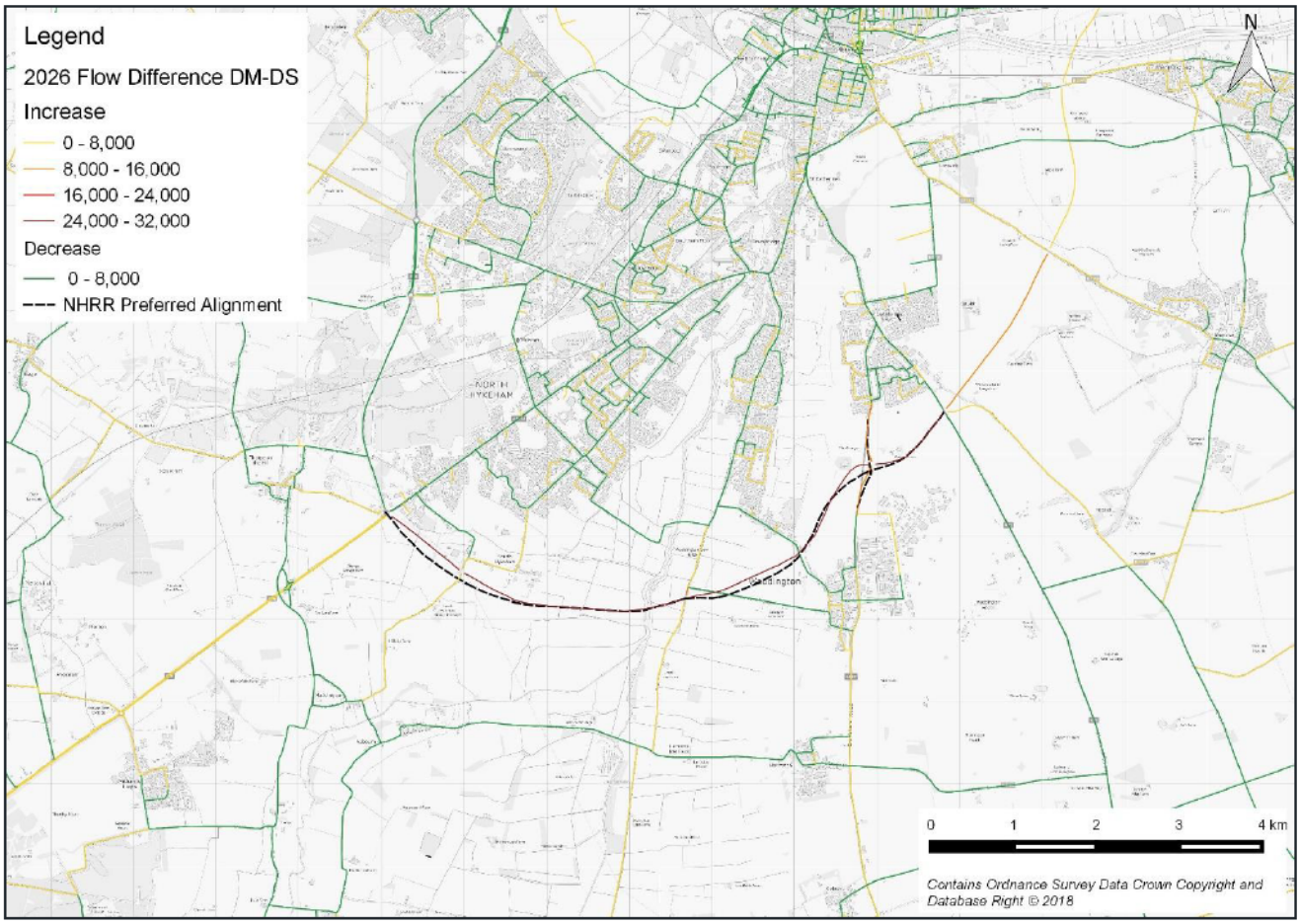
'the relief of severance due to a scheme is not significant where traffic flows are already relatively low (less than 8,000 vehicles AADT)'. As a result, only links with -/+>10% change in vehicle flow and an AADT of over 8,000 vehicles were considered (in the 'Do Minimum' scenario). Links on the A46 were also discounted due to the 60 to 70 mph speed limit in operation and a lack of pedestrian / cycling facilities. This means there will be no pedestrian or cycling activity on these links.

Within the 1km buffers key amenities were identified and the percentage of the population within the buffer which can be considered as 'vulnerable' (as highlighted in Table 1-3) for this indicator. An additional 400 m buffer was placed to represent the distance individuals would be willing to walk to a bus stop as highlighted within TAG Unit A4.2. The buffer zone areas represent walking catchment areas which is the distance individuals would be willing to walk to the amenity or bus stop. In instances where buffers overlap they have been joined together to form one larger buffer area.

However, by adopting the above methodology it is appreciated that in extreme circumstances where links with less than 8,000 AADF in the 'Do Minimum' scenario and experience a significant increase in vehicles flow will not be picked up. The map below shows all links which experience a change in vehicle flow to provide context.

Figure 3-7 - Change in vehicle flow



Identification of Social Groups in Impact Area (Step 2b)

Vulnerable groups are particularly sensitive to the effects of severance. Within these vulnerable groups are children, older people, people with disabilities and households with no access to a car. Table 3-10 shows the proportion of these vulnerable groups within the 1km buffer areas along with regional and national comparisons.

Table 3-10 - Vulnerable Groups

Vulnerable Group	% within Impact Area	% Lincoln	% England
Older People (Aged 65+)	16%	18%	16%
Children (Aged Under 16)	20%	17%	19%
No Car Households	23%	19%	11%
Residents with long-term health problems or disabilities	18%	19%	18%

Key points include:

- The percentage of the population above the age of 65 within the study area is in line with the national average (16%) and slightly lower than the Lincoln average (18%);
- There percentage of children (under 16) within the study area is broadly in line with the national average (19%);
- The percentage of households without a car within the study area (23%) is significantly higher than the national average (11%) and slightly higher than the Lincoln average (19%); and
- The levels of residents which suffer with a long-term health condition / disability within the study area is in line with the national average (18%) and broadly in line with the Lincoln average (19%).

Amenities in the Impact Area (step 2c)

The severance impact area contains a number of local amenities (Figure 3-8) that are likely to be accessed via walking from local residents. As a result, a 1km buffer was applied around the scheme alignment and roads which are forecast to have a significant change in vehicle flow (as defined previously) to represent an acceptable walking distance to the following amenities:

- Schools (primary and secondary);
- Healthcare (GP and hospital); and
- Retail.

A 400m buffer was also utilised with bus stops highlighted which fall within this buffer zone. This represents a reasonable walking distance for residents willing to walk to a bus stop (Figure 3-9).

A summary on the severance impact on amenities and bus stops is presented within Table 3-12 and Table 3-13.

