A12 Chelmsford to A120 widening scheme

TR010060

7.3 Combined Modelling and Appraisal Report

Appendix F: Distributional Impact Report

APFP Regulation 5(2)(q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 7

August 2022

Infrastructure Planning

Planning Act 2008

A12 Chelmsford to A120 widening scheme

Development Consent Order 202[ ]

7.3 COMBINED MODELLING AND APPRAISAL REPORT
APPENDIX F: DISTRIBUTIONAL IMPACT REPORT

Regulation Reference	Regulation 5(2)(q)
Planning Inspectorate Scheme Reference	TR010060
Application Document Reference	TR010060/APP/7.3
Author	A12 Project Team, National Highways

Version	**Date**	**Status of Version**
Rev 1	August 2022	DCO Application

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1 Introduction

1.1 Purpose of report

This report is one of a series of documents that set out the scheme's traffic modelling and economic assessment. These include:

- Transport Data Package Report
- Transport Model Package Report
- Transport Forecasting Package Report
- Economic Appraisal Package Report
- Appraisal Summary Table and Worksheets
- Distributional Impacts Report

Each of these documents are provided as appendices to the overall Combined Modelling and Appraisal (ComMA) Report.

The assessment of Distributional Impacts (DIs) is designed to help understand the impacts of transport interventions on different groups of people, including those people that are potentially more vulnerable to the effects of transport.

The appraisal of DIs is split into three steps. Step 1 forms the screening phase, Step 2 forms the assessment and Step 3 forms the appraisal of impacts. All three steps are considered within this report.

Consideration of the DIs of transport schemes is a mandatory requirement of the Department for Transport's (DfT) Transport Analysis Guidance (TAG). This report has therefore been produced in line with best practice guidance set out in the following TAG Unit A4.2: Distributional Impact Appraisal (May 2020).

1.2 Structure of report

Following the introduction, the structure of this report is:

Chapter 2 Methodology Overview

Chapter 3 Screening Process

Chapter 4 Distributional Impact of User Benefits

Chapter 5 Distributional Impact of Personal Affordability

Chapter 6 Distributional Impact of Accidents

Chapter 7 Distributional Impact of Noise

Chapter 8 Distributional Impact of Air Quality

Chapter 9 Distributional Impact of Severance

2 Methodology Overview

2.1 Introduction

As per TAG Unit A4.2 the DI Appraisal requires the consideration of the following eight DI Indicators:

- Noise
- Air Quality
- Accessibility
- Security
- Severance
- User Benefits
- Affordability
- Accidents

This chapter presents an overview of the appraisal process required for these indicators.

The appraisal process is based on a three-step approach:

- Step 1 – Screening Process
- Step 2 – Assessment
- Step 3 – Appraisal of Impacts

The following sections provide an overview of each step.

2.2 Step 1: Screening Process

To ensure a proportionate approach to the appraisal, TAG suggests that each indicator should be assessed individually to determine whether it needs to be appraised further. Consideration is given to whether:

- The transport intervention might have a negative or positive impact on specific social groups such as children, older people, people with a disability, people without access to a car and people on low incomes
- Some or all of the expected negative impacts can be eliminated through amendment or re-design
- The impacts are sufficiently minor and / or spatially dispersed such that a detailed DI appraisal is disproportionate to the potential impacts.

Where impacts are either significant or concentrated a further analysis is required.

2.3 Step 2: Assessment

Step 2 is divided into three further sub-sets, which are described below.

Step 2a: Confirmation of areas impacted by the intervention

Step 2a of the DI appraisal process identifies the overall affected area for those indicators identified in Step 1. Some indicators may have the common area of impact. However, the affected area should be defined for each indicator separately.

Step 2b: Identification of social groups on the impact area

This step analyses the socio-economic, social and demographic characteristics of:

- Transport users that will experience changes in travel costs resulting from the scheme
- People living in the area who may experience impacts of the scheme
- People travelling in areas identified as likely to be affected by the scheme

Step 2c: Identification of amenities in the impact area

This step identifies the local amenities which are likely to be used by the identified social groups for each indicator such as schools, nurseries, hospitals, community centres etc.

2.4 Step 3: Appraisal of Impacts

Step 3 provides an assessment of the impact of the intervention on each indicator's social groups for input into the AST and is divided into Core and Full appraisal.

Step 3a: Core analysis of impacts

Core appraisal provides an assessment score for each indicator and each social group under consideration. The assessment score follows the bespoke guidance given for each indicator as set out in relevant sections of TAG Unit A4.2, but follows the broad principles set out in Table 5 of the guidance as shown below in Plate 2-1 below.

Step 3b: Full Appraisal of DIs

The full analysis provides a qualitative comment of each indicator to describe the key impacts in each case for input into Appraisal matrix.

Plate 2-1: System for grading DIs

Table 5 General system for grading of DIs for each of the identified social groups	
Impact	**Assessment**
Beneficial and the population impacted is significantly greater than the proportion of the group in the total population	Large Beneficial ✓✓✓
Beneficial and the population impacted is broadly in line with the proportion of the group in the total population	Moderate Beneficial ✓✓
Beneficial and the population impacted is smaller than the proportion of the group in the total population	Slight Beneficial ✓
There are no significant benefits or disbenefits experienced by the group for the specified impact	Neutral
Adverse and the population impacted is smaller than the proportion of the population of the group in the total population	Slight Adverse ×
Adverse and the population impacted is broadly in line with the proportion of the population of the group in the total population	Moderate Adverse ××
Adverse and the population impacted is significantly greater than the proportion of the group in the total population	Large Adverse ×××

3 Screening Process

3.1 Introduction

Step 1 identifies which of the eight DI indicators should proceed to Step 2, by assessing whether their impacts are either significant or concentrated. In accordance with DfT requirements, this assessment has been undertaken using a screening proforma provided in TAG Unit A4.2, which has been completed and is shown in Table 3-1.

Table 3-1: 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, Positive	Industry standard TUBA software has been used to analyse the travel time and VOC benefits. There are expected journey time improvements along the A12 for all vehicles. User benefits will be gained from reduced congestion and higher vehicle speeds travelling along this route.	**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, Positive and Negative	The proposed scheme will increase capacity resulting in increased flows on the A12. This may also affect flows on surrounding connections to the A12. As some links have a flow change greater than 25% a DI noise appraisal will be required.	**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, Positive and Negative	The proposed scheme will increase capacity resulting in changes in traffic flows across different routes, increased average speeds and reduced delay on some parallel routes to the A12. An Air Quality DI Appraisal will be required as the scheme will result in changes in AADT greater than 1000 vehicles on some links.	**Yes**
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, Positive and Negative	A COBALT assessment was undertaken which showed a mixture of increases and decreases in accidents across the road network. The impact of this change on vulnerable groups will be assessed in this DI report.	**Yes**
Security	Any change in public transport waiting/interchange facilities including pedestrian access expected to affect user perceptions of personal security.	Yes, Slight beneficial	The impact of the scheme is slight; detailed surveys of the number of vulnerable users is not available.	**No**

Indicator	(a) Appraisal output criteria	(b) Potential impact (yes / no, positive/ negative if known)	(c) Qualitative Comments	(d) Proceed to Step 2
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, Moderate Beneficial	There is an overall moderate beneficial improvement in severance; however, surveys of the number of vulnerable users are not available.	**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 expected impact on accessibility	The scheme design does not specifically address public transport routes.	**No**
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).	Yes, Negative	The scheme is not expected to impact on public transport fares. The proposed scheme is expected to result in a change in car fuel and non-fuel operating costs. Therefore, the impact of Affordability will require a DI appraisal.	**Yes**

3.2 Results of Screening Process

Table 3-1 (Column D) demonstrates that six DI indicators fulfil the criteria to be taken to Step 2 of the appraisal. These are:

- User Benefits
- Affordability
- Accidents
- Noise
- Air Quality
- Severance

The indicators listed above have been taken forward to Steps 2 and 3 of the appraisal and are discussed in the following chapters of the report individually.

4 Distributional Impact of User Benefits

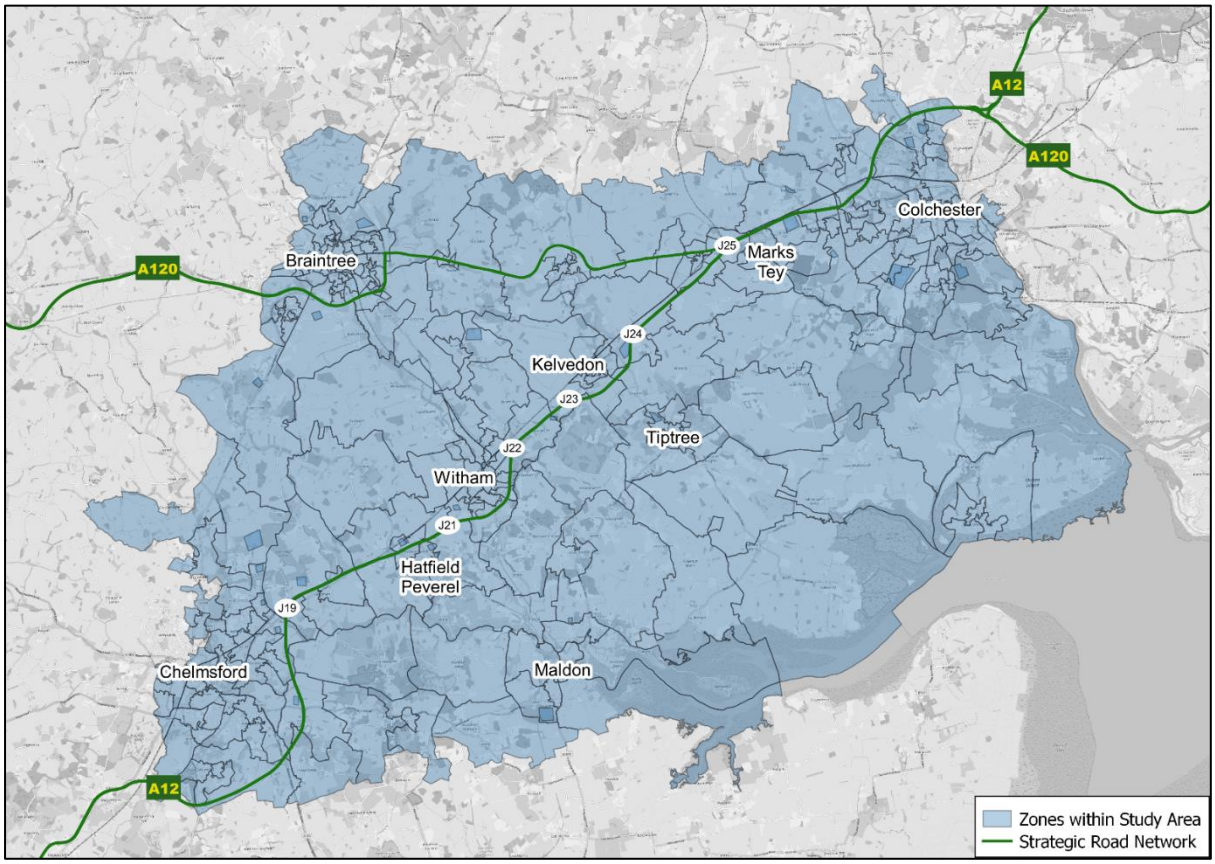
4.1 Introduction

User Benefits concern the travel time and vehicle operating cost (VOC) benefits provided by the scheme. These benefits were calculated using the industry standard software TUBA in accordance with TAG Unit A1.3 and are reported in the Economic Appraisal Package. The DI appraisal of User Benefits is only concerned with home-based non-business car trips within the affected area.

4.2 Step 2a: Confirmation of areas impacted by the intervention

TAG guidance states that the impact area for User Benefits is defined as the area in which the transport intervention will result in changes to the costs of travel (including both time-based costs and financial costs) for users of the transport network. National Highways Guidance clarifies the TAG requirement by indicating that, for User Benefits and Affordability, the overall affected area should be the simulation area of the local traffic model used in TUBA analysis (see Plate 4-1).

Plate 4-1: User Benefits Model Zones Area of Impact

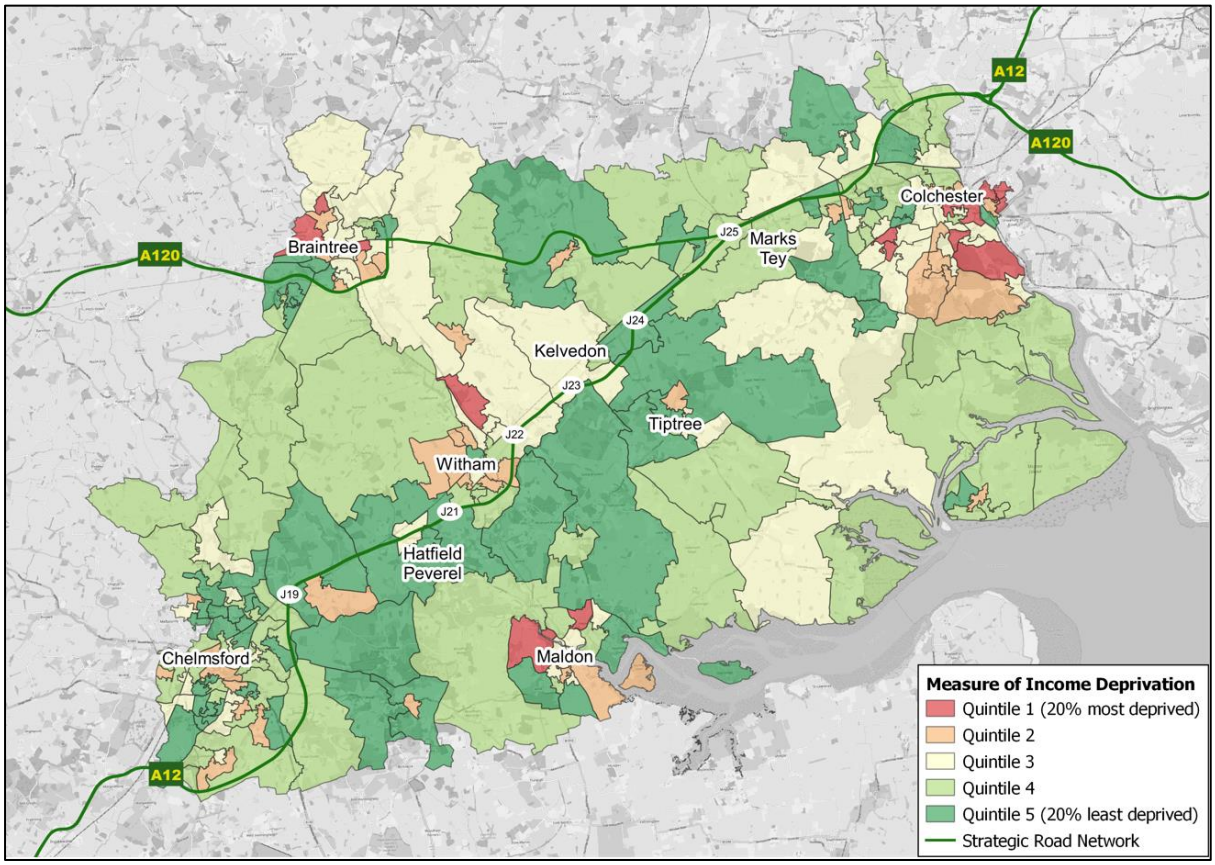


4.3 Step 2b: Identification of Social Groups in the Affected Area

The identification of social groups within the affected area is initially limited to identifying the groups of people with different level of income based on the national quintiles for each Census output within the impact area.

