham to the south of Lincoln. Without another viable alternative Meadow Lane will continue to carry significant volumes of traffic compared to its design standard.

The lack of route choice also results in rat running through residential areas, particularly in the North Hykeham area and the villages to the south of Lincoln. These routes are unsuitable for the volumes of traffic that they currently carry and result in a high level of severance in the local communities.

There is also a poor level of network resilience and this is a key problem on the strategic and major route network. The poor network resilience has a wide impact and affects movement of strategic and local traffic across the Lincoln network. The lack of alternatives to the existing orbital ring road and major routes through the city mean that that traffic is diverted through urban and residential areas which are unsuited to the additional volumes of traffic.

Several important sections of the existing network are also operating either at capacity or would be expected to reach capacity in the short to medium term. This includes the A46, the A15 and the A1434, with congestion resulting in poor average speeds, variable journey times and delay in both peak periods and to some extent also in off peak conditions.

### 10.2.1. Future Problems & Challenges

This report has demonstrated that there are significant levels of planned growth up to 2036. This includes the development of the four SUEs which will contribute to a 50% increase in dwellings in Lincoln by 2036.

The LEB, which is currently under construction, will provide welcome and much needed mitigation for the traffic and transport problems affecting Lincoln but once open several residual issues will remain.

In particular the lack of east west connectivity will remain a significant problem which will continue to exacerbate the existing congestion problems on radial routes and routes into Lincoln.

Travel demands are also forecast to increase substantially over the next 20 years. Increases in vehicle trips of up to 20% by 2036 are forecast and will result in a deterioration in conditions on key areas of the network particularly on the western side of Lincoln including the A46 WRR, A1434 Newark Road and sections of the A15.

The forecast impact of the future level of travel demand on infrastructure illustrated by link capacity, junction capacity and average speed indicates issues of congestion and poor speeds on the key route network including A46 WRR and A1434 Newark Road and on local routes in the South of Lincoln and North Hykeham area. This includes the Meadow Lane and Brant Road – the current main east west crossing of the River Witham in the south of Lincoln

Without a suitable transport intervention traffic conditions in the future will deteriorate and the road network will struggle to:

- Accommodate forecast growth;
- Support the delivery of SUEs;
- Support the delivery of the CLLP;
- Support the Major Road Network development;
- Accommodate the increase travel demand;
- Accommodate increased congestion; and

- Suffer from network capacity issues.

If a suitable transport intervention is not implemented existing and future conditions will result in:

- A lack of strategic connectivity: the A46/A15 currently provide strategic connectivity to wider economic areas such as the Humber ports. Congestion which will be exacerbated in the future which will inhibit efficient movement on this route and therefore wider strategic connectivity;
- Constrained economic growth: the transport network is forecast to face increasing congestion which may impact on the areas ability to deliver sustainable economic growth;
- An impact on housing targets: the ability to deliver housing targets will be compromised; and
- An impact on the indicative Major Road Network: existing and future congestion on the A15 and A46 may hinder the potential of these routes to operate as part of the MRN.

## 10.3. OBJECTIVES

A robust set of objections have been developed in response to the key challenges and issues identified as part of the review of the existing and future situation. A significant level of development is proposed for the Lincoln area up to 2036 and it is critical that this is supported by the delivery of new transport infrastructure.

The intervention would also need to support the delivery of the LITS, its aims and objectives. This includes ensuring that the transport infrastructure meets the needs of existing and proposed developments and the continued investment and development in infrastructure that reduces congestion on key strategic and local routes within and around the Lincoln urban area.