Figure 3-8 - Amenities within impact area with traffic flow change

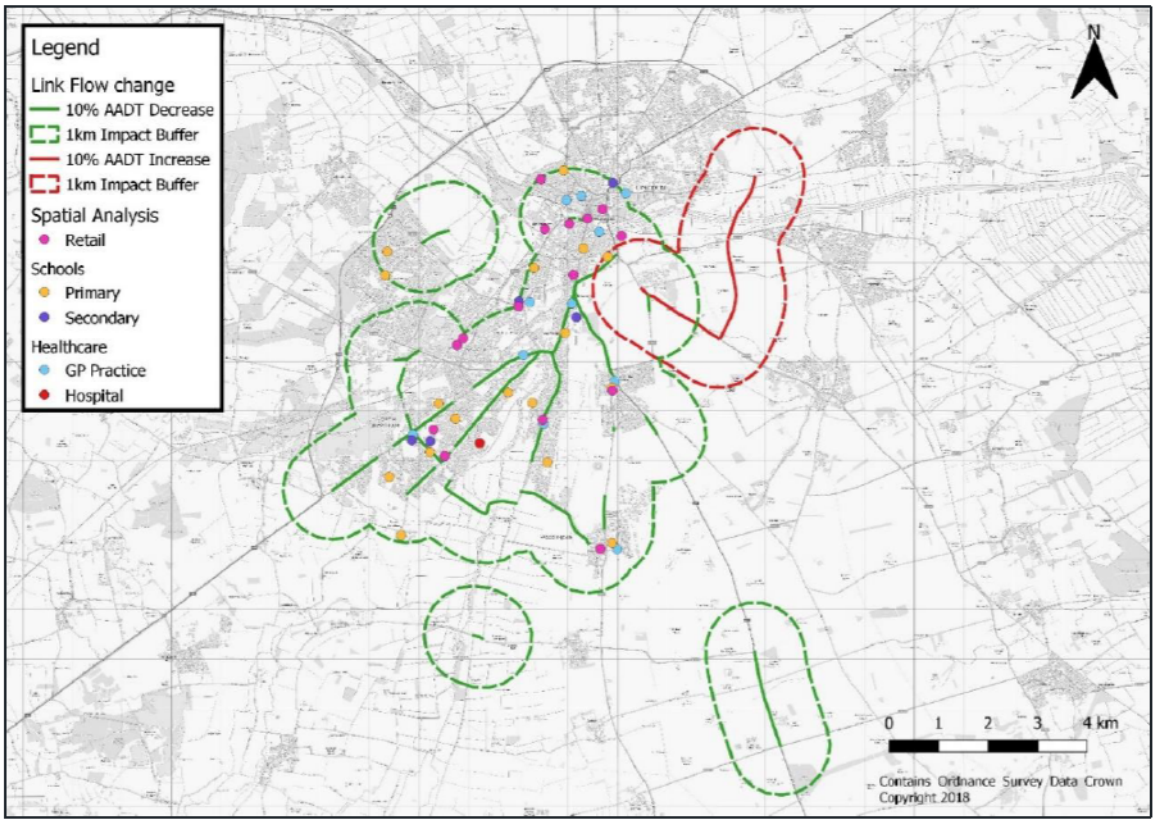
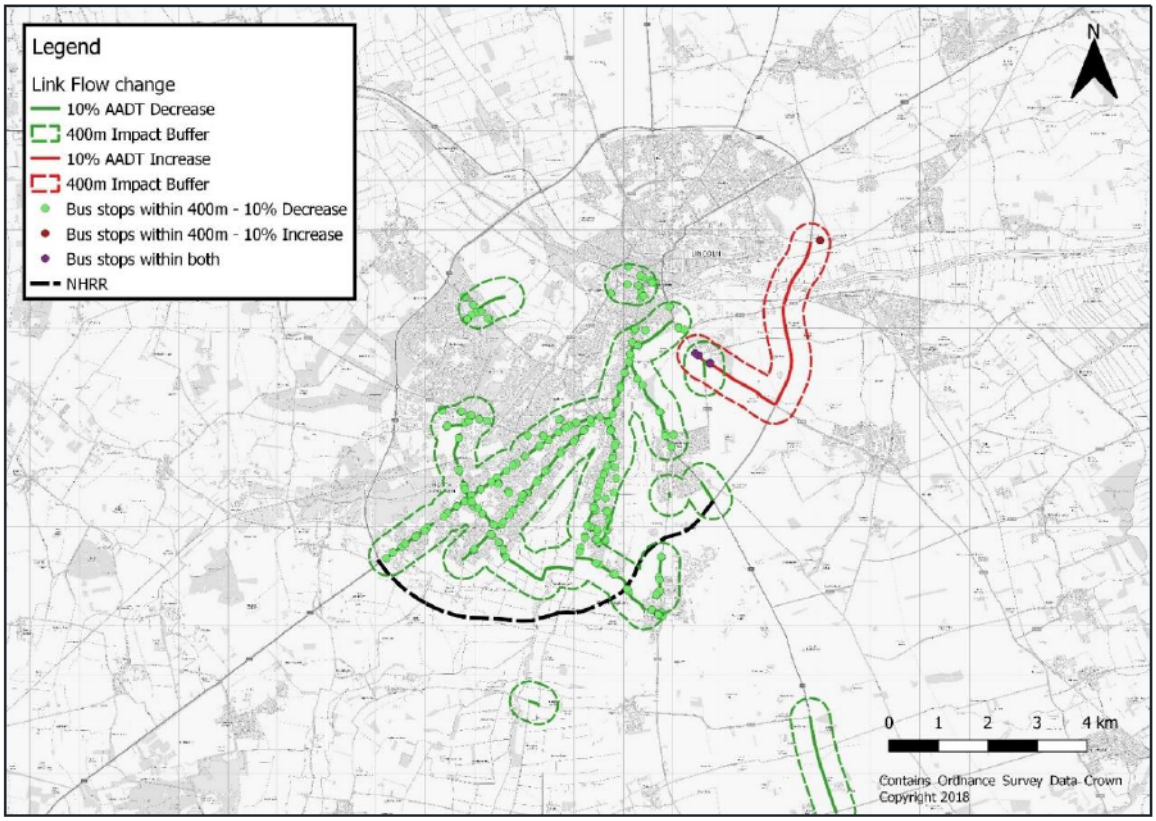


Figure 3-9 - Bus stops within impact area with traffic flow change



Appraisal of Impact (Step 3)

Vulnerable groups in this instance includes:

- Children (under 16);
- Older people (over 65);
- People with disabilities; and
- Households without access to a car.

As mentioned previously an assessment has been undertaken on identifying the population belonging to specific vulnerable groups within 1km of roads suffering from severance. The result of this exercise is shown in Table 3-11.

Appendix E shows the distribution of the vulnerable groups highlighted in the table below at an LSOA level within the study area.

Table 3-11 – Number of residents experiencing a change in severance

	Number of Residents			
Impact	**Children (under 16)**	**Older people (over 65)**	**People with disabilities**	**No car households**
Positive	13,851	13,928	15,828	8,599
Negative	1,206	1,133	1,219	728
Difference	**+12,645**	**+12,795**	**+14,609**	**+7,871**

As shown in the table above there is an overwhelming positive impact on reducing severance for vulnerable groups. This can be attributed to a reduction in severance on a number of radial routes heading into the city centre as well as local roads providing east west connectivity within North Hykeham.

As mentioned previously, an assessment has also been undertaken on the overall impact on the severance to amenities and this has been summarised in the table below. Overall it shows an overwhelming positive impact on reducing severance to identified amenities.

Table 3-12 – Number of amenities experiencing a change in severance

	Number of Amenities		
Amenity	**Positive**	**Negative**	**Difference**
Retail	15	0	**+15**
Primary school	16	1	**+15**
Secondary school	5	0	**+5**
GP	11	0	**+11**
Hospital	1	0	**+1**

Table 3-13 – Impact on bus stops

Impact	Number of bus stops
Positive	221
Negative	6
Difference	+215

The table above shows that there is also an overall positive impact in terms of reducing severance to bus stops which is also highlighted within Figure 3-9. The reduction in traffic on local bus routes and on surrounding roads reduces severance by assisting individuals in accessing bus stops.

Figure 3-10 highlights where NHRR will intersect existing roads which has the potential to create severance for pedestrians and cyclists. However, the design of NHRR will mean severance is minimised at these junctions:

- A46 / NHRR roundabout: A grade separated NMU structure will be provided at this point which will maintain the National Cycle Network route 9;
- Wath Lane: A grade separated NMU structure will be provided over NHRR to maintain existing public rights of way on Wath Lane;
- Brant Road: There is currently no cycling or pedestrian facility on this section of Brant Road meaning it is expected to continue to have minimal pedestrian and cycling use; and
- Viking Way / A607 Grantham Road: A grade separated NMU structure will be provided to maintain existing public rights of way along Viking Way and the cycle route along the A607 Grantham Road.