The income segmentation is based upon the 2019 Indices of Income Deprivation at Lower Super Output Area (LSOA) level. Using the national deprivation ranking (as a proxy for income), the LSOAs have been divided into 5 quintiles. Quintile 1 represents the 20% most deprived LSOAs whereas quintile 5 represents the 20% least deprived LSOAs. A map of LSOAs by income quintile in the User Benefits affected area is provided in Plate 4-2.

Plate 4-2: LSOAs by income quintile in the User Benefit Affected Area



Mid-year 2019 Office for National Statistics data has been used to determine the population within each of the LSOAs and therefore the total population by income quintile within the User Benefits affected area.

Population estimates for each of the Income Quintiles within the User Benefits Affected Area are summarised in Table 4-1. It shows that the population living in the area of impact is distributed among all five quintiles, with 6% in the most deprived income quintile and 23% living in the least deprived income quintile.

Table 4-1: LSOAs and Population by Income Group

	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
No of LSOAs in Affected Area	15	38	58	63	57	231
Population in Affected	25,914	65,265	106,244	114,446	95,211	407,080
% of Total Population in Affected Area	6%	16%	26%	28%	23%	100%

4.4 Step 2c: Identification of Amenities in the Affected Area

As per the TAG A4.2, the identification of amenities is not required for the User Benefits and Personal Affordability DI appraisal.

4.5 Step 3a: Core Analysis of Impacts

The core analysis aims to assess how the travel time and VOC benefits are distributed among different income groups.

Travel time and VOC benefits are calculated in TUBA. As reported in the Economic Appraisal Package, a TUBA analysis has been undertaken on the full A12 transport model area.

The analysis has been undertaken for the standard 60 year appraisal period and assumes an opening year of 2027 and a horizon year of 2086.

The TUBA results are split down into the following vehicle categories and journey purposes:

- Car Commute
- Car Employers Business
- Car Other (Leisure, Education etc.)
- Light Goods Vehicles (LGVs)
- Heavy Goods Vehicles (HGVs)

To assess the distributional impacts of the User Benefits Indicator, the following steps were undertaken:

Isolating the benefits from within the Affected Area

The first stage in the process was to isolate the affected area benefits. This has been achieved by using the 'sectors' feature available in TUBA. The model zoning system consists of a total of 579 zones. Out of these, 311 are in the User Benefits affected area and the remaining 267 are external to that area. For simplicity, the external zones were merged into one zone. The TUBA output was extracted for the 312

sectors comprising both affected and external zones. All the benefits associated with people who live in the external area were removed from the analysis.

Isolating the benefits from non-car business trips only

DI of User Benefits is only concerned with non-business car trips (i.e. Car Commute and Car Other journey purposes). Therefore, the second stage in the process was to remove the business trips and non-car trips from the TUBA results.

Assessing home-based benefits

The third stage in the process is to assign benefits to the home end of the trip. As the TUBA assessment is based on Origin-Destination matrices rather than Production-Attraction matrices, the origin of a trip is not necessarily home. Thus, to overcome this issue National Highways guidance note suggests that the zonal benefits in the AM Peak should be the total of the benefits from that zone (Origin trips) and in the PM Peak the zonal benefits should be the total of the benefits to that zone (Destination trips). For the Inter Peak and Weekend periods the zonal benefits can be taken as the average of the sum of the benefits to and from each zone.

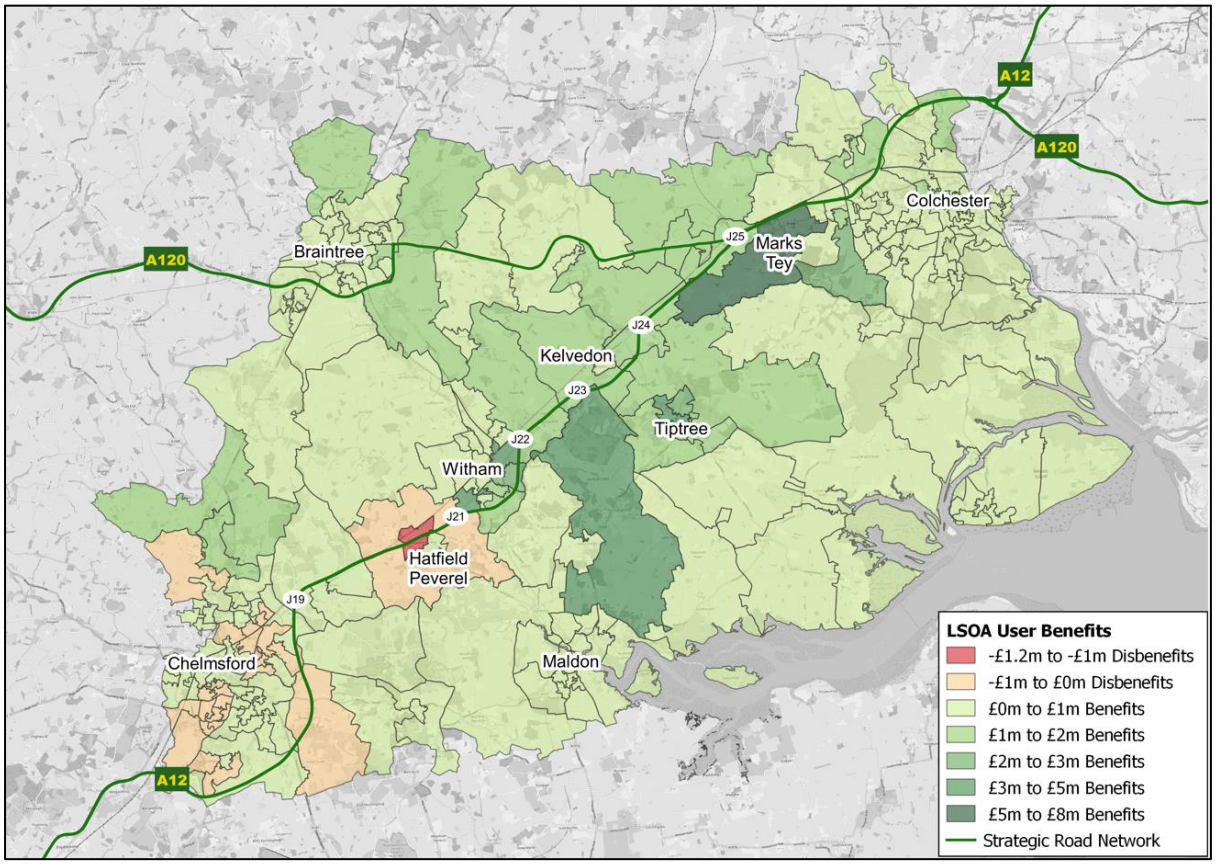
This approach is justified based on the assumption that there is likely to be a very high proportion of home based car trips (commuting and other) leaving individual zones in the AM peak and conversely a high proportion of home based car trips (commuting and other) entering individual zones in the PM Peak.

Aggregate / disaggregate the TUBA zonal benefits into each LSOA

This stage is necessary because the DI analysis requires benefits to be presented at the LSOA level so that assessment by income quintile can be undertaken. As the transport model/TUBA zoning system is not completely based on LSOAs the zone boundaries do not always match the LSOA boundaries. The benefits were re-mapped to LSOA boundaries. In cases where there were multiple LSOAs per zone, the benefits were split evenly across the LSOAs.

Plate 4-3 shows the distribution of user benefits for each LSOA within the study area.

Plate 4-3: LSOA User Benefit



The LSOA User Benefits plot shows that the most significant benefits are in the areas surrounding the proposed scheme, in particular in Marks Tey, Witham and Tiptree. This plate shows that there are some journey time disbenefits in Hatield Peverel. This relates to the the fact that A12 junctions 20a and 20b are being removed from the centre of the village. Although this provides significant benefits in terms of reducing traffic through the village, it does result in some slightly longer journey for trips starting or finishing in the village.

Analysis of Results

A summary of the DI assessment for the User Benefits of the proposed scheme, reported per income quintile, is provided in Table 4-2. In line with TAG the assessment score is based on how the proportion of User Benefits of each income group relates to the proportion of each income group population within the study area.

Table 4-2: Summary of User Benefits DI Analysis. All benefits discounted to 2010 in 2010 prices

User Benefits	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Benefits [A]	£3.8m	£20.0m	£26.1m	£44.0m	£28.0m	£121.8m
Share of overall benefits [B] = [A]/ Σ[A]	3%	16%	21%	36%	23%	100%
Population [C]	25,914	65,265	106,244	114,446	95,211	407,080
Share of overall population [D] = [C]/ Σ[C]	6%	16%	26%	28%	23%	100%
Benefits Share – Population Share [C] – [F]	-3%	0%	-5%	8%	0%	
Assessment Score	Moderate Beneficial ✓✓	Moderate Beneficial ✓✓	Moderate Beneficial ✓✓	Large Beneficial ✓✓✓	Moderate Beneficial ✓✓	

The assessment score has been based on the scoring system shown previously in Plate 2-1.

There are positive user benefits for all income groups. This corresponds to a beneficial score within each income quintile.

Quintiles 1, 2, 3 and 5 all receive a share of benefits which are broadly in line with their share of the population, so are awarded a score of Moderate Beneficial.

The 2nd least deprived quintile (quintile 4) experiences proportionally more benefits relative to its population, therefore is awarded a score of Large Beneficial.

5 Distributional Impact of Personal Affordability

5.1 Introduction

Personal Affordability is concerned with out-of-pocket non-business user costs. As the scheme does not introduce road user charging and has no effect on public transport fares, the affordability analysis has been restricted to changes in vehicle operating costs (VOCs).

Therefore, the Personal Affordability DI analysis is based on the results of the same TUBA assessment which was used for the User Benefits indicator but excluding travel time benefits.

5.2 Step 2: Area of Impact, Social Groups and Amenities

The methodology for undertaking Steps 2a to 2c of the DI appraisal for the Personal Affordability Indicator is identical to the methodology used for the User Benefits DI appraisal. The steps are described in detail in Sections 4.2 to 4.4 of the report and the impact area also presented previously in Plate 4-2.

5.3 Step 3a: Core Analysis of Impacts

The Personal Affordability benefits (i.e. home-based non-business car trip VOC benefits calculated in TUBA) have been isolated from the other benefits and attributed to the LSOAs in the same way as it has been done for the User Benefits analysis.

Plate 5-1 shows the VOC benefits for each LSOA and within the study area.

A summary of the DI assessment for Personal Affordability for the proposed scheme is provided in Table 5-1. The assessment scores have been derived using the same grading system as for User Benefits.

Plate 5-1: LSOA VOC Benefits

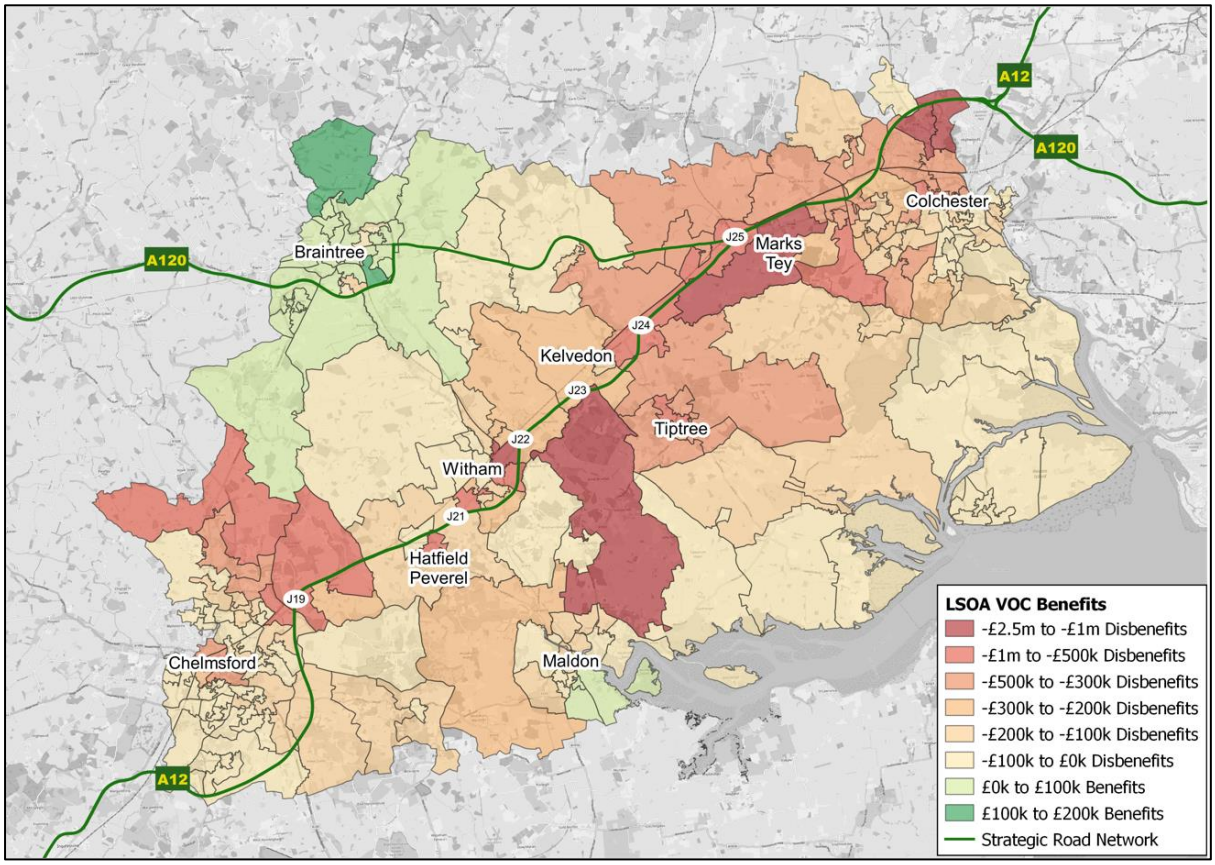


Table 5-1: Summary of Personal Affordability DI Analysis. All benefits discounted to 2010 in 2010 prices

User Benefits	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Benefits [A]	-£1.1m	-£5.7m	-£8.0m	-£16.8m	-£10.3m	-£41.9m
Share of overall benefits [B] = [A]/ Σ[A]	3%	14%	19%	40%	25%	100%
Population [C]	25,914	65,265	106,244	114,446	95,211	407,080
Share of overall population [D] = [C]/ Σ[C]	6%	16%	26%	28%	23%	100%
Benefits Share – Population Share [C] – [F]	-4%	-2%	-7%	12%	1%	
Assessment Score	Moderate Adverse ××	Moderate Adverse ××	Slight Adverse ×	Large Adverse ×××	Moderate Adverse ××	

The results show that all income quintiles within the Affected Area receive an overall affordability disbenefit, therefore in absolute terms each income quintile receives an adverse score. All quintiles, except quintiles 3 and 4, experience a disbenefit which is broadly proportional to its population, as such they receive a score of Moderate Adverse. Quintile 4 experiences more disbenefit than expected relative to its population and is scored as Large Adverse impact. Quintile 3 experiences proportionally fewer disbenefits relative to its population, as such, quintile 3 is awarded a score of Slight Adverse.