- To improve east west connectivity in the South of Lincoln for strategic and local traffic;
- To reduce traffic levels on local urban and rural roads in the South of Lincoln through the transfer of strategic traffic to appropriate routes;
- To reduce NMU severance in South Lincoln caused by high levels of traffic on the local road network and lack of east west connectivity;
- To support the delivery of the Sustainable Urban Extensions by improving access to the identified sites;
- To support the delivery of the South West quadrant through the provision of additional network capacity and non-motorised user infrastructure necessary for the delivery of new housing;
- To reduce traffic levels and congestion around Lincoln and on key routes through the city to support:
    - Improved access to central Lincoln;
    - The improvement of access to the Humber Ports and Airport; and
    - The improvement of access to the Lincolnshire Coast.
- To improve the resilience of the orbital and key route network through and around Lincoln and reduce the impact of major incidents.

## 10.4. NHRR OPTIONS

The NHRR has been developed over a long period of time and subject to a robust options assessment and selection process. The preferred route was initially developed and in 2006 and the requirements for the scheme were further developed as part of the LITS process.

The options assessment work described in this document uses the Preferred Route as the starting point and the focus of the analysis relates to the carriageway standard.

As part of this three primary options for a NHRR between the A46 (A46/A1434 Pennell's Roundabout) to the A15 (A15 Lincoln Eastern Bypass/Sleaford Road Roundabout) have been considered as part of this OAR stage; these being:

- A single carriageway
- A dual carriageway

- A single carriageway with future-proofed junctions and structure which will allow for dualling of the scheme at a future date

In addition, further options for shorter schemes have also been considered:

- A46 to South Hykeham Road – single carriageway
- A46 to South Hykeham Road – dual carriageway
- A46 to Brant Road – single carriageway
- A46 to Brant Road – dual carriageway

## 10.5. OPTIONS ASSESSMENT

To assess the impact of the scheme options a structured process has been followed which is closely aligned with WebTAG. It included the following stages:

- **Initial Sift:** An initial sift of options was completed to identify any significant problems and issues which are likely to prevent an option progressing.
- **Early Assessment & Sifting Tool:** The Early Assessment and Sifting Tool (EAST) has been utilised. This was developed by the DfT as a decision support tool to develop, quickly summarise and present evidence on options in a clear manner which is consistent with the DfT's five case transport business structure.
- **Traffic Impacts:** The traffic impacts of each option have been assessed on the strategic and major road network as well as on the local roads and routes.

### 10.5.1. Initial sift

The initial sift process resulted in the shorter options (A46 to South Hykeham Road and the A46 to Brant Road) being discounted. In summary:

- They scored poorly against scheme objectives;
- They were not deemed deliverable on the grounds that they do not align with long term policy aspirations of a relief road to the south of Lincoln as stated within the Lincoln Integrated Transport Strategy, Lincolnshire 4th Local Transport Plan and the Central Lincolnshire Local Plan; and
- They were not deemed feasible as the options are not technically appropriate when considering future demand.

### 10.5.2. East assessment

The EAST Assessment identified the dual carriageway as being the best performing option in relation to the objectives and overall impact. In the main this is due to the slightly higher level of traffic relief expected to result from its implementation. However, each option is likely to deliver high value for money (in line with DfT's criteria).

### 10.5.3. Traffic Assessment

The following summarise the traffic impacts and issues for the three shortlisted options:

- Across all three options, the opening year traffic flows for the NHRR are consistent with those acceptable for a dual 2 lane all-purpose carriageway as set out in guidance contained within the Design Manual for Roads and Bridges.
- The journey times along the dual carriageway option are over a minute quicker than the single carriageway and future proofed options in the peak periods both in 2026 and 2036. The average speeds are also forecast to be significantly quicker (approximately 10mph) in the dual carriageway option;

- Analysis indicates that the single carriageway links, particularly at the western end of the NHRR, may operate close to capacity by the end of the Local Plan period (2036) or at the design year (2041) whilst the dual carriageway option should remain well within capacity in these timescales.
- The Lincoln Eastern Bypass is being constructed as a single carriageway with future proofed junctions and features. There remains an aspiration to upgrade this to a dual carriageway at some point in the future. Progressing the NHRR as a standard single carriageway could be seen as being inconsistent with the overall design approach to the LEB;
- As dependent development the South West Quadrant has not been taken into account in the 'with NHRR' scenario. This will place further development pressures on the network;
- All three options will improve the resilience of the transport network through the expansion of the orbital network and increases in capacity. However, a dual carriageway option would further improve resilience as it will have the capacity to better deal with incidents and the impact of maintenance works.
- The dual carriageway option is forecast to provide the greatest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road on the sections between Skellingthorpe Road and Riseholme Road.
- All three options will provide significant traffic relief across a number of routes both within central Lincoln and in the south of the city;
- The dual carriageway option provides the greatest level of relief although for many routes this is a marginal difference.