Figure 3-10 - NHRR

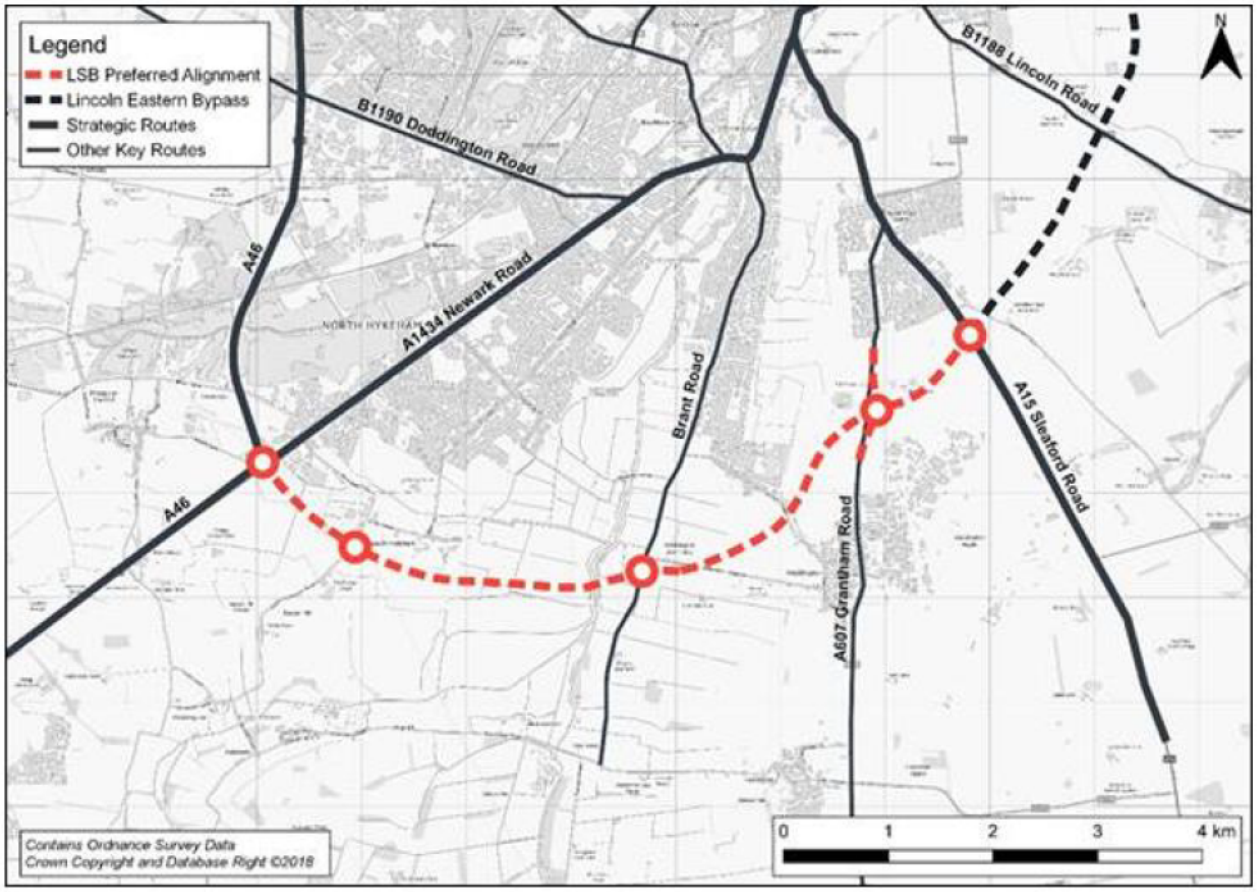


Table 3-14 – Benefit assessment

Impact	Children	Older People	People with a Disability	Households without access to a car
Large Beneficial	✓✓✓	✓✓✓	✓✓✓	✓✓✓

Based on the evidence provided within this indicator a WebTAG severance sheet has been completed (Table 3-14).

The DI assessment for Severance in relation to NHRR is considered to be Large Beneficial.

3.6 PERSONAL AFFORDABILITY

In line with WebTAG, the personal affordability impacts of the scheme have been considered throughout the appraisal process. Changes in transport costs have the potential to disproportionately affect areas where there are few or no travel alternatives, particularly in areas where income levels preclude car ownership. As a result, impact on travel to work, education and affordable food for example can be expected. These impacts are likely to be exacerbated in areas with low income, low car ownership and a high elderly population.

Screening (Step 1)

The only element assessed for the affordability impact appraisal was fuel and non-fuel operating costs (TUBA benefit). This outcome is a result of measuring potential impacts in line with WebTAG A4.2 (as shown in Table 3-15). Guidance states 'non-working time' should be assessed for car fuel and non-fuel cost.

Table 3-15 - Screening of personal affordability impact appraisal

Mode	Cost Change	Cost Change Expected	Change Captured in TUBA	Impact
Car	Car fuel and non-fuel cost	Yes	Yes	Changes due to rerouting of traffic
	Road user charges	No	No	N/A
	Public parking charges	No	No	N/A
	Other car charge/costs	No	No	N/A
Public Transport	Bus fares	No	No	N/A
	Rail fares	No	No	N/A
	Rapid transit fares	No	No	N/A
	Mode shift between public transport modes due to change in supply	No	No	N/A
	Concessionary fares	No	No	N/A
	Other public transport charges/costs	No	No	N/A
Non-motorised modes	Walking costs	No	No	N/A
	Cycling costs	No	No	N/A

Areas of impact (Step 2a)

The impact area for the DI appraisal follows the boundary of the fully modelled area as identified in the user benefits analysis (Figure 3-1). The impact area outlines the area in which passengers' cost of travel is being directly affected by the scheme.

Identification of social groups in the impact area (Step 2b)

In line with WebTAG methodology, the primary group of interest is people on low income. To ensure consistency, the same method for the User Benefit appraisal was adopted whereby five quintiles were identified using the IMD income domain at an LSOA level throughout the scheme area.

Appraisal of Impact (Step 3)

Overall, across the study area, there is a disbenefit of £15,569,556 million in car fuel and non-fuel costs over the 60-year appraisal period (2010 prices). This is as a result of traffic using the new route and travelling longer distances to travel around Lincoln (as opposed to using the existing congested shorter routes through the city). Although the scheme will generate significant journey time benefits (as set out in Table 3-1) the higher speeds and longer average travel distances will result in disbenefits in car fuel and non-fuel costs.

Table 3-16 provides a distributional assessment of fuel and non-fuel costs across the five IMD income domains. The assessment for each group is based on whether the intervention generates an overall benefit or disbenefit and the share of the benefit / disbenefit that a group receives in relation to its proportion of the population.

Table 3-16 - Distribution of Personal Affordability Benefits by Income Deprivation Quintile

	IMD Income Domain				
	0%<20%	20%<40%	40%<60%	60%<80%	80%<100%
Share of user benefits in impact area	11%	14%	13%	32%	29%
Total population	28,709	33,971	40,438	50,310	46,962
Proportion of population in impact area	14%	17%	20%	25%	23%
Overall benefits	-£1,741,200	-£2,178,545	-£2,054,365	-£5,060,047	-£4,535,398
Distribution of benefits in impact area	8%	9%	9%	22%	20%
Assessment	××	××	×	×××	×××

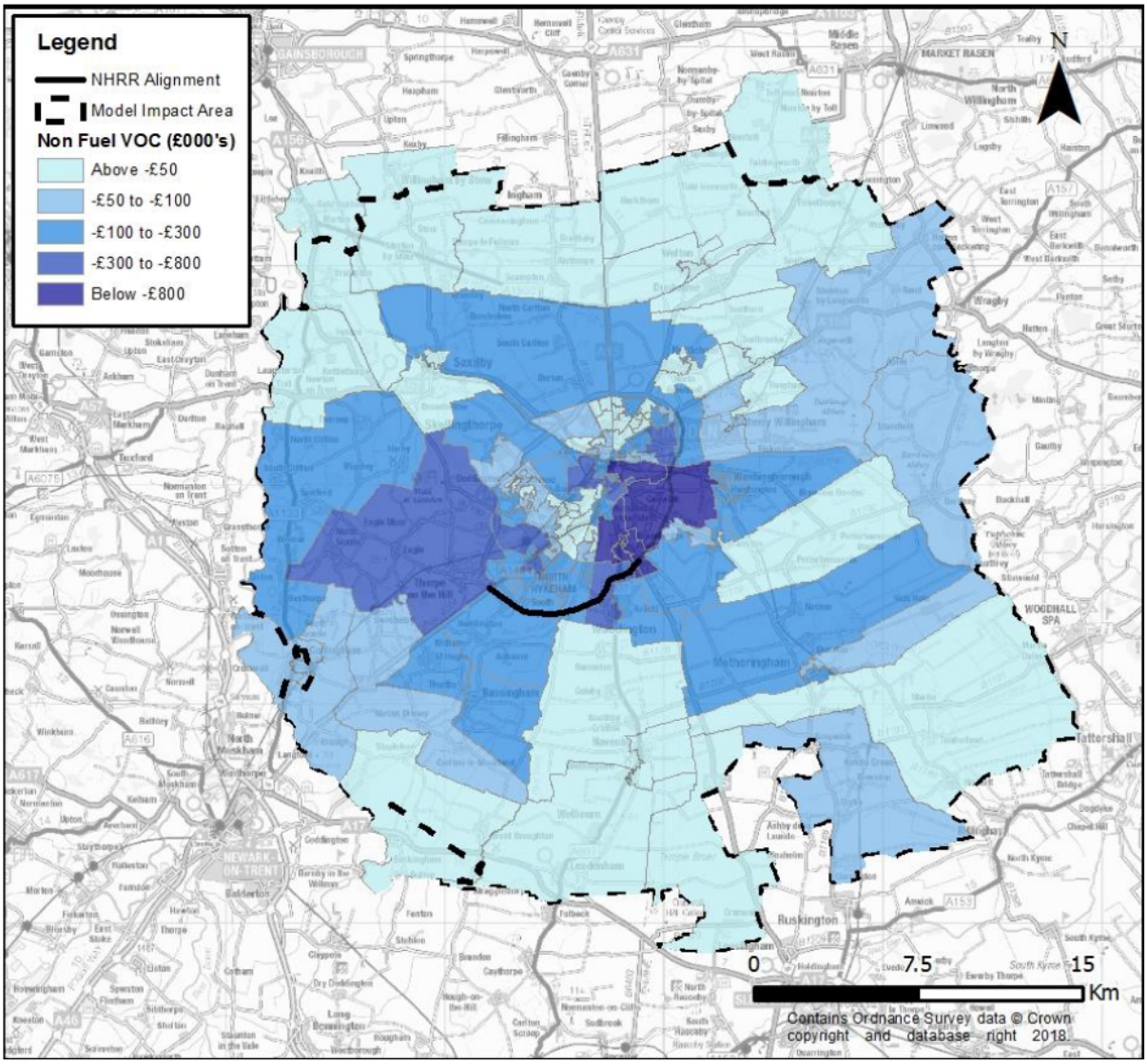
Key points include:

- There is a dis-benefit across all income domain groups;
- The highest dis-benefited group is the least income deprived group (80%<100%); and
  The least dis-benefit is experienced by the income domain group between 40%<60% which makes up 20% of the population.