6 Distributional Impact of Accidents

6.1 Introduction

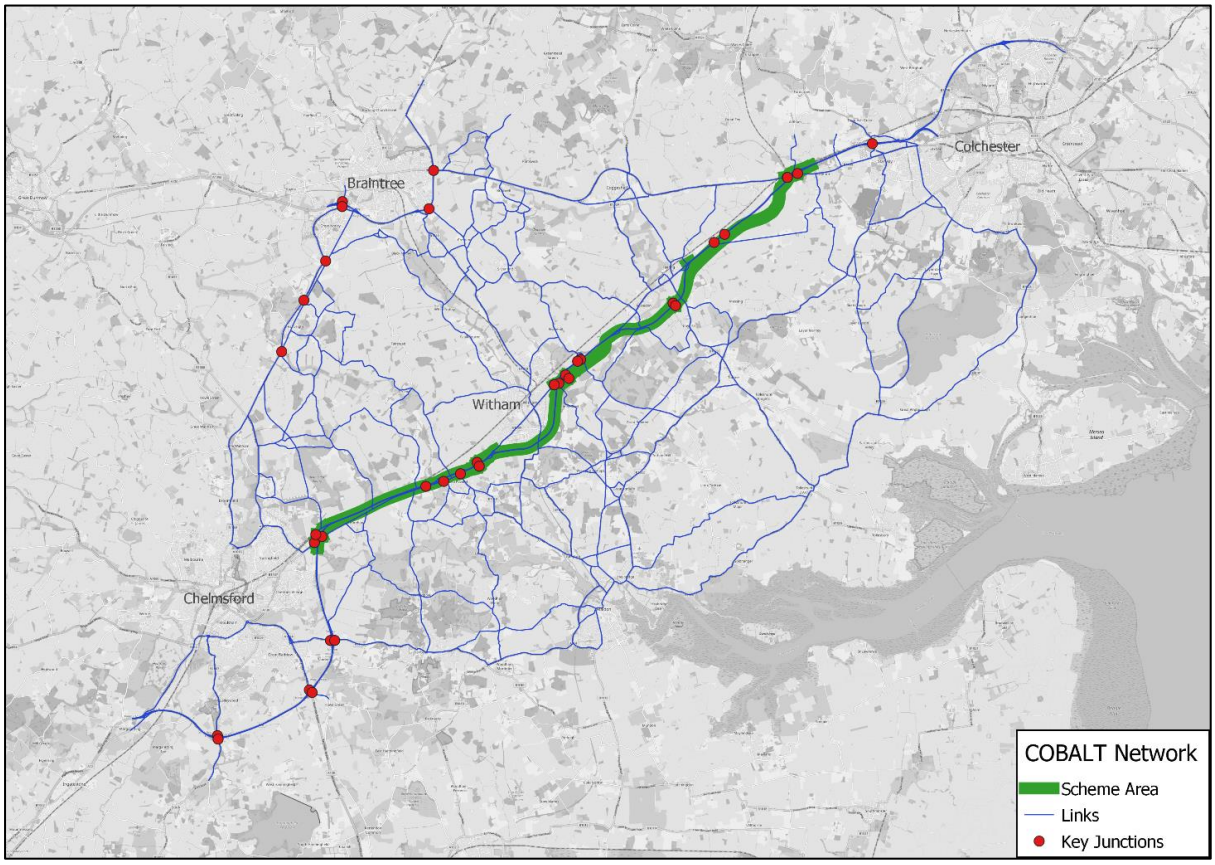
Most transport-related accidents, injuries and deaths occur on the road network. Vulnerable groups include children, older people (both particularly as pedestrians) cyclists and motorcyclists. There is also a strong link between deprivation and road accidents: children from the most deprived background are five times more likely to be involved in a fatal road accident than those from the least deprived. Therefore,

the DI assessment of accidents focuses on those vulnerable groups outlined above and those living in areas of deprivation.

6.2 Step 2a: Area of Impact

The COBALT accident benefits assessment undertaken as part of the economic appraisal of the scheme has been used as the basis for the DI analysis of accidents. However, the COBALT assessment only used observed accident data for the area where there is likely to be a significant impact because of the scheme. The DI assessment area was constrained to this area for which observed accident information is available. The overall COBALT network is shown in Plate 6-1, while the DI assessment area is shown by the area in Plate 6-2 for which accident information is displayed.

Plate 6-1: COBALT Accident Assessment Network



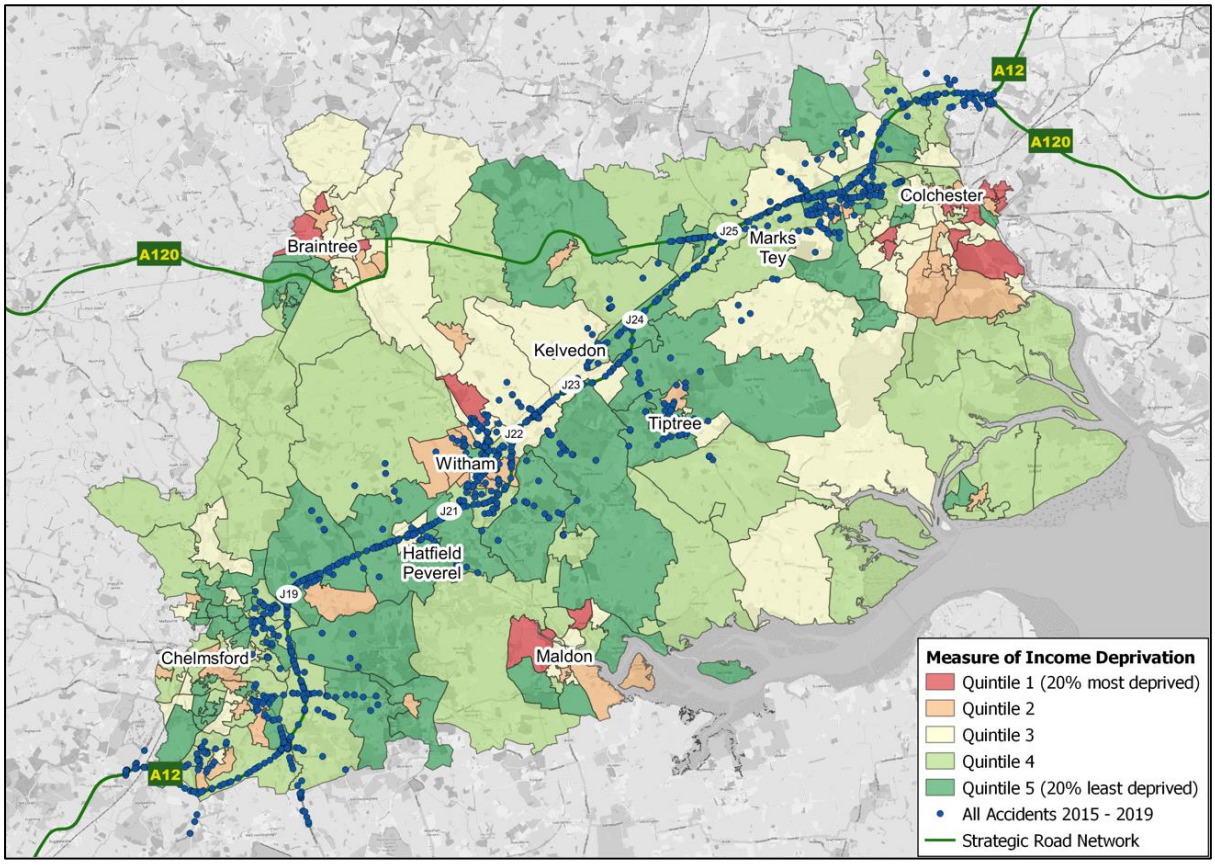
6.3 Step 2b: Identification of Social Groups in the Affected Area

TAG recommends undertaking analysis of deprivation statistics because there is evidence that people living in more deprived areas are more vulnerable to accidents on the road network.

The national Indices of Income Deprivation at the LSOA level has been used to identify the most deprived areas in the accidents impact area. Plate 6-2 shows the

deprivation range of the area assessed along with all the accidents occurring in the area.

Plate 6-2: Identified Income Quintile Classification with all Casualties



6.4 Step 2c: Identification of Social Groups and Amenities in the Affected Area

The concentration of vulnerable groups within the area of impact may be affected by the presence of amenities which attract different vulnerable groups.

The following type of amenities have been identified in the affected area attracting children and older people:

- Schools, nurseries and playgrounds attracting children,
- Hospitals, nursing homes, rest homes and retirement homes attracting older people.

No specific amenities attracting pedestrians and cyclists have been identified in detail other than the town centres. No specific identification of concentrations of young male drivers has been undertaken.

In addition, analysis of demographic information has been undertaken based on mid-2019 population estimates. This identified areas with higher concentrations of vulnerable groups living within them. This analysis is shown throughout Section 6.5.

6.5 Step 3a: Core Analysis of Impacts

TAG guidance recommends a proportionate approach to the DI appraisal for accidents. As stated in the guidance, a detailed assessment should only be undertaken for those links where there are over 50 casualties over 5 years. If the number of accidents on the affected links does not meet this threshold a qualitative assessment is recommended.

Analysis of the STATS19 casualty data for years 2015 to 2019 showed that none of the affected links and junctions shown in the area of impact had more than 50 casualties over a 5-year period and therefore no detailed appraisal of accidents indicator was required. As recommended, a qualitative assessment was undertaken instead.

To inform this qualitative assessment, vulnerable group casualties within the affected area were analysed, using STATS19 casualty data. Vulnerable groups assessed include:

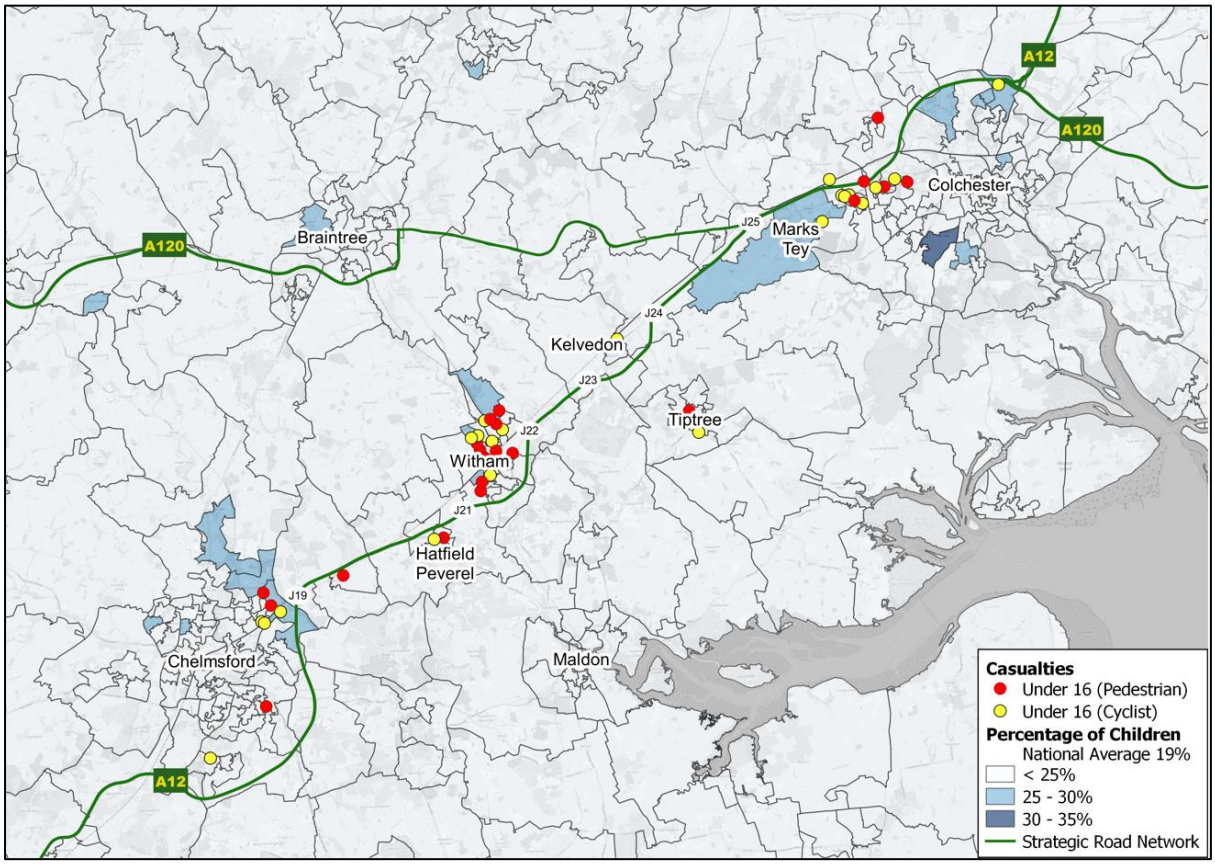
- Children
- Young Male Drivers
- Older People (70+)
- Pedestrians / Cyclists / Motorcyclists

Clusters of vulnerable group casualties were identified and the predicted change in accidents on links from the COBALT analysis were used to determine the potential impacts upon them.

Step 3a: Core Analysis of Impacts – Children Casualties

Pedestrian and cyclist casualties for children aged under 16 have been mapped in Plate 6-3, along within information showing which areas contain a significantly high proportion of children.

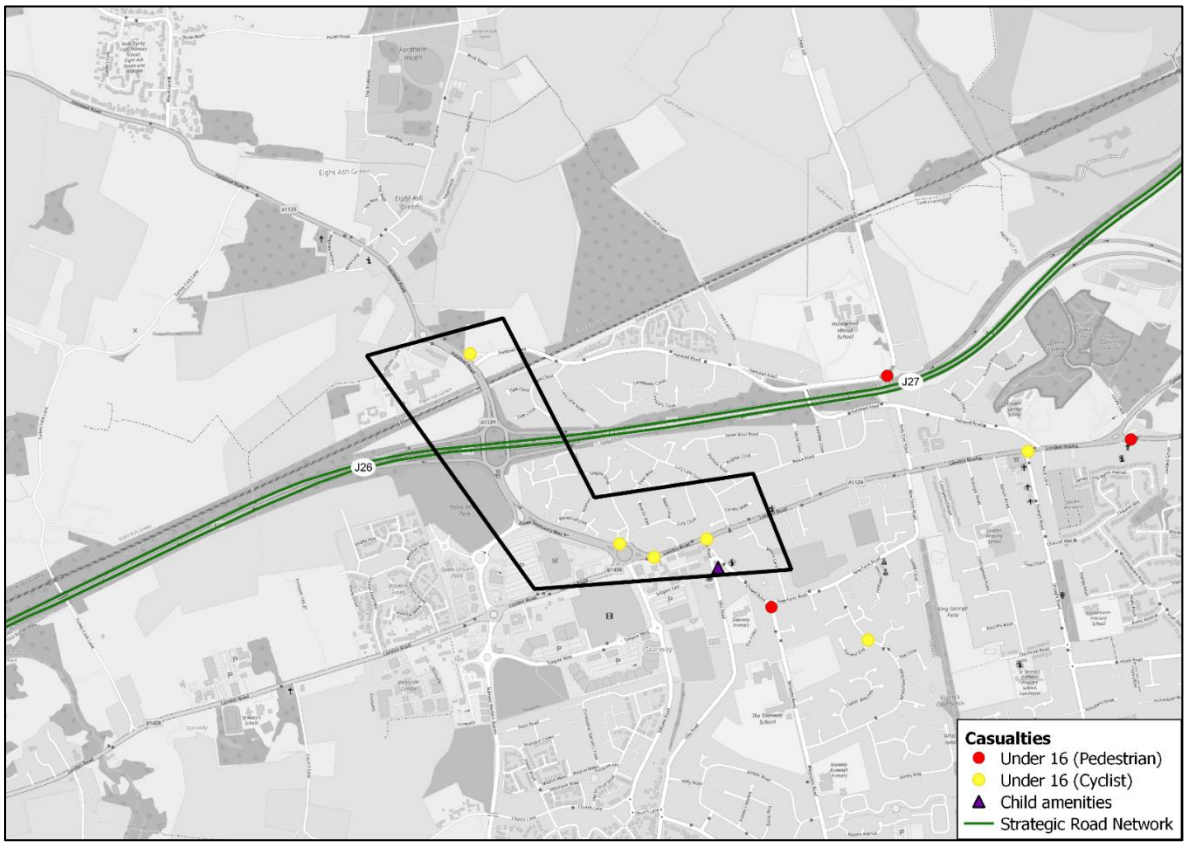
Plate 6-3: Children Casualties within the Accident Impact Area



Amenities attracting children identified in Step 2 have been plotted together with casualties among individual younger than 16 years old. Two clusters were identified in the area of impact where there are a greater number of child casualties, close to amenities attracting children, these are shown in Plate 6-4 and Plate 6-5. The first cluster is located in Witham town centre and the second cluster is located near to Junction 26 on the A12.