### 10.5.4. Scheme costs

The initial outturn scheme cost estimates range from £100m for the single carriageway option to £148m for the dual carriageway.

| Single Carriageway | Single Carriageway - Future Proofed | Dual Carriageway |
|---|---|---|
| £60,620,560 | £72,168,966 | £91,040,330 |
| *£17,900,000* | *£20,324,000* | £25,440,000 |
| £21,508,792 | £25,339,031 | £32,043,039 |
| **£100,029,352** | **£117,831,997** | **£148,523,369** |

**Does not include any sunk costs*

### 10.5.5. Forecast Benefits

The outcome of the indicative value for money assessment is set out in the table below. This summarises the forecast transport user and accident benefits for each option, the present value of costs and the benefit to cost ratio (BCR). It shows that the single carriageway and future proofed options are likely to produce a similar level of benefit and the dual carriageway is forecast to provide the greatest level of benefit (£321m over 60 years). However, the given the relatively modest difference in benefits between the three options and the lower scheme costs, the single carriageway would be expected to result in a higher BCR. It should also be

noted that the BCRs for all options fall in the high value for money category (BCR between 2 and 4) as defined by DfT[6].

| Indicative Value for Money Assessment | Option | | |
|---|---|---|---|
| | Single Carriageway | Single Carriageway Future Proofed | Dual Carriageway |
| Present Value of Benefits (PVB)** | **£277,600,000** | **£277,763,000** | **£321,800,000** |
| Present Value of Costs (PVC)** | £75,580,170 | £89,046,233 | £112,227,573 |
| Net Present Value (NPV)** | £202,019,830 | £188,716,767 | £209,572,427 |
| **Indicative BCR** | **3.67** | **3.12** | **2.87** |

**The operating costs have not been calculated. This will be completed for the OBC.*

*** 2010 prices and values*

### 10.5.6. Engagement outcome

Stakeholder and public engagement was undertaken in June 2018. The engagement process included two stakeholder workshops and four public drop-in exhibitions. In parallel a questionnaire was also released, of which 1,023 were completed. Some 73% of respondents strongly supported the scheme and 89% either supported or strongly supported the scheme. Only 8% of respondents opposed or strongly opposed the scheme with 2% either not knowing/having no opinion. In addition, 87% of respondents preferred a scheme between the A46 and the A15 with 75% of respondents preferring the dual carriageway option. Only 1% of respondents preferred any version of the A46 to South Hykeham Road option with 8% preferring the A46 to Brant Road option.

### 10.5.7. Assessment outcome

The OAR has assessed a number of options for NHRR including three different carriageway standards and three different lengths. Through initial sifting the two shorter versions of the NHRR were discounted and more detailed assessment and appraisal has been undertaken for the options of three different standards of the full A46 to A15 route. In summary:

#### Single Carriageway

- The single carriageway option will deliver the scheme objectives. It will improve the east west connectivity in the south of Lincoln, help to reduce traffic levels on local urban and rural roads, support the delivery of the Sustainable Urban Extensions and help improve the resilience of the orbital and key route network through and around Lincoln;
- It will provide significant traffic relief across a number of local routes both within central Lincoln and in the south of the city;
- The forecast flows on the single carriageway exceed the opening year flow range for a single carriageway as defined by DMRB. This identifies that a dual carriageway standard is likely to be more economically and operationally acceptable. Congestion Reference Flow analysis also indicates that