Given the fuel and non-fuel operating costs covers the same area as the user benefits a separate visual representation of the income domain quintiles is not presented within this indicator and instead can be found in Figure 3-2.

Figure 3-11 shows where the monetary disbenefits are being accrued within the impact area by LSOA level.

Figure 3-11 - Fuel and non-fuel operating cost distribution



Given the evidence has shown that there is a dis-benefit across all income domain quintiles, the DI of Personal Affordability for NHRR has been appraised as Moderate Adverse.

4 CONCLUSION

A summary of each indicator score is presented within the table below.

Table 4-1 – Assessment scores

Assessment type	Indicator	Score
Social impact appraisal	Security	Slight beneficial
	Accessibility	Scoped out
	Physical activity	Slight beneficial
	Journey quality	Slight beneficial
Distributional impact appraisal	User benefits	Moderate beneficial
	Noise	–
	Air quality	–
	Accidents	Moderate beneficial
	Severance	Large beneficial
	Personal affordability	Moderate adverse

Appendix A

ACCESSIBILITY MAPS

ACCESSIBILITY MAPS

Figure App-1 - Lincoln bus route

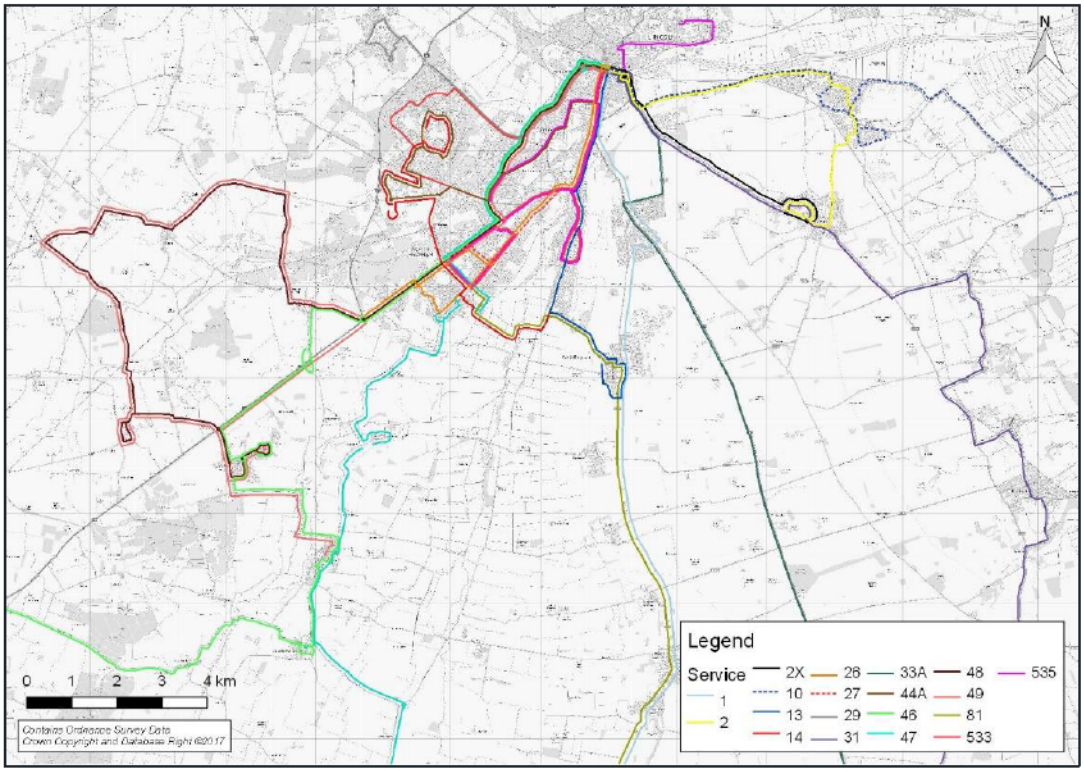
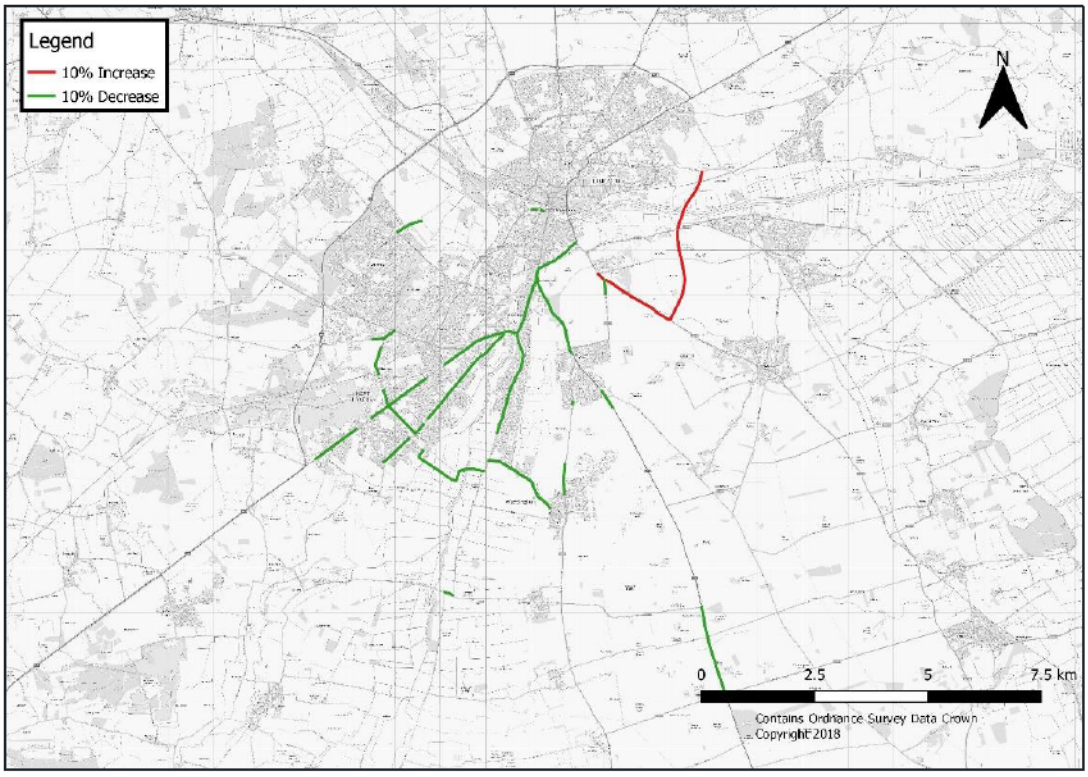


Figure App-2 - Change in traffic flow



Appendix B

SCREENING PROFORMA

SCREENING PROFORMA

Table App-1 – Distributional Impact Appraisal Screening Proforma

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2
User benefits	The TUBA user benefit analysis software or an equivalent process has been used in the appraisal; and/or the value of user benefits Transport Economic Efficiency (TEE) table is non-zero.	Yes. Expected to be positive overall.	TUBA will be used to assess user benefits. Significant positive benefits as a result of the improved journey times for east west traffic and reduction in congestion on the major routes through and around Lincoln.	Yes
Noise	Any change in alignment of transport corridor or any links with significant changes (>25% or <-20%) in vehicle flow, speed or %HDV content. Also note comment in TAG Unit A3.	Yes. Not known at this stage whether overall impact on sensitive receptors will be positive or negative.	Desktop study and noise measurement surveys have been undertaken and modelling is currently in progress. It is anticipated there will be 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. However, the NHRR could also introduce traffic impacts to new receptors and change the location of Noise Impact Areas which may have adverse noise impacts on the surrounding receptors.	Yes
Air quality	Any change in alignment of transport corridor or any links with significant changes in vehicle flow, speed or %HDV content: • Change in 24-hour AADT of 1000 vehicles or more • Change in 24-hour AADT of HDV of 200 HDV vehicles or more • Change in daily average speed of 10kph or more • Change in peak hour speed of 20kph or more • Change in road alignment of 5m or more	Yes. Not known at this stage whether overall impact on sensitive receptors will be positive or negative.	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 PM10 and NO2 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.	Yes