Plate 6-4: Children Casualties and Amenities within the Accident Impact Area (1)

Plate 6-5: Children Casualties and amenities within the Accident Impact Area (2)



The first cluster, shown in Plate 6-4, is located in Witham town centre along Spa Road. The modelling forecasts show that in 2042, the scheme increases traffic slightly in this area. However, the increase in traffic levels is unlikely to have a significant impact on the number of child casualties.

The second cluster Plate 6-5 is located near to Junction 26 on the A12. The modelling forecasts show that in 2042, the scheme increases traffic on London Road by 1%. This increase in traffic levels will not have an impact on the number of child casualties.

Overall, the impact of the scheme on child casualties is neutral.

Step 3a: Core Analysis of Impacts – Young Male Casualties

In Plate 6-6 casualties for young male drivers have been mapped together with the proportion of the population of each LSOA which are between 16 and 25 years old.

Plate 6-6: Young Male Driver Casualties within Accident Impact Area

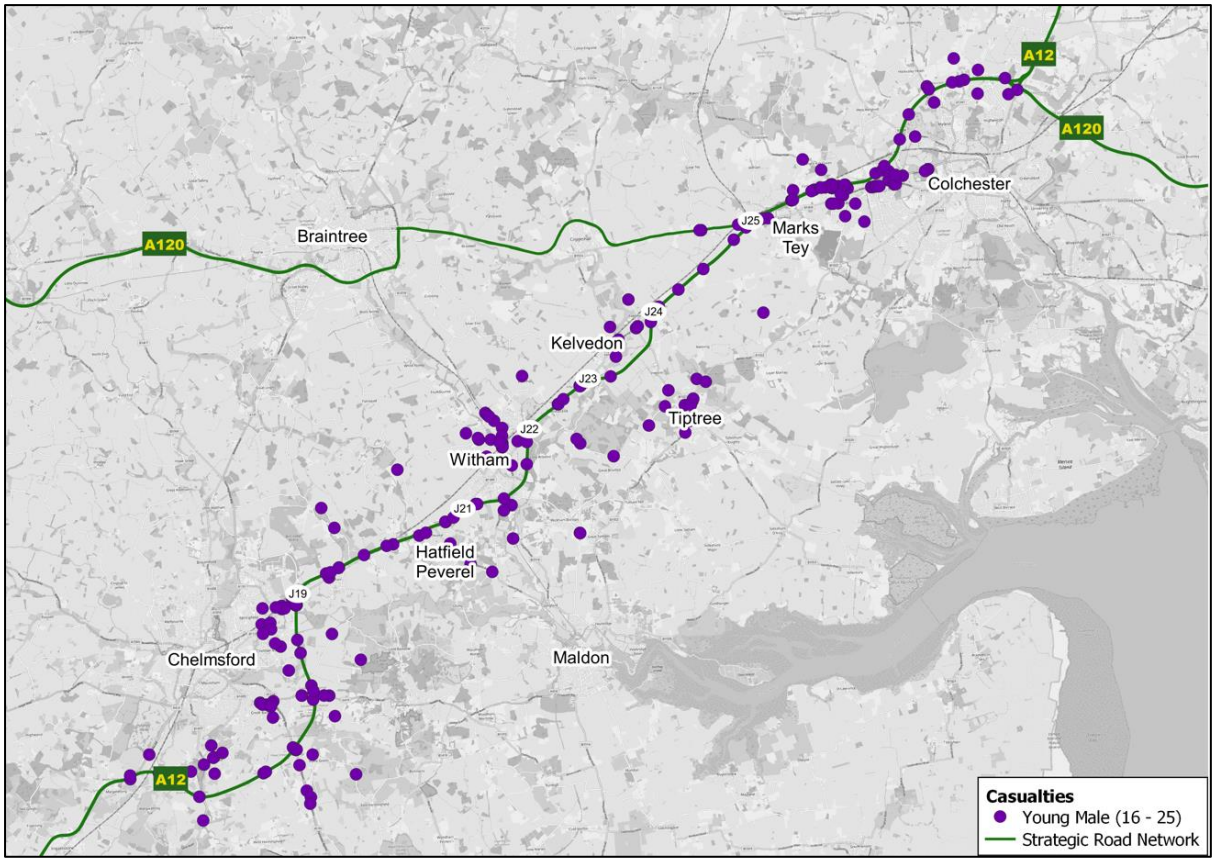
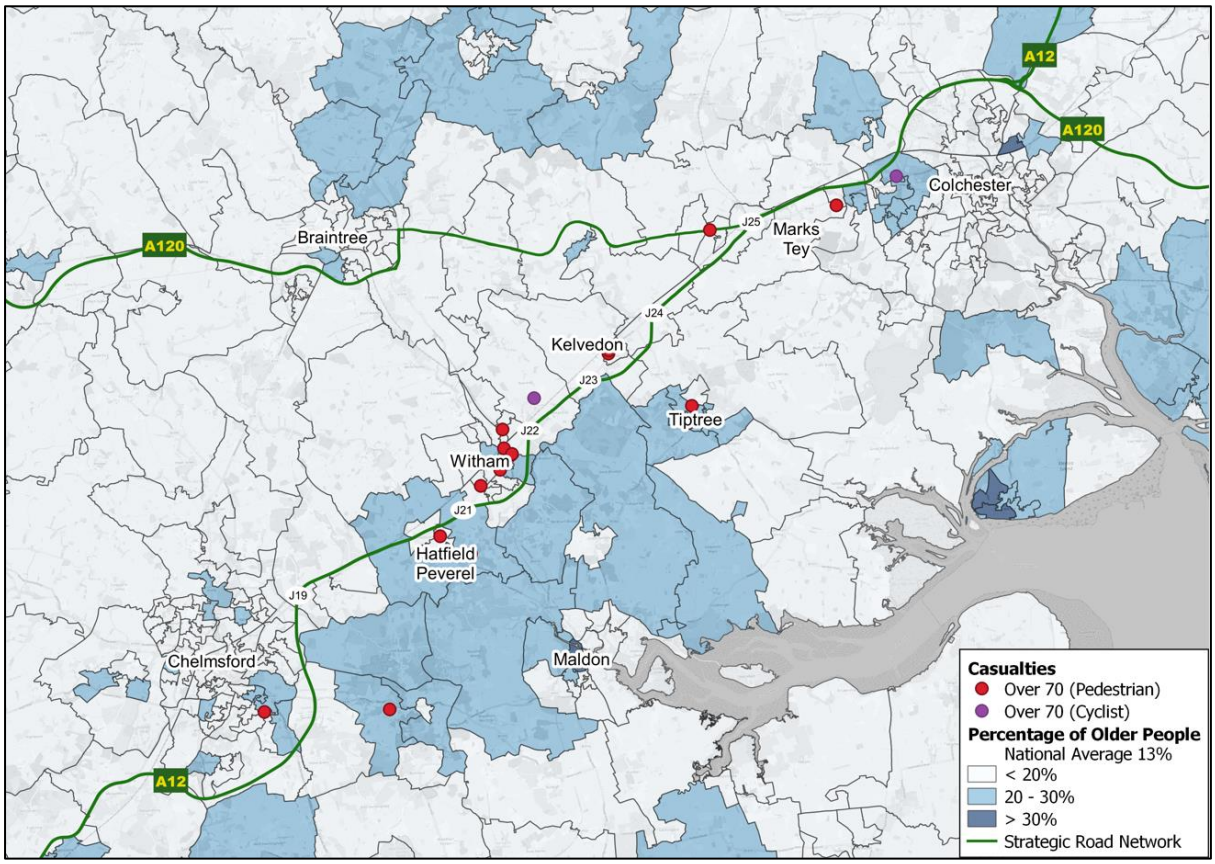


Plate 6-6 does not present a clear pattern for Young Male casualties. Casualties tend to occur mostly along the A12 and in town centres. Given the absence of a cluster and specific amenities which would be a potential focus for young male driver accidents being difficult to identify, the impact of the scheme on Young Male casualties is considered neutral.

Step 3a: Core Analysis of Impacts – Older People Casualties

Casualties for older people have been mapped in Plate 6-7.

Plate 6-7: Older People Casualties within Accident Impact Area



Nationally, 13% of the population is 70 years of age or older. Plate 6-7 shows that casualties involving older people tend to occur mostly in town centres. Given the absence of specific clusters, the impact of the scheme on older people casualties is neutral.

Step 3a: Core Analysis of Impacts – Pedestrian, Cyclist and Motorcyclist Casualties

Casualties for Pedestrians, Cyclists and Motorcyclists have been mapped in Plate 6-8.

Plate 6-8: Pedestrian, Cyclist and Motorcyclist Casualties within Accident Impact Area

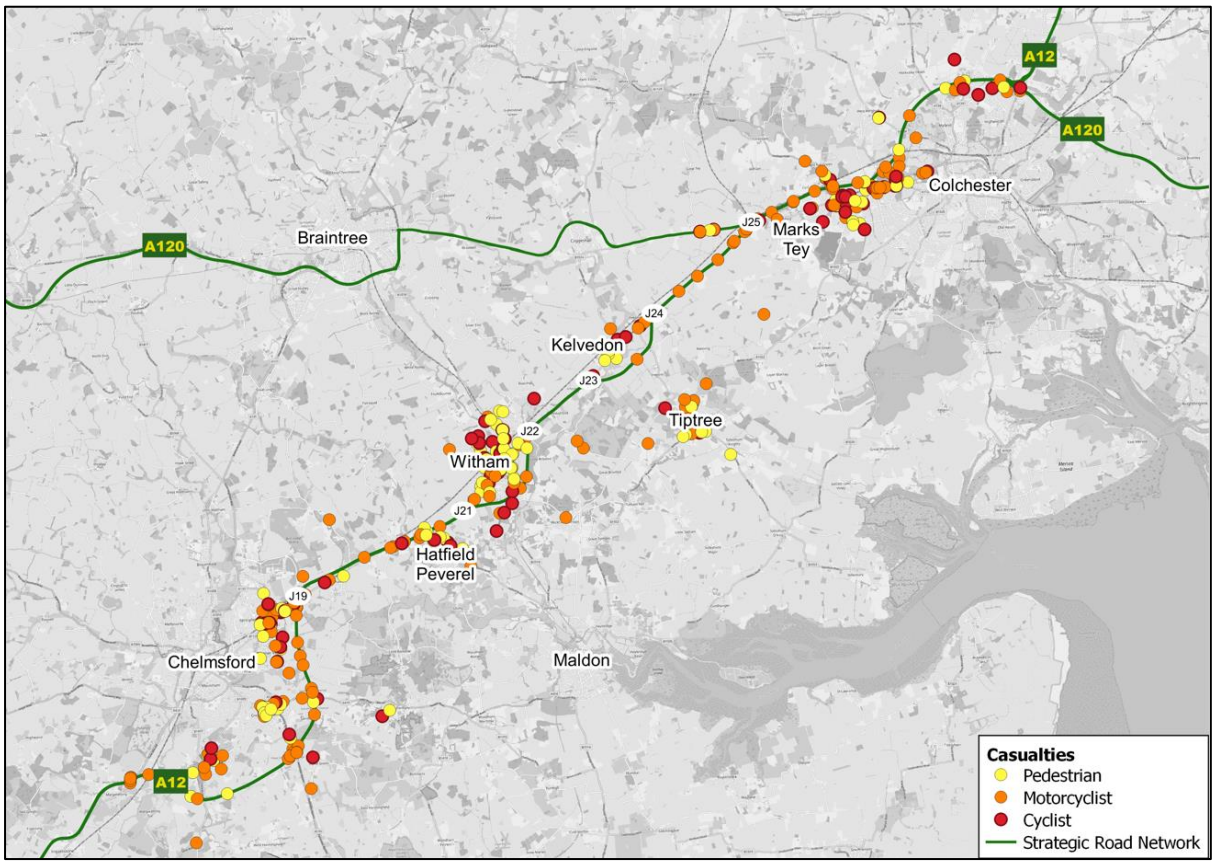


Plate 6-8 shows that the majority of pedestrian and cyclist casualties occur in the main urban areas along the A12. With the introduction of the scheme, traffic is generally expected to decrease through these areas, although some areas would see traffic increases. Motorcycle casualties are spread across these same urban areas, as well as the A12 itself where the change in total accidents is predicted to be small.

No specific clusters of pedestrian or motorcyclist causalities were identified.

Two clusters for cyclists were identified within the area of impact, where the number of cyclist accidents was considered to be higher than average. The first cluster is located to the south of Witham and is shown in Plate 6-9. The second cluster is located at Tollgate roundabout near to Junction 26 on the A12, shown in Plate 6-10.