[6] DfT Value for Money Framework 2015

some sections of a single carriageway scheme may be operating close to capacity at the end of the plan period in 2036 or at the design year in 2041;

- It will produce acceptable levels of benefits albeit these will be lower than the dual carriageway option;
- The standard single carriageway is the lowest cost option and the outturn costs are expected to be in the region of £48m lower than the dual carriageway;
- This option will produce a BCR that is within the high value for money category, as defined by DfT. However, due to the lower costs, and relatively similar levels of benefits, the single carriageway option is predicted to provide the best value for money with the dual carriageway option notably lower; and
- Progressing the NHRR as a standard single carriageway could be seen as not being consistent with the overall design approach to the LEB. This is being developed as a future proofed single carriageway and there is a clear aspiration to upgrade the route at a later date.

**Single Carriageway + Future Proofing**

- The future proofed option is expected to have a similar level of performance to the standard single carriageway and it will deliver the scheme objectives;
- It will provide similar level of traffic relief to the standard single carriageway across a number of local routes both within central Lincoln and in the south of the city;
- The forecast flows on the scheme are again similar to single carriageway and exceed the opening year flow range for a single carriageway as defined by DMRB.
- It will also produce acceptable levels of benefits albeit these will be lower than the dual carriageway option;
- This is the second lowest cost option. The outturn costs for the option with future proofing are expected to be in the region of £30m lower than the dual carriageway;
- This option will produce a BCR that is within the high value for money category, as defined by DfT. Due to the higher costs, and relatively similar levels of benefits, the BCR for this option is lower than that of the single carriageway, but higher than for the dual carriageway option.
- The design standard will be consistent with the overall design approach to the LEB. However, there are risks in adopting this approach as it requires land not immediately required for the scheme making the case for compulsorily purchasing some elements of land more difficult to justify.

**Dual Carriageway**

- All three carriageway standard options of the full route deliver the scheme objectives, however, due the greater capacity of the dual carriageway option, it is likely to do so more robustly;
- An analysis of opening year daily traffic flows compared to DMRB guidance for carriageway standards indicates that a dual carriageway standard is most likely to be economically and operationally acceptable;
- The recent stakeholder and public engagement exercise has shown that a very significant majority of people (75%) support the dual carriageway option for the full A46 to A15 NHRR;
- The dual carriageway option is forecast to provide the highest level of traffic relief on the A46 when compared to the Do-Minimum situation in both 2026 and 2036. This is more pronounced on the northern sections of the existing relief road. The dual carriageway option is also forecast to result in more traffic reassigning to use the eastern bypass with the southern section to the B1188 Lincoln Road expected to see the most significant increases;
- The dual carriageway option will provide the highest level of benefits, although not significantly higher than the other two options in proportion to the relative costs;
- The dual carriageway is significantly more expensive than the other two options and has an outturn cost of approximately £148m;
- This option has the lowest BCR of all three options.

- If taken forward to the OBC stage, further work will need to be undertaken to demonstrate that the dual-carriageway option will provide sufficient value for money, wider economic benefits and strategic fit for the DfT to consider funding.

# Appendix A

POLICY & STRATEGY REVIEW

# Appendix B

## SUPPLEMENTARY TRAFFIC DATA

# Appendix C

## SELECT LINK ANALYSIS

# Appendix D

## JUNCTION CAPACITY

# Appendix E

## ENVIRONMENTAL CONSTRAINTS REPORT

# Appendix F

## OBJECTIVES & OUTCOMES

# Appendix G

## LITS OPTIONS GENERATION

# Appendix H

## STRUCTURES OPTIONS

# Appendix I

NON-MOTORISED USER STRATEGY

# Appendix J

## INITIAL SIFTING

# Appendix K

## EAST ASSESSMENT

# Appendix L

## TRAFFIC IMPACTS ASSESSMENT

# Appendix M

## OPTIONS APPRAISAL FRAMEWORK ASSESSMENT

# Appendix N

## STAKEHOLDER ENGAGEMENT REPORT

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