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2
Accidents	Any change in alignment of transport corridor (or road layout) that may have positive or negative safety impacts, or any links with significant changes in vehicle flow, speed, %HGV content or any significant change (>10%) in the number of pedestrians, cyclists or motorcyclists using road network.	Yes. Expected to be positive impacts.	The scheme will reduce traffic in existing residential areas with the south of Lincoln and provide a new strategic route. The accident appraisal shows a positive impact over the 60-year appraisal period as a result of significant traffic flow changes.	Yes
Security	Any change in public transport waiting/interchange facilities including pedestrian access expected to affect user perceptions of personal security.	No	No direct impact on public transport waiting/interchange facilities which would affect user perception of security.	No
Severance	Introduction or removal of barriers to pedestrian movement, either through changes to road crossing provision, or through introduction of new public transport or road corridors. Any areas with significant changes (>10%) in vehicle flow, speed, %HGV content.	Yes	It is anticipated that traffic will re-route from the local road network south of Lincoln onto NHRR resulting in less traffic on the local road network. Traffic acts as a barrier to walking and cycling including at peak times where there is evidence of rat running on the local road network. Furthermore, a shared pedestrian and cycle route on the north side of NHRR and a bridleway on the south side of NHRR will be provided. This will reduce barriers to cycling and walking.	Yes
Accessibility	Changes in routings or timings of current public transport services, any changes to public transport provision, including routing, frequencies, waiting facilities (bus stops / rail stations) and rolling stock, or any indirect impacts on accessibility to services (e.g. demolition & re-location of a school).	No	No direct impact on routings, frequencies, timings or rolling stock of current public transport services form part of the scheme. No demolition or relocation of key facilities is required. Indirectly, the implementation of the scheme may provide the opportunity for public transport operators to reschedule services, as a result of journey time savings afforded by NHRR. In addition, new public transport services could be introduced as part of the new dependent developments (SWQ) associated with the scheme. However these impacts are outside of the scope of this project and as a result cannot be assessed.	No

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2
Affordability	In cases where the following charges would occur; Parking charges (including where changes in the allocation of free or reduced fee spaces may occur); Car fuel and non-fuel operating costs (where, for example, rerouting or changes in journey speeds and congestion occur resulting in changes in costs); Road user charges (including discounts and exemptions for different groups of travellers); Public transport fare changes (where, for example premium fares are set on new or existing modes or where multi-modal discounted travel tickets become available due to new ticketing technologies); or Public transport concession availability (where, for example concession arrangements vary as a result of a move in service provision from bus to light rail or heavy rail, where such concession entitlement is not maintained by the local authority[1]).	Yes - Expected to be positive	Positive car fuel and non-fuel cost benefits are expected as a result of rerouting, increase in journey speeds and congestion relief and have been assessed in TUBA.	Yes