Plate 6-9: Cyclist Casualties within Accident Impact Area (1)

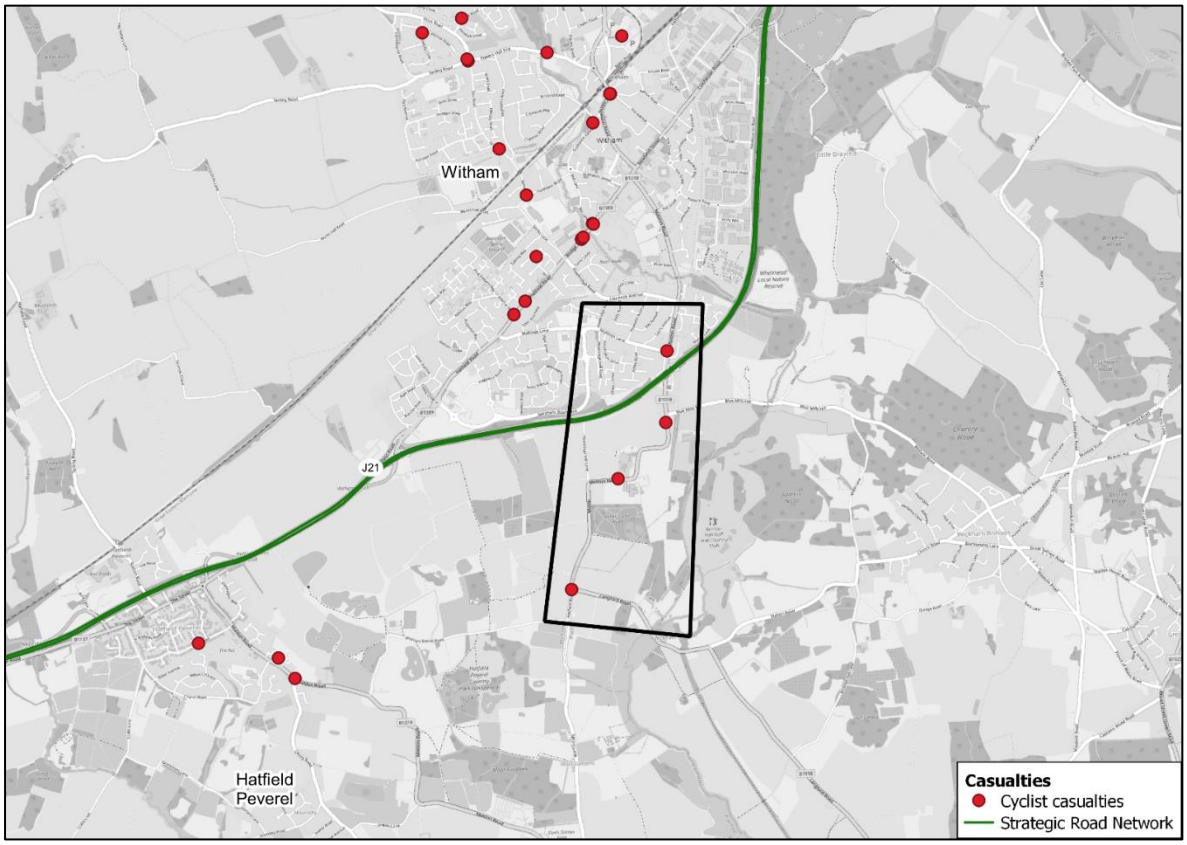
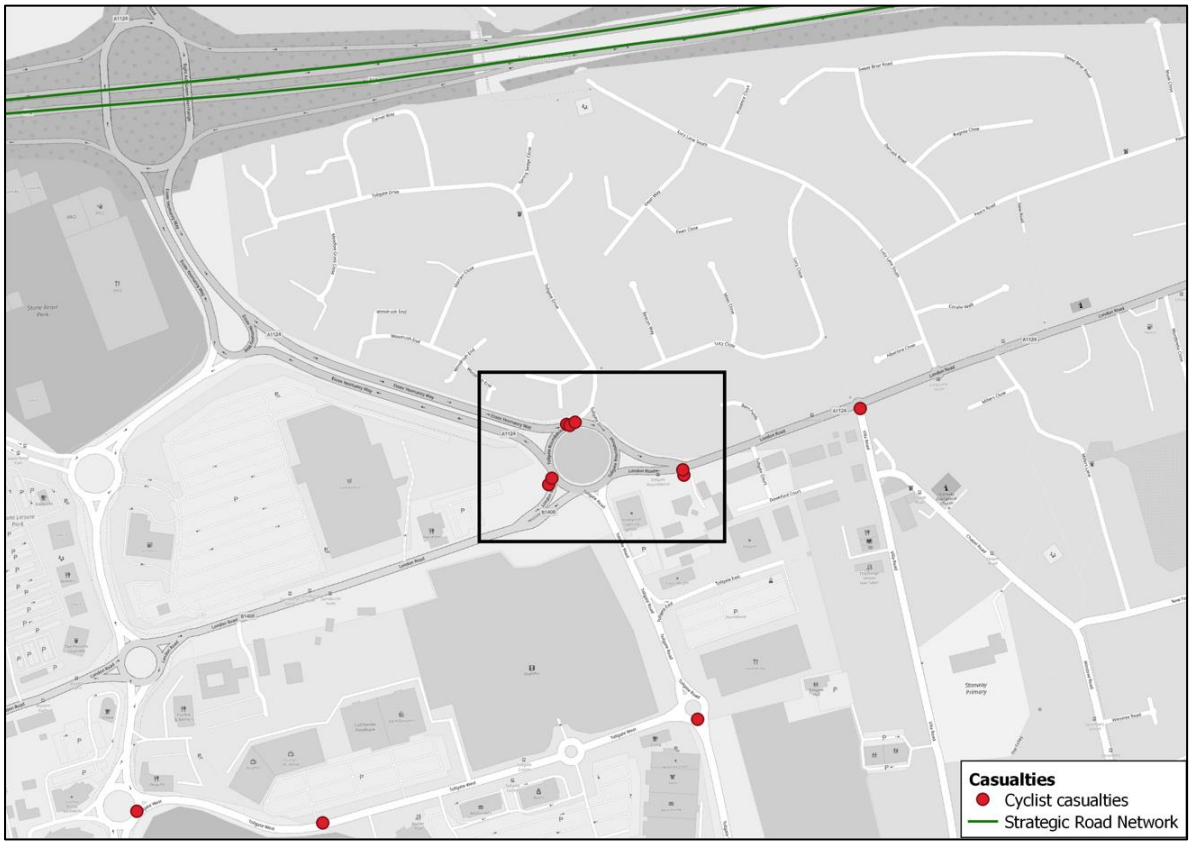


Plate 6-10: Cyclist Casualties within Accident Impact Area (2)



The first cluster, shown in Plate 6-9, is located to the south of Witham. The modelling forecasts show that in 2042, the scheme increases traffic on Maldon Road by 4%. It is considered that this increase in traffic levels is unlikely to have a significant impact on the number of cyclists accidents.

The second cluster, Plate 6-10, is located at Tollgate roundabout near to Junction 26 on the A12. The modelling forecasts show that in 2042, the scheme increases traffic in this location by 1%. This increase in traffic levels will not have an impact on the number of cyclists accidents.

Overall, the impact of the scheme on pedestrian, cyclist and motorcyclist casualties is neutral.

6.6 Summary of Accident Impacts Analysis

The results of the qualitative Distributional Impacts appraisal for the accidents indicator obtained in the previous section are summarised in Table 6-1. No vulnerable group is expected to receive a particularly strong safety impact compared o the wider population.

Table 6-1: Summary of Accident Impacts Analysis

	Vulnerable user group					
	Children	***Older People***	***Young Male Drivers***	***Pedestrians***	***Cyclists***	***Motorcyclists***
Assessment Score	*Neutral*	*Neutral*	*Neutral*	*Neutral*	*Neutral*	*Neutral*

7 Distributional Impact of Noise

7.1 Introduction

There is clear evidence that changes in noise levels can have an effect on children's concentration when learning. Thus, there is a requirement to analyse changes in noise levels affecting schools and nurseries. Noise can also impact on health outcomes; as older people disproportionately experience health problems the impact on this group should also be considered. Those with lower incomes may be less able to make adjustments to changing noise levels (e.g. the installation of insulation or double glazing) than other groups so should also be included in the analysis. Therefore, the DI assessment of noise focuses on children, older people and people living in areas of deprivation.

7.2 Step 2a: Area of Impact

The impact area for the noise indicator has been defined through the noise analysis which has been undertaken in accordance with the requirements of TAG Unit A3. The process that was used to define the impact area within this noise assessment is described below.

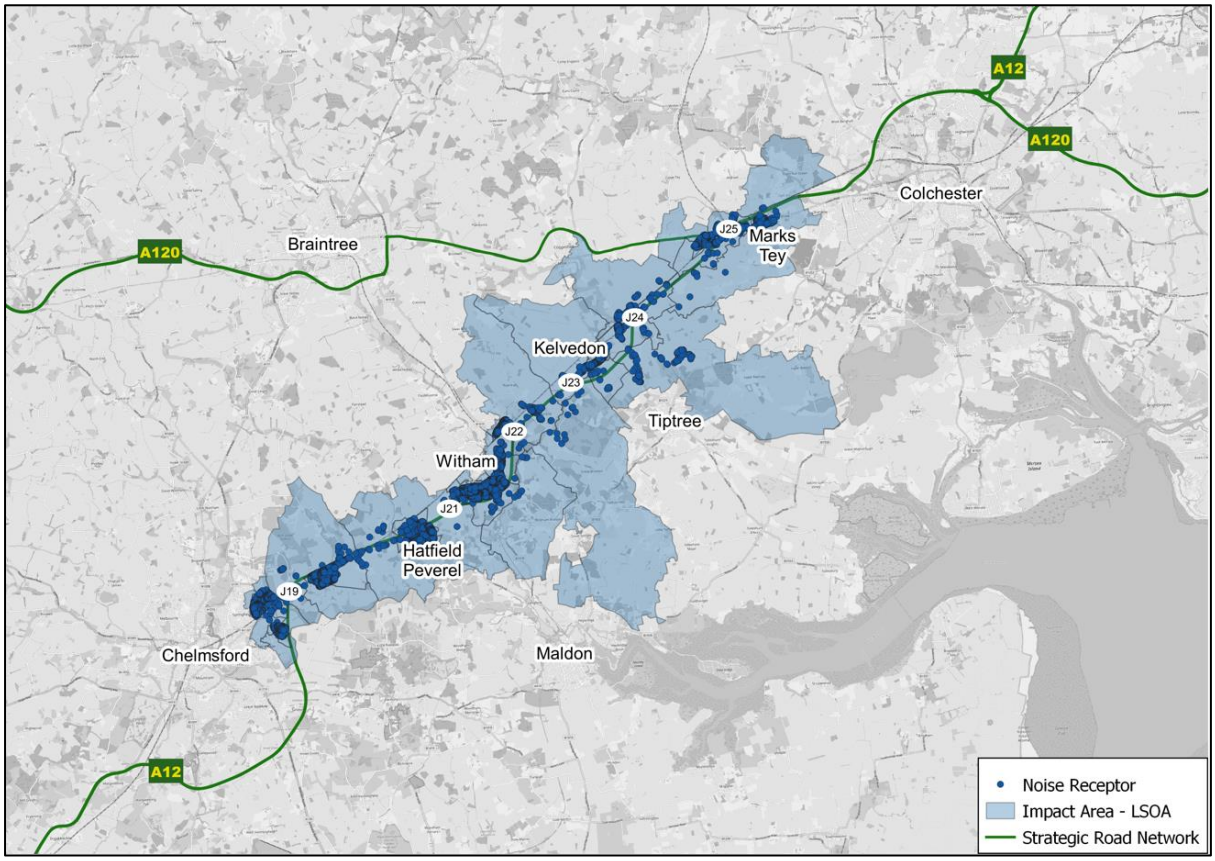
The first step in identifying the study area involved identifying the 'project boundary', which is the start and end points of the physical works associated with the project, the existing routes that are being bypassed or improved, together with any proposed new routes between the start and end points.

'Affected routes' were then identified from the traffic data for road links within the 1km zone around the project boundary. An affected route is one where there is the possibility of a change in noise of 1dB(A) or more between the Do-Minimum and Do-Something scenarios in the short-term or 3dB(A) or more in the long-term. A 600m boundary is then defined around all affected routes within the 1km zone around the project boundary (and the project boundary). This is the 'calculation area' within which the detailed noise modelling exercise is undertaken.

Sensitive receptors such as schools, hospitals and care homes within the 600 / 1000m boundary were also identified and a 'simple' assessment (as defined in DMRB 11.3.7) undertaken if required.

Plate 7-1 shows the receptors within the Noise Indicator impact area as well as the LSOAs in which the receptors are located.

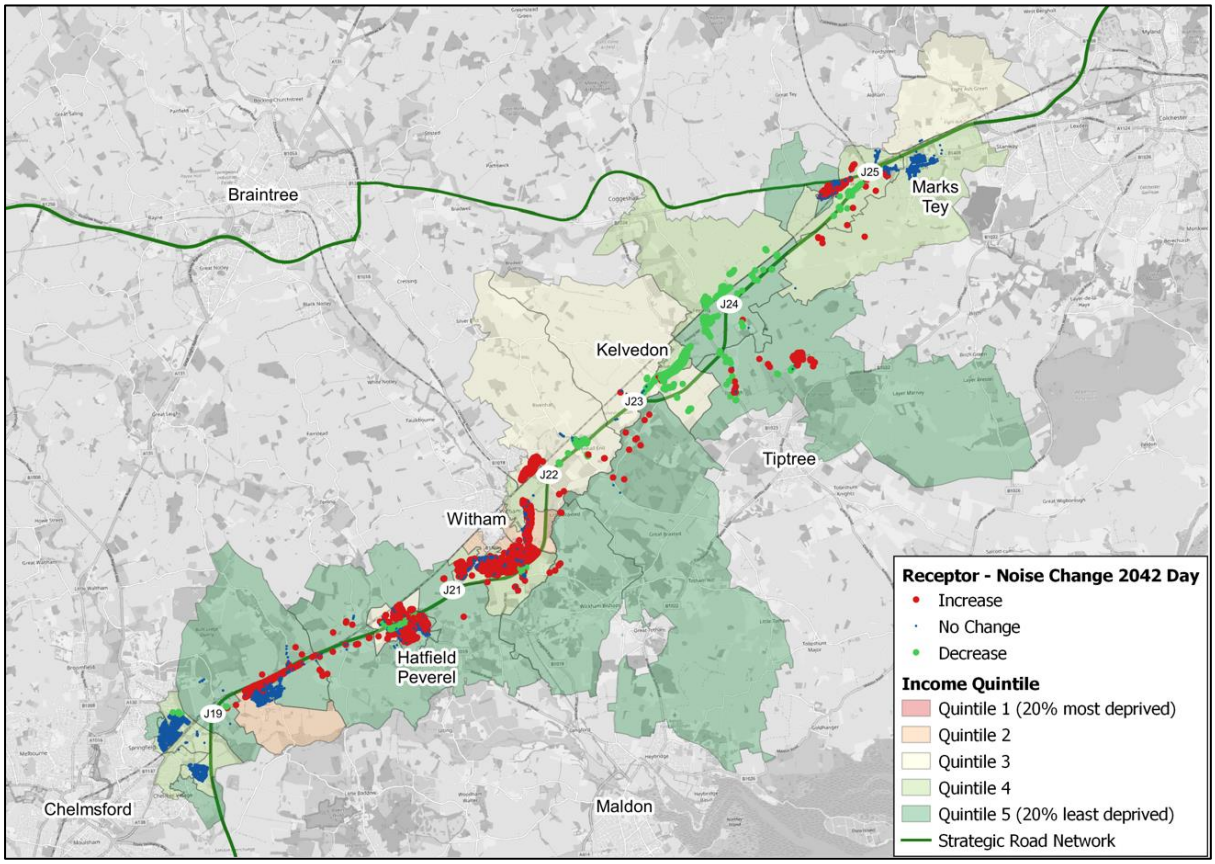
Plate 7-1: Receptors within the Impact Area for Noise



7.3 Step 2b & 2c: Identification of Social Groups and Amenities in the Affected Area

Plate 7-2 shows the income quintiles in the noise impact area at LSOA level as well as the change in noise levels at each receptor.

Plate 7-2: Income Quintiles within the Impact Area for Noise



The changes in noise and the proportion of children in the population is shown in Plate 7-3 while the change in noise and proportion of older people in the population is shown in Plate 7-4.

Plate 7-3: Receptors and Percentage of Children within the Impact Area for Noise

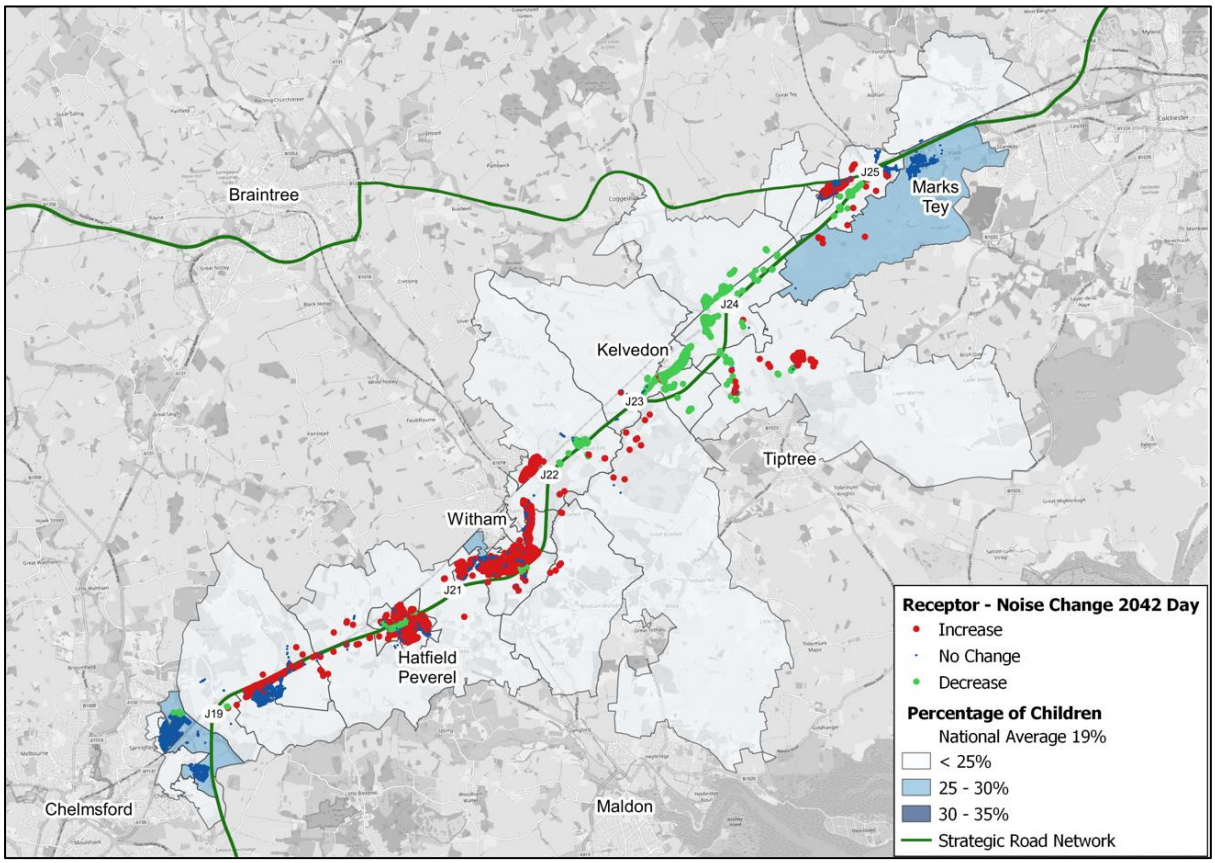
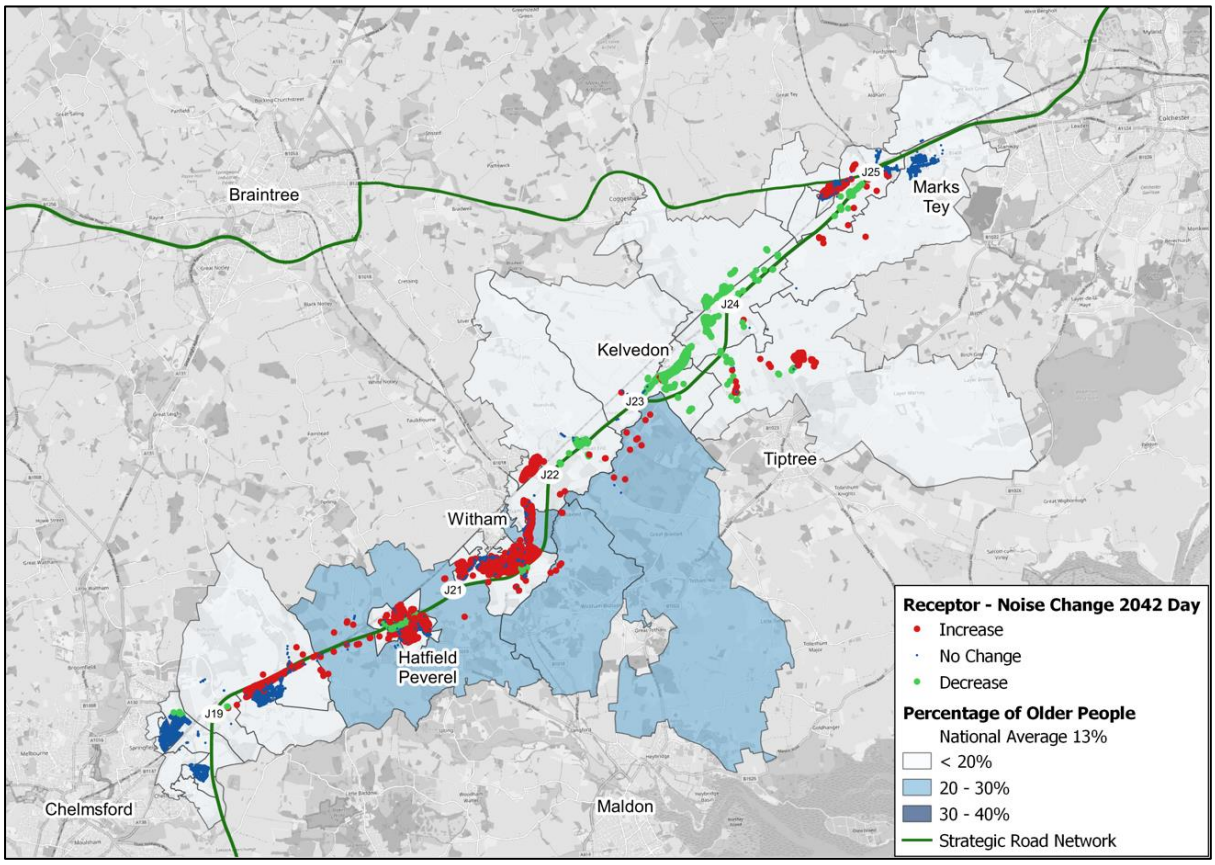
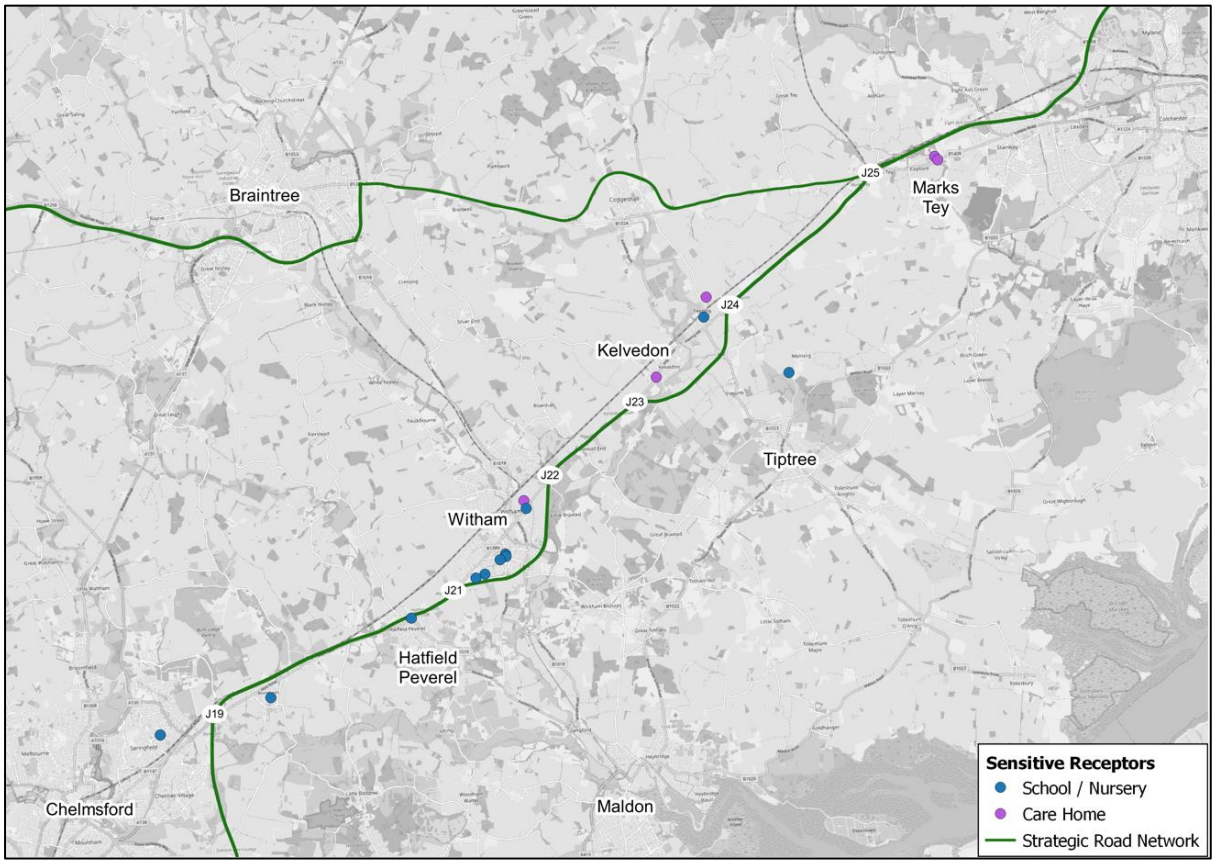


Plate 7-4: Receptors and Percentage of Older People within the Impact Area for Noise



Sensitive receptors such as schools, hospitals and care homes have also been identified within the area of impact in order to analyse the noise impact on children and older people. They are shown in Plate 7-5.

Plate 7-5: Sensitive Receptors and Amenities within the Impact Area for Noise



7.4 Step 3a: Core Analysis of Impacts

The DI analysis for the noise indicator requires the identification of the population in each income quintile which would experience an increase, decrease or no change in noise as a result of the scheme. This requires the aggregation / disaggregation of the population experiencing a change in noise as identified in the TAG worksheet between LSOAs.

The TAG noise assessment which was undertaken as part of the environmental appraisal of the scheme shows the number and location of households (dwellings) and therefore estimated population (assuming 2.36 residents per household, as per the 2011 census) experiencing an increase or decrease in noise as a result of the scheme in the 15th year after opening (2042). Each household and its associated noise impact was plotted to determine the LSOA it lies in and therefore its income quintile.

This was used to estimate the population experiencing an increase, decrease or no change in noise within each income quintile. All households that lie within the identified noise calculation area were included in the assessment. The results of the assessment are presented in Table 7-1.

Table 7-1: Households/population Per Income Quintile Experiencing a Change in Noise

Noise	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Households in each group with **increased noise**>1dB	0	823	1,237	2,354	656	5,070
Population in each group with **increase noise** >1dB	0	1,942	2,919	5,555	1,548	11,965
Households in each group with **decrease noise** >1dB	0	0	286	471	199	956
Population in each group with **decrease noise** >1dB	0	0	675	1,112	470	2,256
Households in each group with **No Change**	0	626	480	2,760	1,987	5,853
Population in each group with **No Change**	0	1,477	1,133	6,514	4,689	13,813

Table 7-1 shows that 11,965 people are forecast to experience an increase in noise levels as a result of the scheme while 2,256 people are forecast to experience a decrease in noise levels. The increase in noise is primarily seen in Witham and Boreham. There is a decrease in noise for residents of Rivenhall End, Kelvedon and Feering, and a mixture of some increase and some decrease in Hatfield Peverel and Marks Tey.

There are no receptors in LSOAs with quintile 1 (the most deprived).

Using the plates presented in Table 7-1 the net number of ‘winners’ (i.e. those with a decrease in noise) compared to ‘losers’ (those with an increase in noise) has been calculated for each income quintile. This is presented in Table 7-2, along with the proportion of the total population in each quintile. An assessment score has then been derived. The assessment score is dependent on the overall impact (beneficial / adverse) to each income group compared to the proportion of that group in the total population.

Table 7-2: Noise DI Summary

Noise	Income Quintiles ← Most Deprived Least Deprived →					Totals
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Population in each group with increased noise **[A]**	0	1,942	2,919	5,555	1,548	11,965
Population in each group with decreased noise **[B]**	0	0	675	1,112	470	2,256
Population in each group with no change in noise **[C]**	0	1,477	1,133	6,514	4,689	13,813
Total population in each group [A]+[B]+[C]	0	3,420	4,727	13,181	6,707	28,034
Net no of Winners / Losers in each group **[D]** = [B] – [A]	0	-1,942	-2,244	-4,444	-1,079	-
Total number of Winners / Losers across all groups **[E]** = ∑[D]						-9,709
Net winners/losers in each area as percentage of total **[F]** = [D] / [E]	0%	20%	23%	46%	11%	-
Share of total population in the impact area	0%	12%	17%	47%	24%	-
Assessment Score		Large Adverse xxx	Large Adverse xxx	Moderate Adverse xx	Slight Adverse x	

Table 7-2 shows that the second to most deprived quintile (quintile 2) and middle quintile (quintile 3) receive an overall increase in noise that is greater than their share of total population and are awarded a score of Large Adverse. These quintiles cover parts of Boreham, Hatfield Peverel and Witham where an increase in noise is forecast.

Income group 4 receives a disbenefit that is broadly in line with the proportion of population, so receives a score of moderate adverse. Quintile 5, the least deprived income quintile, receives an undersized share of the disbenefits, so receives a score of slight adverse. Quintile 5 includes locations in Boreham which shows an increase in noise, but also locations such as Feering where a decrease in noise is expected.

Additional analysis has been conducted to investigate the noise impacts on children and older people with respect to the proportions of each group in the noise impact area.

Plate 7-3 and Plate 7-4 showed the locations of receptors with increased and decreased noise as well as the percentage of children and older people, according to census data, in the impact area.

The plates show that LSOAs with a high proportion of children include Copford and parts of Chelmsford; in both of these areas receptors show mainly no change in noise as a result of the scheme. The plate for older people shows there are a higher proportion of older people in parts of Witham and rural areas around Hatfield Peverel. Receptors in these locations predominantly show an increase in noise levels due to the scheme.

In addition to the households experiencing a change in noise as a result of the scheme the TAG assessment also considers sensitive receptors where children and older people are likely to spend significant amounts of time, such as schools and care homes. These types of locations which are found within the noise area of impact were shown in Plate 7-5 with information on how they are affected in terms of noise given in Table 7-3.

Table 7-3: Noise Impact on Vulnerable Groups

Receptor	Vulnerable Group	Change (dB)	Noise Impact
Feering C of E Primary School, Feering	Children	-2.6	Negligible
Boreham Primary School, Boreham	Children	0.3	Negligible
The Bishops' C of E & R C Primary School,	Children	-0.3	Negligible
The Bishops' C of E & R C Primary School,	Children	-0.3	Negligible
Howbridge C of E Junior School, Witham	Children	1.1	Negligible
Chipping Hill Primary School, Witham	Children	1.2	Negligible
Howbridge C of E Infant School, Witham	Children	1.4	Negligible
Holy Family Catholic Primary School,	Children	1.6	Negligible
Messing Primary School, Messing	Children	-1.7	Negligible
Little Rangers Day Nursery, Hatfield Peverel	Children	1	Negligible
The Little Bears Day Nursery, Hatfield	Children	-0.1	Negligible
Holly Trees Montessori Nursery, Witham	Children	0.5	Negligible
Gershwin Park Nursery School, Witham	Children	1.8	Negligible
Drummonds, Feering	Older	-2.9	Negligible
St Dominics Residential Home, Kelvedon	Older	-0.4	Negligible
St Georges Nursing Home, Witham	Older	1.7	Negligible
New Copford Place care home, Copford	Older	-0.2	Negligible

All sensitive receptors are forecast to have negligible changes in noise (>3dB, ‘Design Manual for Roads and Bridges, volume 11 section 3 part 7’ long-term change scale). A Primary school and a care home in Feering are forecast to experience a reduction in noise of over 2dB, while the six sensitive receptors in Witham all experience an increase in noise of over 1dB.