Appendix C

AIR QUALITY MAPS

AIR QUALITY MAPS

Figure App-3 - No_2 2026

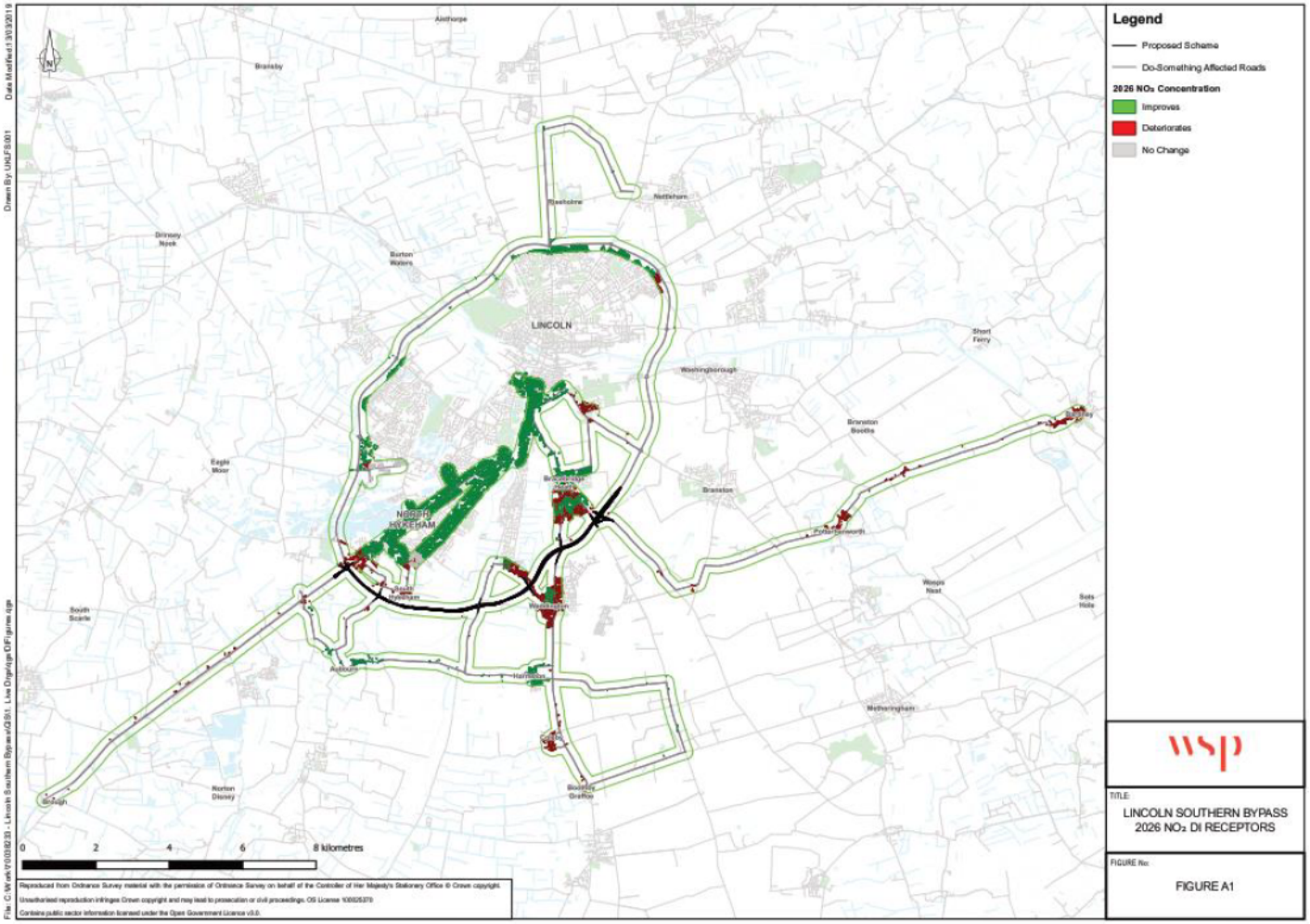


Figure App-4 - No2 2041

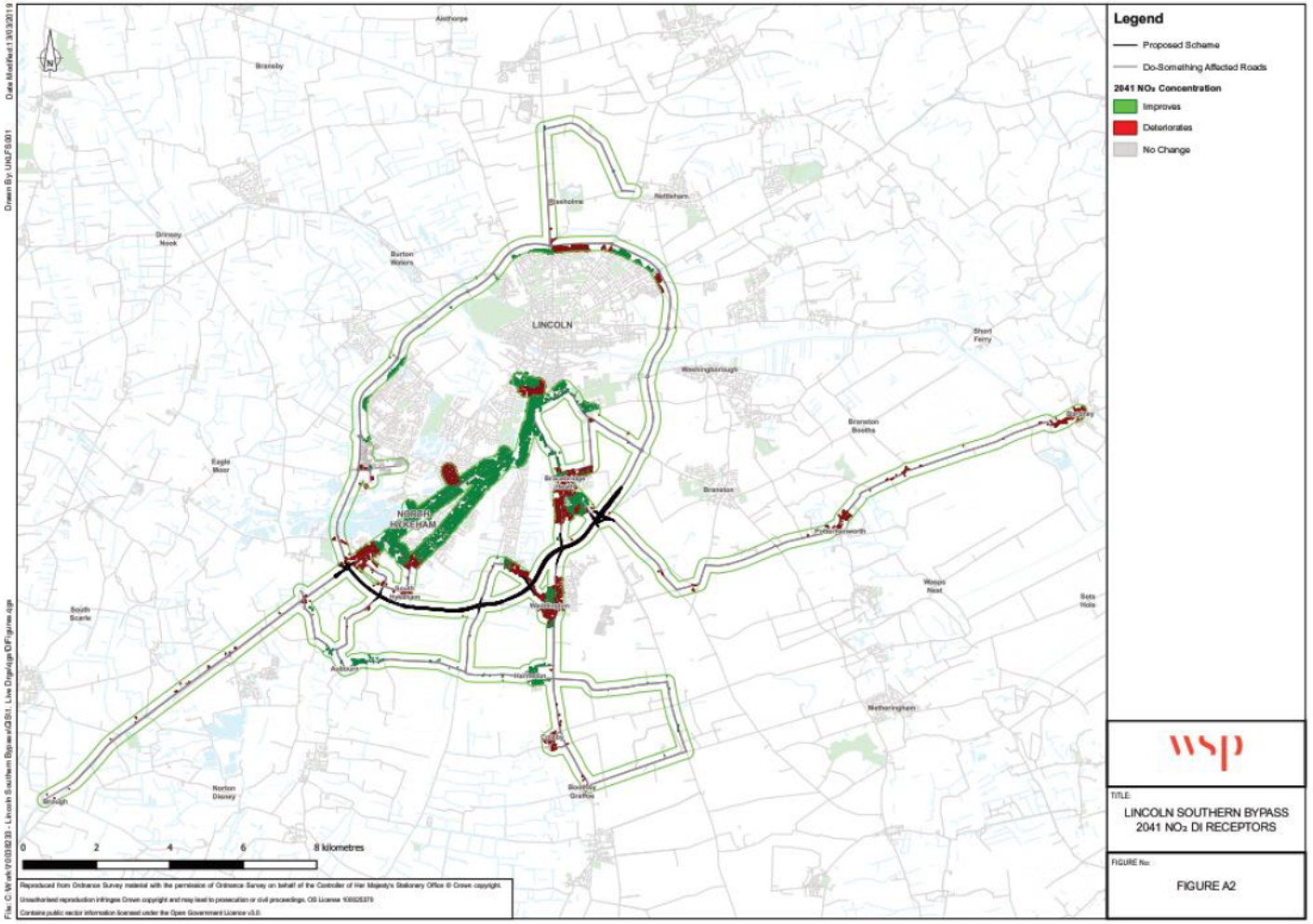


Figure App-5 - PM_{10} 2026

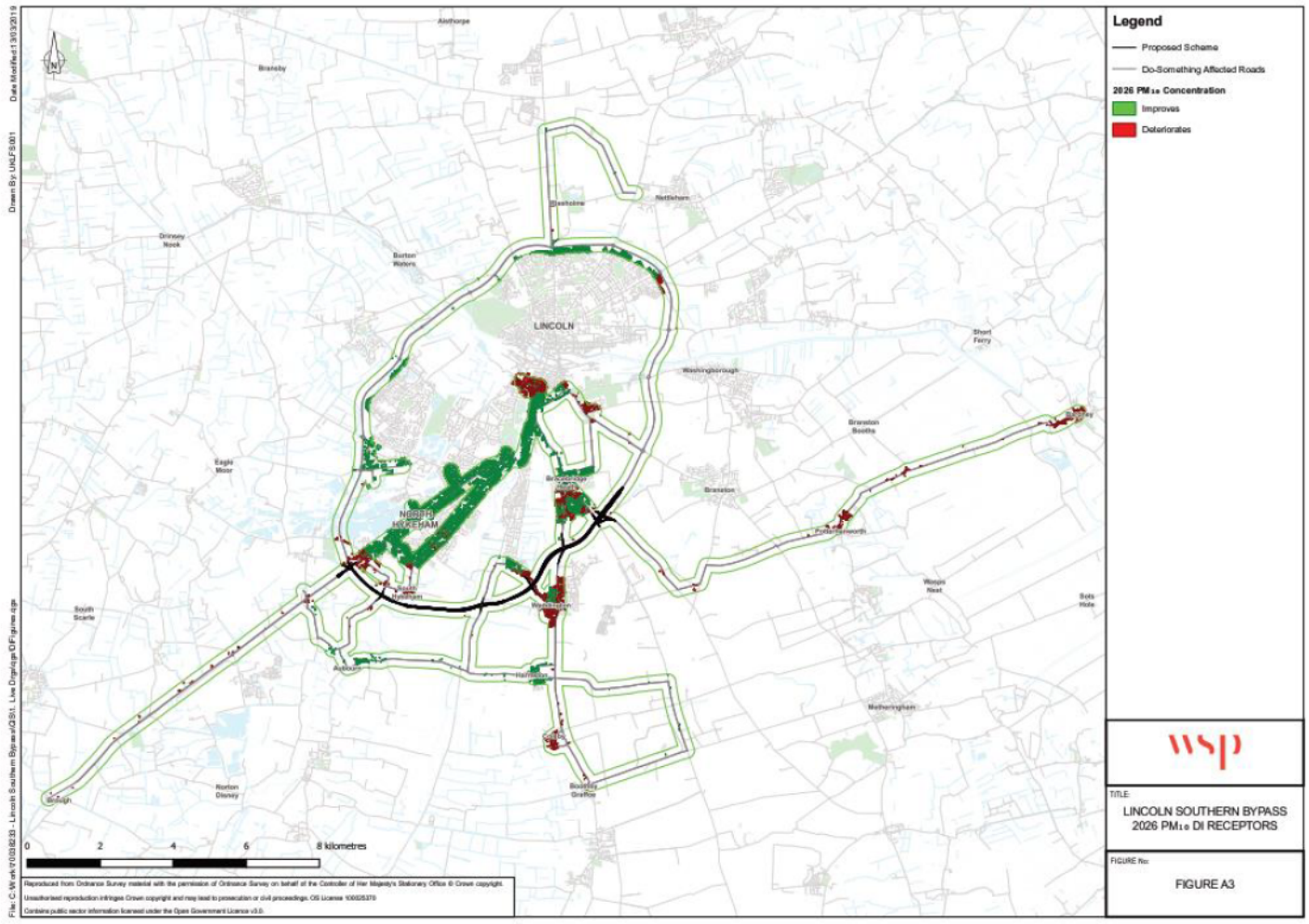
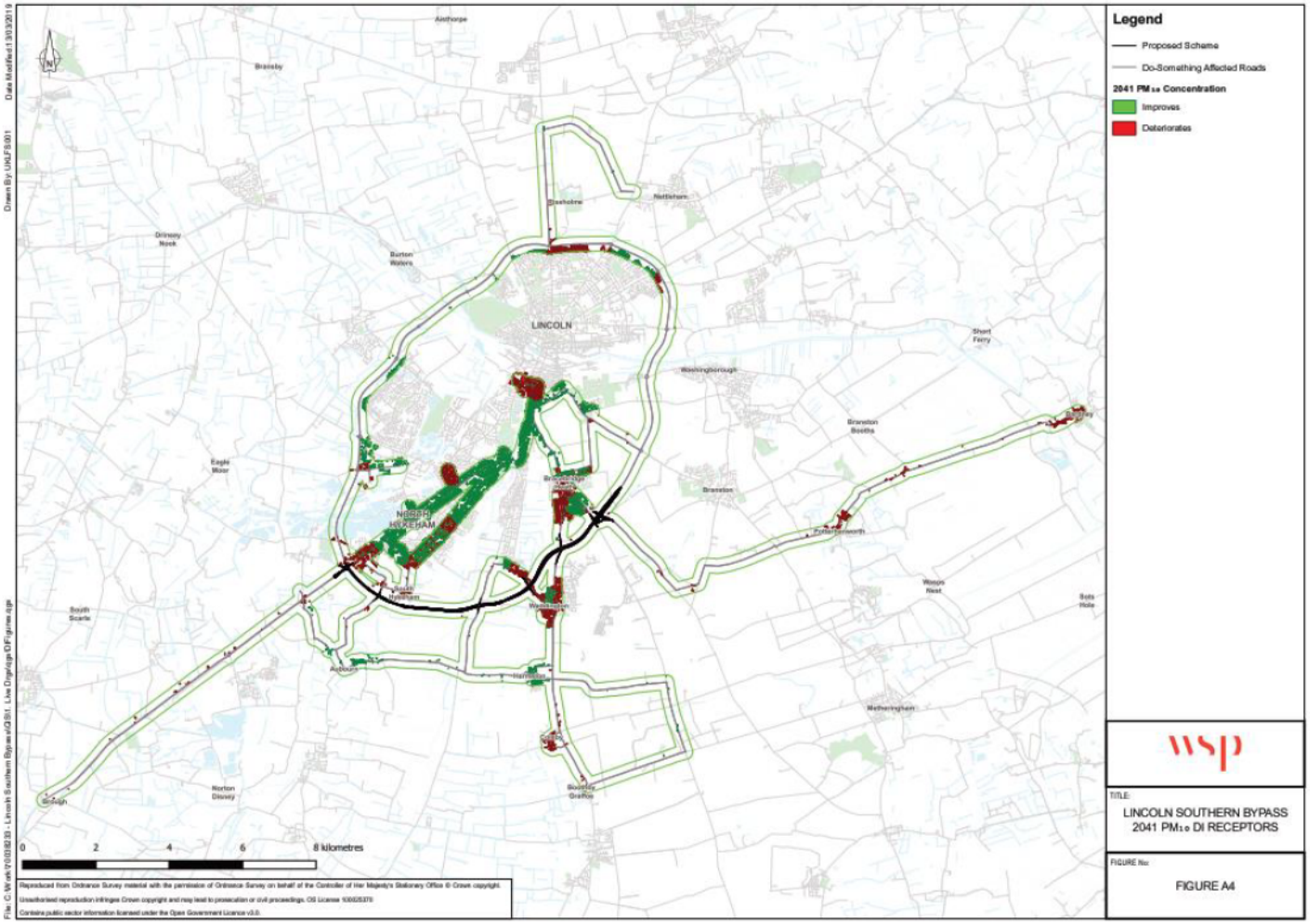