Based on the analysis above, a score of neutral has been given to both children and older people vulnerable groups in terms of noise. Children and older people receive disbenefit in noise levels at home which is line with the overall population. All schools and care home receptors have negligible changes in noise.

8 Distributional Impact of Air Quality

8.1 Introduction

Poor air quality problems are often experienced in areas of deprivation, in which people already suffer relatively poor health. Evidence also suggests that children are at more risk from air pollution due to the fact that they generally spend more time outside and therefore experience more exposure to harmful pollutants that impact on lung development. The DI assessment of air quality therefore focuses on these two social groups.

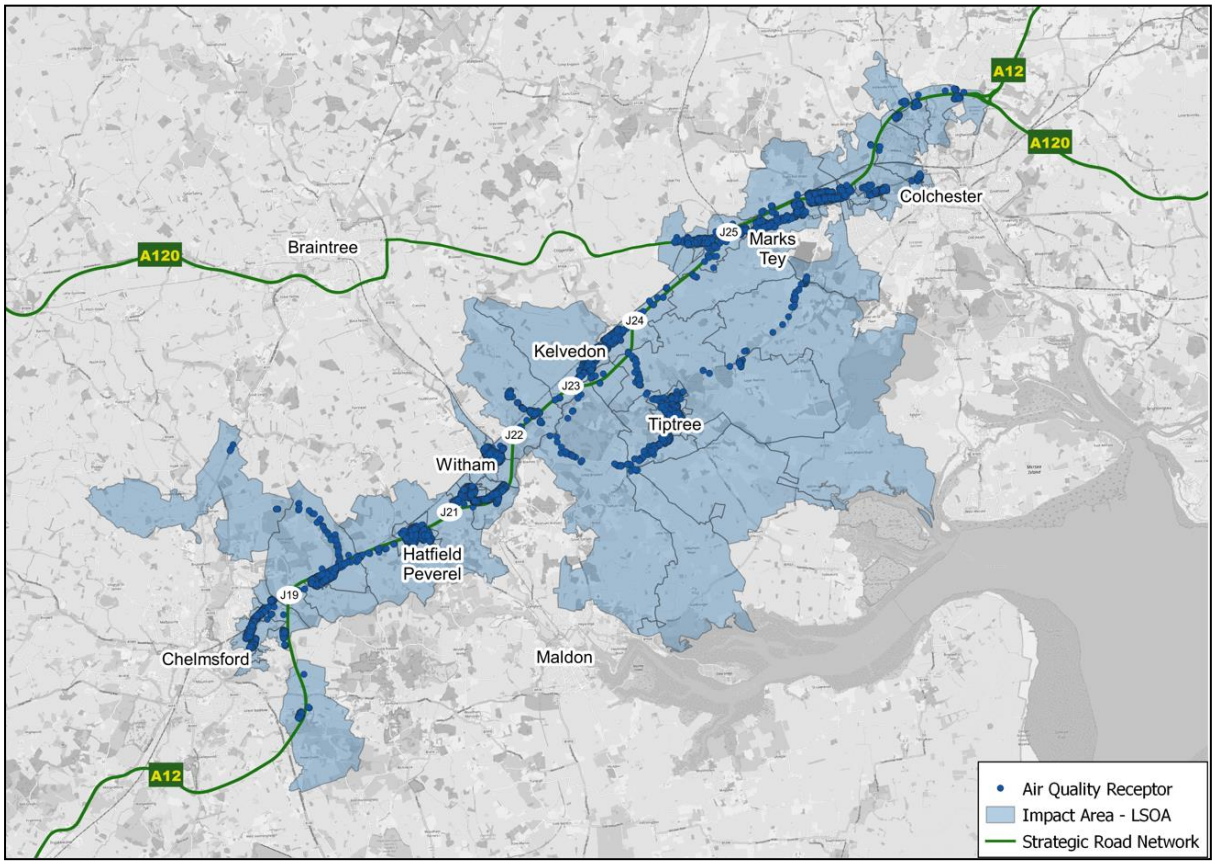
8.2 Step 2a: Area of Impact

The impact area for the air quality indicator has been defined through the air quality assessment which has been undertaken in accordance with the requirements of TAG Unit A3. The process that was used to define the impact area within this air quality assessment is described below.

For each of the links that are identified as being affected by the scheme, a buffer zone of 200m from the centre of the carriageway was defined. The resultant area is known as the air quality calculation area i.e. the affected area.

The TAG assessment identifies all receptors (properties) within the affected area that are likely to experience a change in air quality (NO_2 and PM_{10} pollutant concentrations) as a result of changes in traffic flow. Plate 8-1 shows the location of receptors within the affected area.

Plate 8-1: Receptors within the Impact Area for Air Quality



8.3 Step 2b & 2c: Identification of Social Groups and Amenities in the Affected Area

Plate 8-2 and Plate 8-3 show the income quintiles in the air quality impact area at LSOA level.

Plate 8-2: Income Quintiles within the Impact Area for Air Quality with change in NO_2 levels

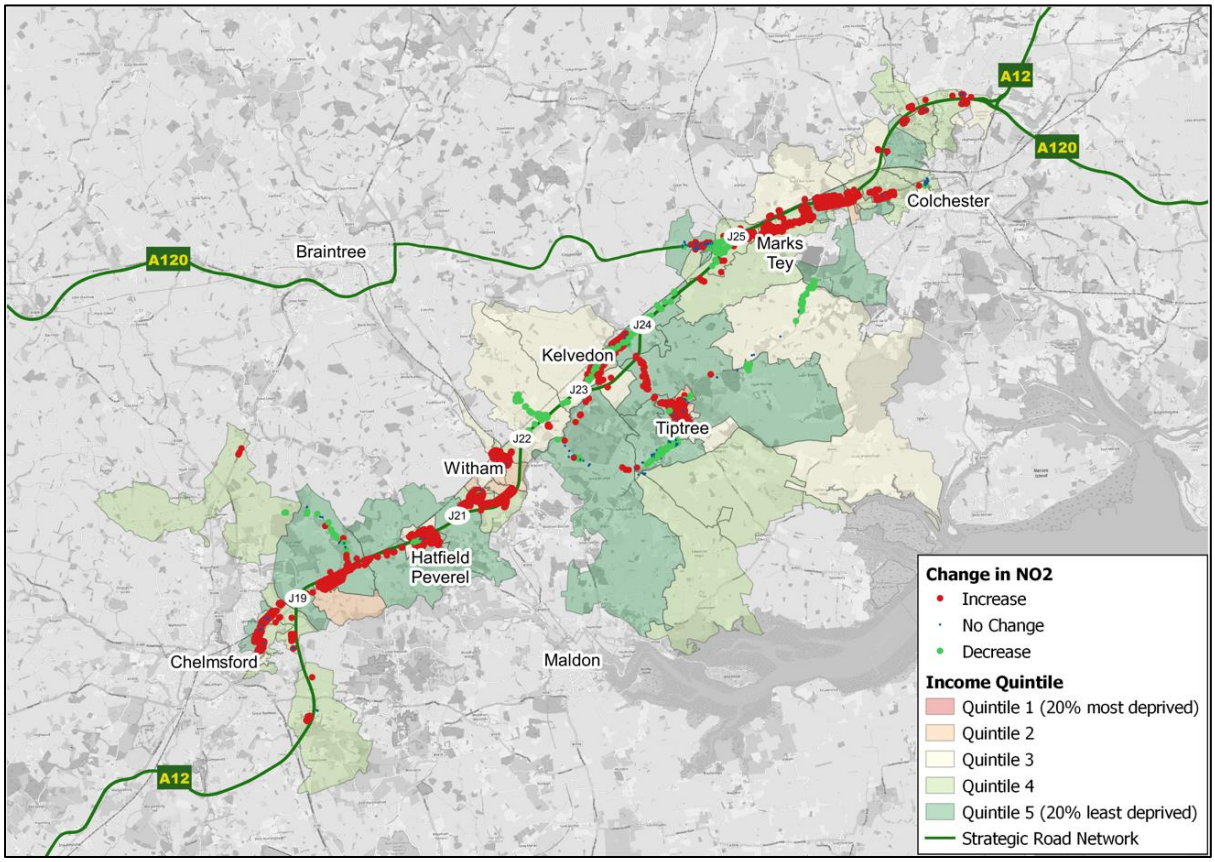


Plate 8-3: Income Quintiles within the Impact Area for Air Quality with Change in PM_{10} Levels

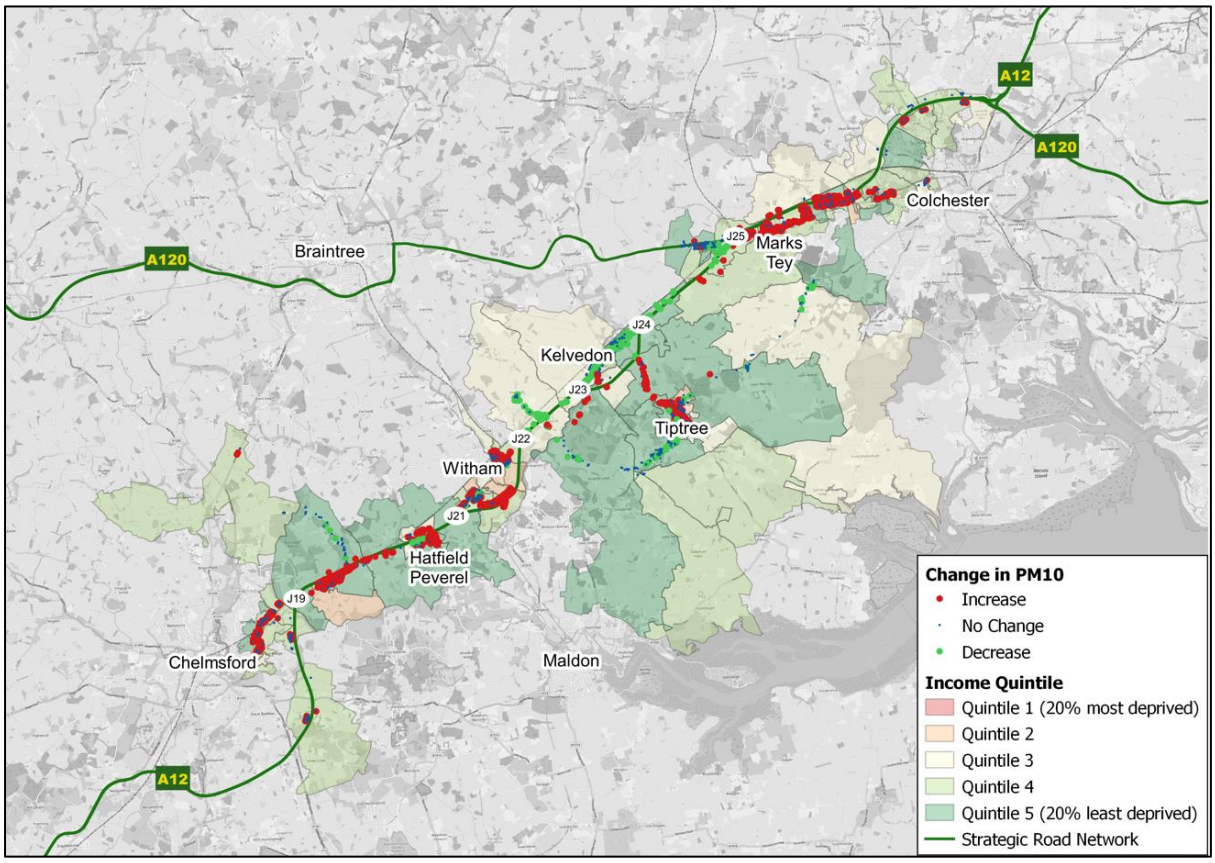


Plate 8-4 and Plate 8-5 show the percentage of the population who are children for each LSOA in the air quality impact area.

Plate 8-4: Percentage of Children within the Impact Area for Air Quality with Change in NO_2 Levels