Figure App-6 - PM_{10} 2041



Appendix D

ACCIDENTS MAPS

ACCIDENTS MAPS

Figure App-7 – Collision by Severity (2013 – 2017)

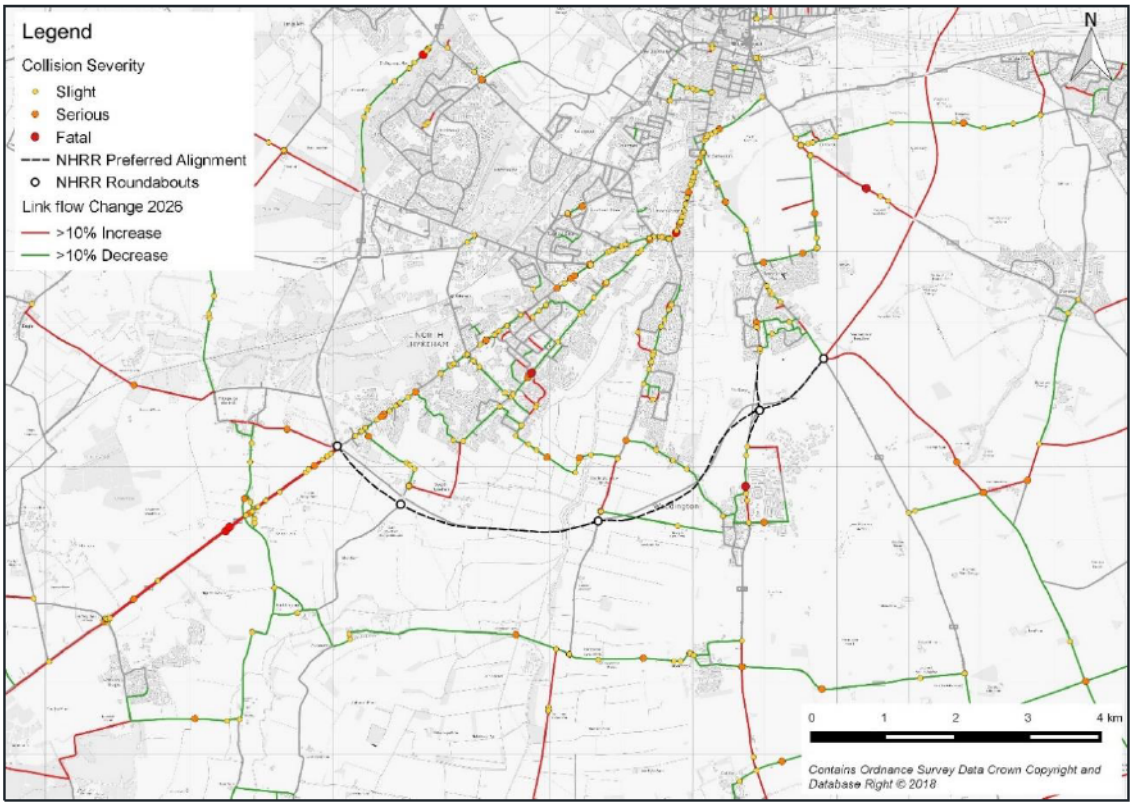


Figure App-8 – Collision Involving Children Under 16 (2013 – 2017)

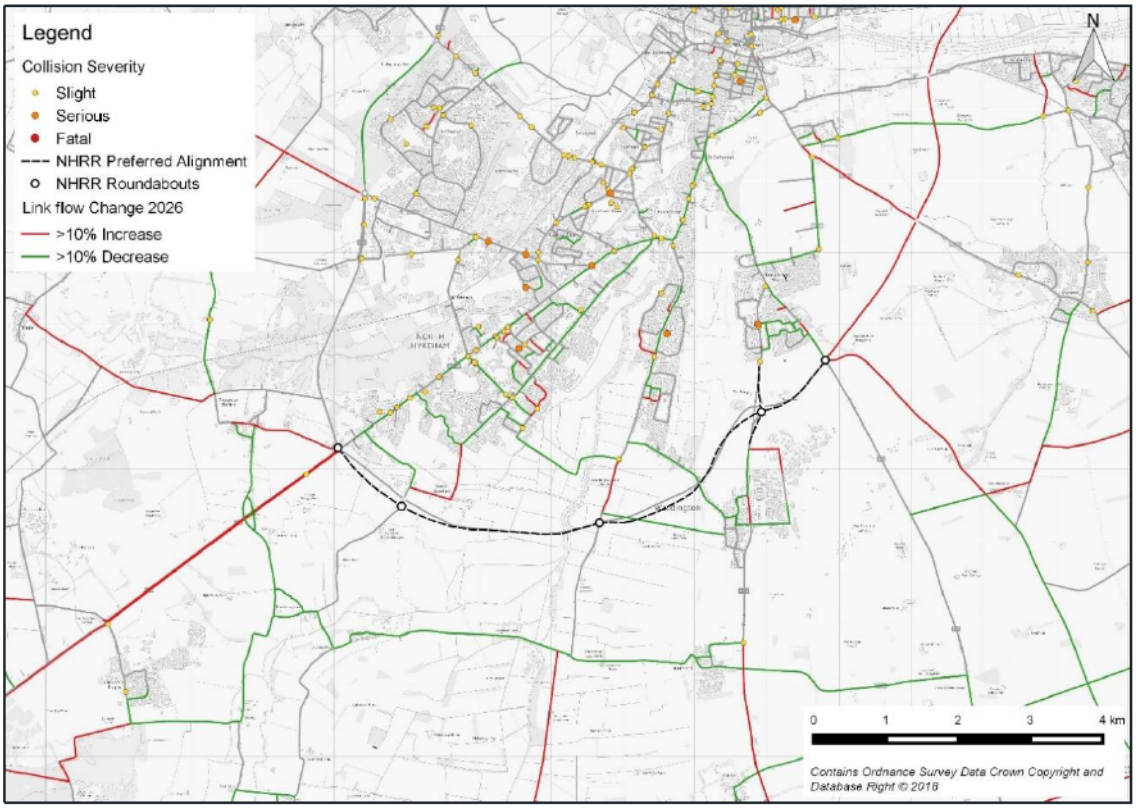


Figure App-9 – Collision Involving those Aged (2013 – 2017)

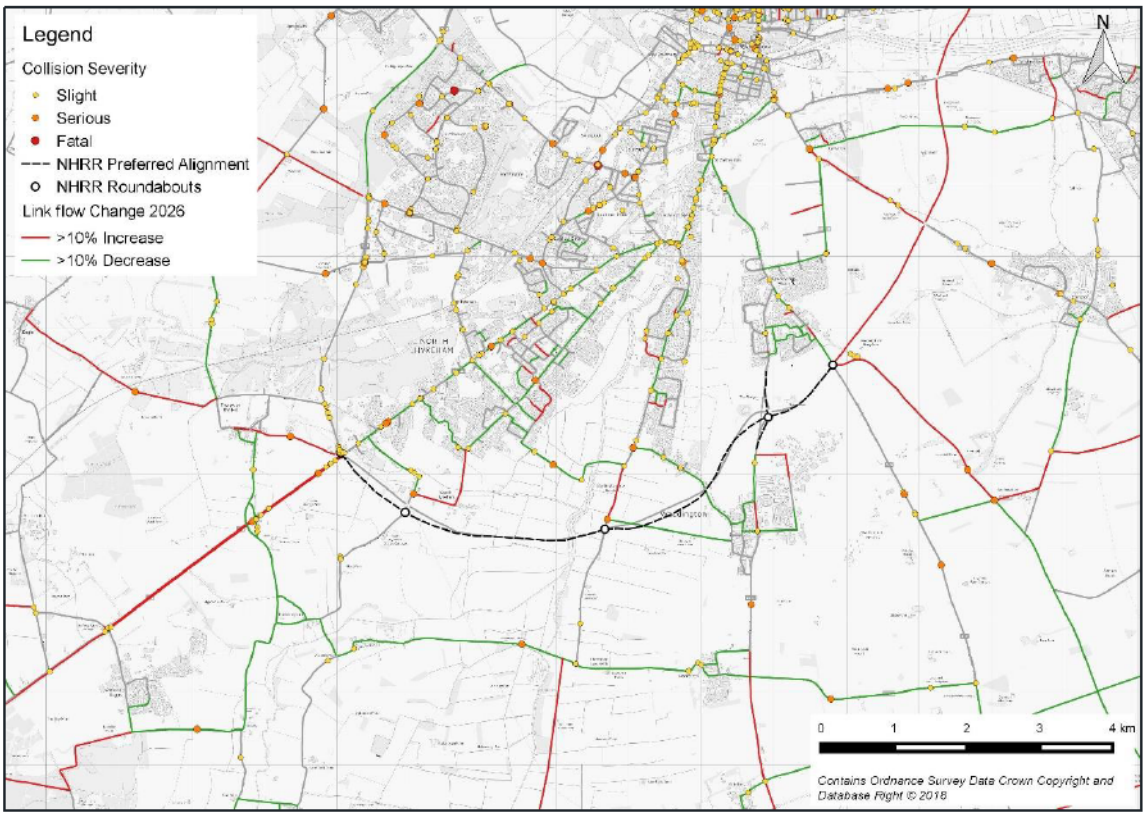


Figure App-10 – Collision Involving those Over 65 (2013 – 2017)

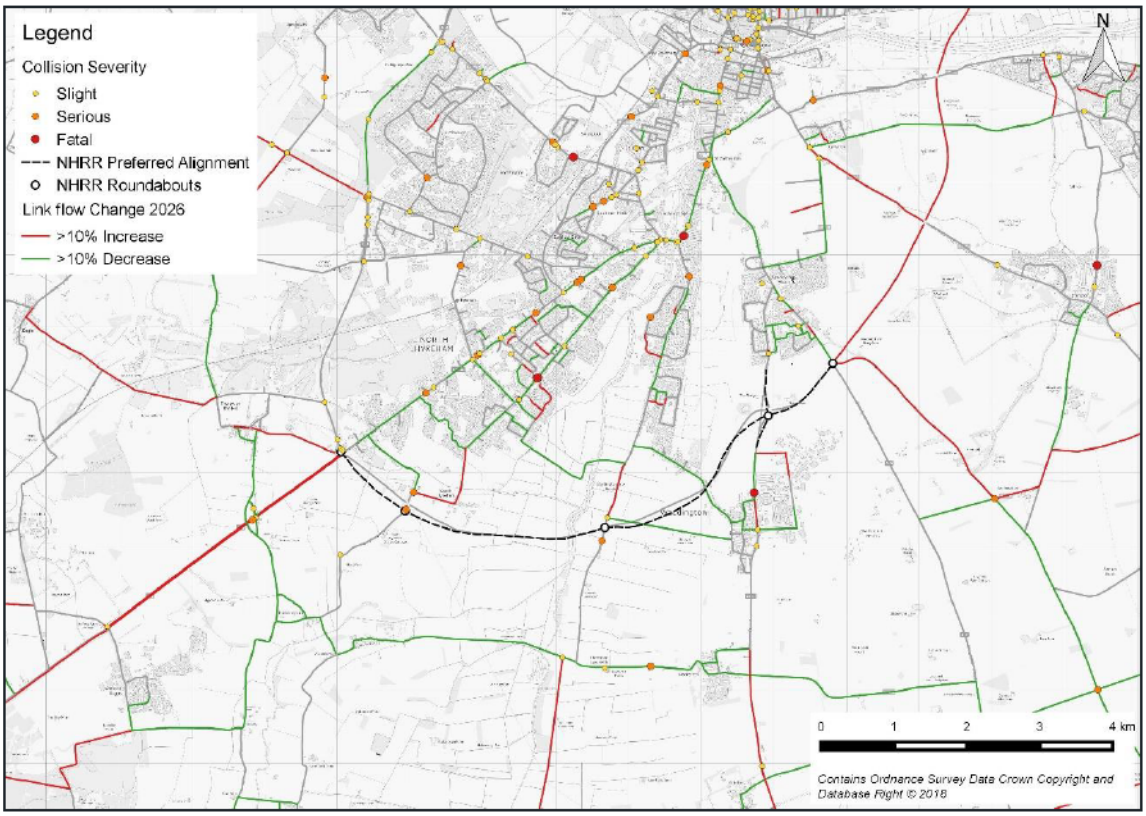


Figure App-11 – Collision Involving Pedestrians by Severity (2013 – 2017)

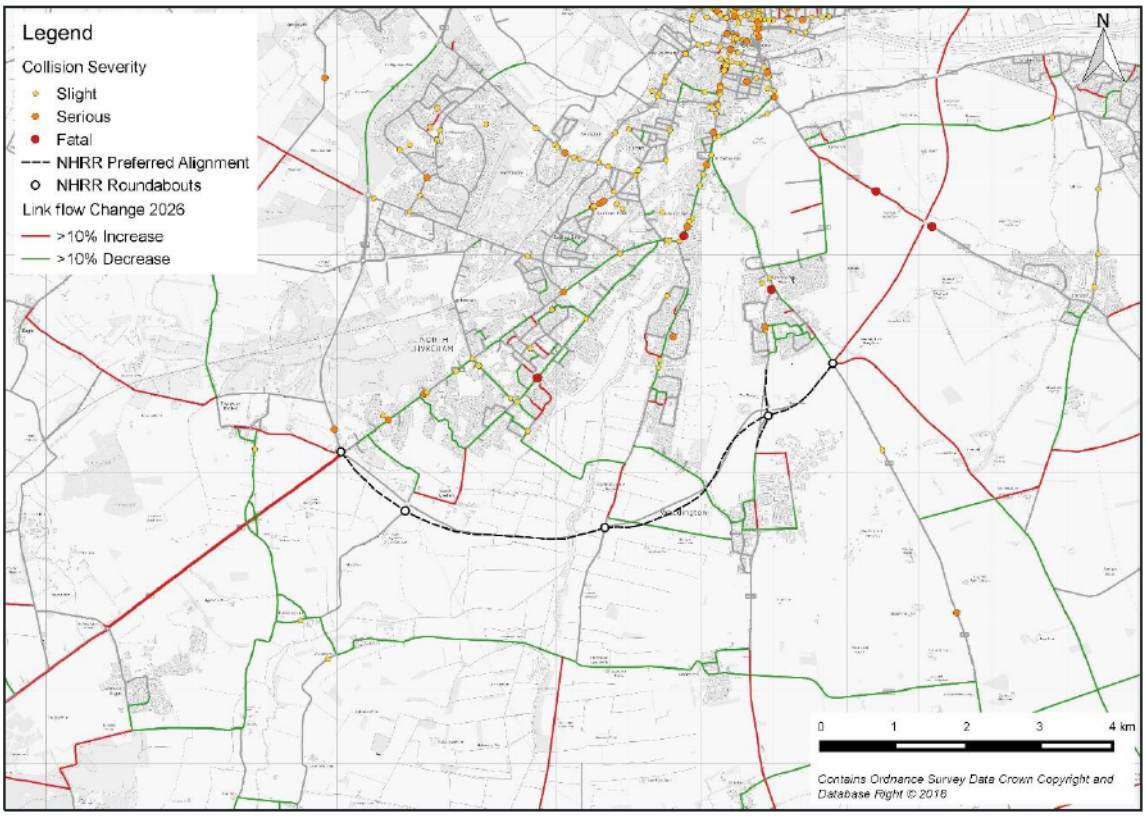


Figure App-12 – % of Children Under 16