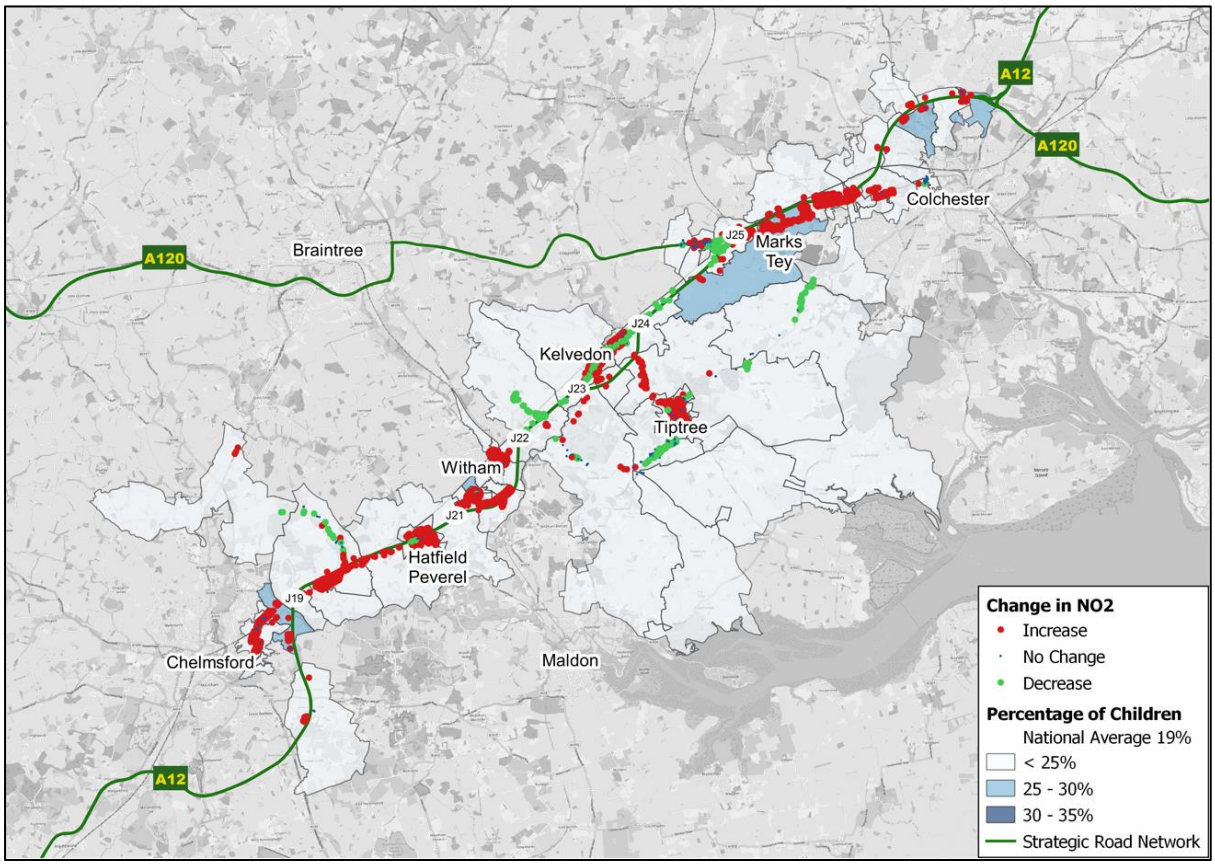
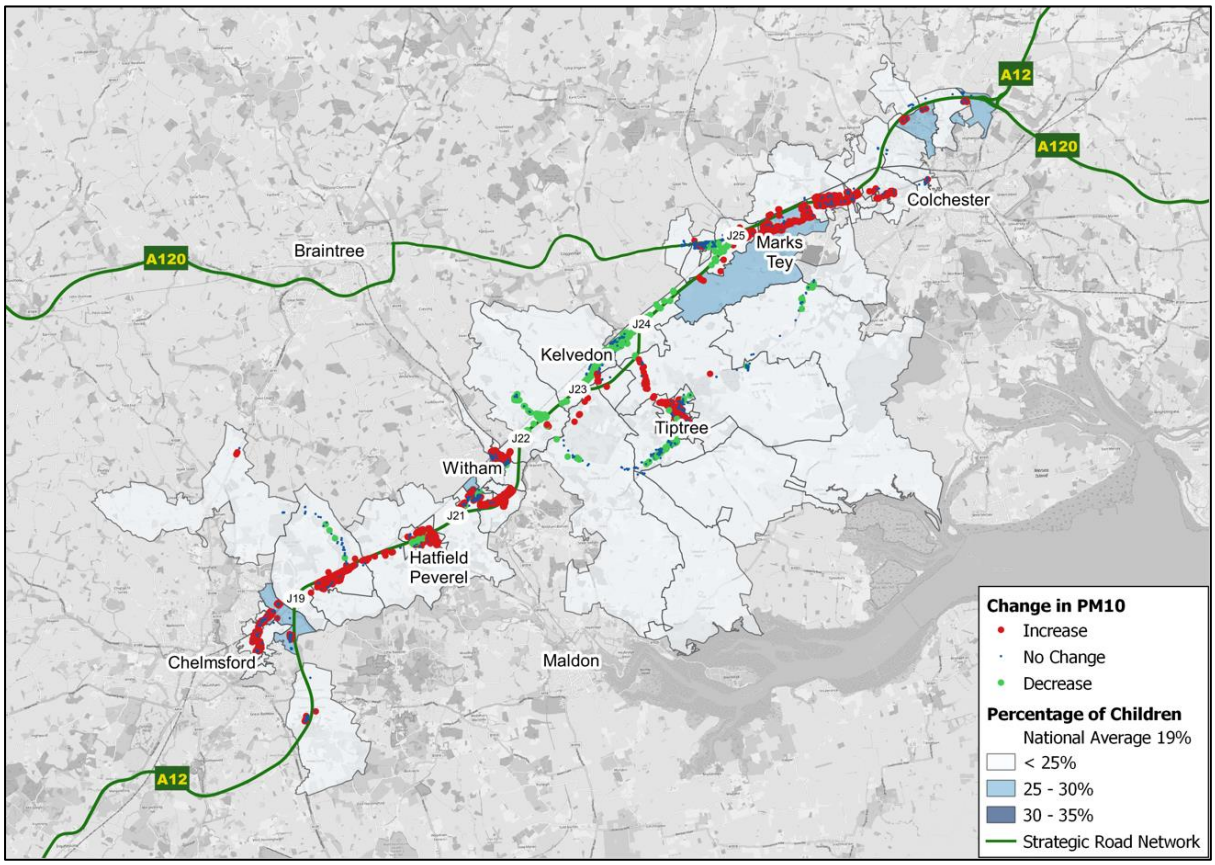
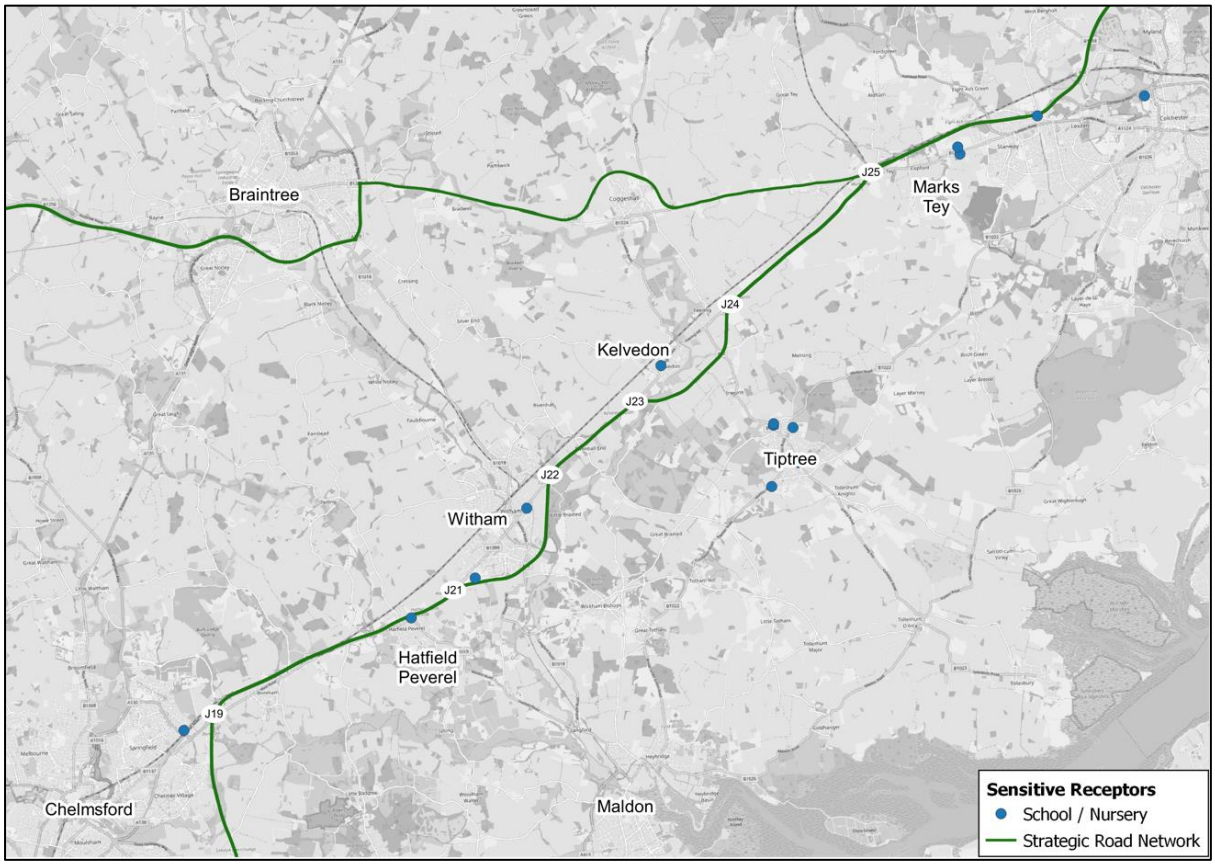


Plate 8-5: Percentage of Children within the Impact Area for Air Quality with Change in PM_{10} Levels



Sensitive receptors have also been identified within the area of impact in order to analyse the noise impact on children. They are shown in Plate 8-6.

Plate 8-6: Sensitive Receptors and Amenities in the Air Quality Impact Area



8.4 Step 3a: Core Analysis of Impacts

The DI analysis for the air quality indicator requires the identification of the population in each income quintile which would experience an increase, decrease or no change in air quality as a result of the scheme. This requires the aggregation / disaggregation of the population experiencing a change in air quality as identified in the TAG worksheet between LSOAs.

The TAG air quality assessment which was undertaken as part of the environmental appraisal of the scheme shows the number and location of households (dwellings) and therefore estimated population (assuming 2.36 residents per household, as per the 2011 census) experiencing an increase or decrease in NO_2 and PM_{10} as a result of the scheme in opening year, 2027. Each household and its associated air quality impact was plotted to determine the LSOA it lies in and therefore its income quintile.

This was used to estimate the population experiencing an increase, decrease or no change in air quality within each income quintile. All households that lie within the identified air quality calculation area were included in the assessment. The results of the assessment are presented in Table 8-1 for NO_2 and Table 8-2 for PM_{10} below.

Table 8-1: Households/populations per Income Quintile Experiencing a Change in NO2

Air Quality NO_2	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Households in each group with **improvement** in AQ	0	10	349	413	423	1,195
Population in each group with **improvement** in AQ	0	24	824	975	998	2,820
Households in each group with a **worsening** AQ	0	949	864	3,783	2,246	7,842
Population in each group with a **worsening** in AQ	0	2,240	2,039	8,928	5,301	18,507
Households in each group with **No Change**	0	148	291	846	817	2,102
Population in each group with **No Change**	0	349	687	1,997	1,928	4,961

Table 8-2: Households/populations per Income Quintile Experiencing a Change in PM_{10}

Air Quality PM_{10}	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Households in each group with **improvement** in AQ	0	7	391	349	338	1,085
Population in each group with **improvement** in AQ	0	17	923	824	798	2,561
Households in each group with a **worsening** AQ	0	301	218	1,566	1,044	3,129
Population in each group with a **worsening** in AQ	0	710	514	3,696	2,464	7,384
Households in each group with **No Change**	0	799	895	3,127	2,104	6,925
Population in each group with **No Change**	0	1,886	2,112	7,380	4,965	16,343

Table 8-1 shows that for NO_2 2,820 people are forecast to experience an improvement, 18,507 people are expected to experience a worsening and 4,961 people will experience no change. Table 8-2 shows that for PM_{10} 2,561 people are

forecast to experience an improvement, 7,384 people are expected to experience a worsening and 16,343 people will experience no change.

Using the figures presented in Table 8-1 and Table 8-2, the net number of 'winners' (i.e. those with an improvement in Air Quality) compared to 'losers' (those with a worsening in Air Quality) has been calculated for each income quintile. NO_2 and PM_{10} analysis are presented in Table 8-3 and Table 8-4, along with the proportion of the total population in each quintile. An assessment score has then been derived using the guidance presented in TAG Unit A4.2. The assessment score is dependent on the overall impact (beneficial / adverse) to each income group compared to the proportion of that group in the total population.

Table 8-3: Summary of Air Quality DI Summary (NO_2) DI Analysis

Air Quality NO_2	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Population in each group with improved Air Quality **[A]**	0	24	824	975	998	2,820
Population in each group with no change in Air Quality **[B]**	0	349	687	1,997	1,928	4,961
Population in each group with worse Air Quality **[C]**	0	2,240	2,039	8,928	5,301	18,507
Total population in each group **[D]** =[A] + [B] + [C]	0	2,613	3,549	11,899	8,227	26,288
Net no. of Winners / Losers in each group **[E]** = [A] - [C]	0	-2,216	-1,215	-7,953	-4,302	-
Net no. of Winners / Losers across all groups **[F]** = ∑ [E]						-15,687
Net winners / losers in each area as percentage of total **[G]** = [E] / [F]	0%	14%	8%	51%	27%	-
Share of Total Population in Study Area (based on [D])	0%	10%	14%	45%	31%	-
Assessment Score		Moderate Adverse ××	Slight Adverse ×	Large Adverse ×××	Moderate Adverse ××	

Table 8-4: Summary of Air Quality DI Summary (PM_{10}) DI Analysis

Air Quality PM_{10}	Income Quintiles					Totals
	← Most Deprived				Least Deprived →	
	1	2	3	4	5	
	(0%- 20%)	(20%- 40%)	(40%- 60%)	(60%- 80%)	(80%- 100%)	
Population in each group with improved Air Quality **[A]**	0	17	923	824	798	2,561
Population in each group with no change in Air Quality **[B]**	0	1,886	2,112	7,380	4,965	16,343
Population in each group with worse Air Quality **[C]**	0	710	514	3,696	2,464	7,384
Total population in each group **[D]** =[A] + [B] + [C]	0	2,613	3,549	11,899	8,227	26,288
Net no. of Winners / Losers in each group **[E]** = [A] - [C]	0	-694	408	-2,872	-1,666	-
Net no. of Winners / Losers across all groups **[F]** = ∑ [E]						-4,824
Net winners / losers in each area as percentage of total **[G]** = [E] / [F]	0%	14%	-8%	60%	35%	-
Share of Total Population in Study Area (based on [D])	0%	10%	14%	45%	31%	-
Assessment Score		Moderate Adverse ××	Large Beneficial ✓✓✓	Large Adverse ×××	Moderate Adverse ××	

In terms of NO_2, there is an overall worsening of air quality. Table 8-3 shows that income groups 2 and 5 receive disbenefits that are broadly in line with their proportion of population, so receive a score of moderate adverse. However, quintile 4 receives an outsized share of the disbenefits, so receive a score of large adverse, this is largely due to the increases in NO_2 in Witham, Copford, Stanway and parts of Chelmsford which fall within this income group. Quintile 3 receives an undersized share of the disbenefits, so receives a score of slight adverse. There are no receptors in LSOAs with quintile 1 (the most deprived).

The situation is similar for PM_{10}. Income groups 2 and 5 receive disbenefits that are broadly in line with their proportion of population, so receive a score of moderate adverse, income group 4 receives an outsized share of the disbenefits, so receive a score of large adverse. However, quintile 3 receives a benefit for PM_{10} air quality and receives a score of large beneficial, this is mainly due to improvements in air quality in Rivenhall End as well as parts of Hatfield Peverel.

Additional analysis has been conducted to investigate the noise impacts on children with respect to the proportions of children in the air quality impact area.

Plate 8-4 and Plate 8-5 showed the locations of receptors with increased and decreased NO_2 and PM_{10} as well as the percentage of children according to census data, in the impact area. Locations with a high proportion of children are Copford, parts of Colchester and parts of Chelmsford. These areas experience an increase in NO_2 and a mixture of an increase and no change to receptors for PM_{10} as a result of the scheme.

In addition to the households experiencing a change in air quality as a result of the scheme the TAG assessment also considers sensitive receptors where children are likely to spend significant amounts of time, such as schools. The air quality modelling identified 14 sensitive receptors at schools and nurseries in the impact area, the locations of which were shown in Plate 8-6 with information on how they are affected in terms of NO_2 and PM_{10} compared to the without scheme scenario given in Table 8-5.

Table 8-5: Air Quality Impact on Children

Receptor	Change NO_2 ($\mu g/m^3$)	Magnitude of change NO_2	Change PM_{10} ($\mu g/m^3$)	Magnitude of change PM_{10}
Baynards Primary School, Tiptree	0.1	Imperceptibl	0	Imperceptible
Tiptree Pre School Playgroup, Tiptree	0.1	Imperceptibl	0	Imperceptible
Brimpton House Nursery, Kelvedon	0	Imperceptibl	0	Imperceptible
Tiptree Heath Primary School, Tiptree	0	Imperceptibl	0	Imperceptible
Little Rangers Day Nursery, Hatfield	1.8	Small	0.2	Imperceptible
St. Helena School, Colchester	0	Imperceptibl	0	Imperceptible
Thurstable School Secondary School,	0.1	Imperceptibl	0.1	Imperceptible
Safari Childcare, Colchester	0.5	Small	0.1	Imperceptible
Scallywags Nursery School, Chelmsford	0.1	Imperceptibl	0	Imperceptible
Gershwin Park Day Nursery School,	0.6	Small	0.1	Imperceptible
Saint Luke's Church School, Tiptree	0	Imperceptibl	0	Imperceptible
Busy Bees, Stanway	0.2	Imperceptibl	0.1	Imperceptible
Holly Trees Day Nursery, Witham	0.2	Imperceptibl	0.1	Imperceptible
St Mary's Lower School for Girls, Stanway	0.2	Imperceptibl	0	Imperceptible

According to the 'Design Manual for Roads and Bridges, LA105 Air quality – Standards for Highways' a change of >4$\mu g/m^3$ is considered large, >2$\mu g/m^3$ is considered medium, >0.4$\mu g/m^3$ is considered small and a change less than this is not a significant change.

Of the identified receptors, for NO_2, three would experience a small increase in terms of NO_2 pollutants, all others receive no change. For PM_{10} all receptors receive no change in levels of pollutants. None of the receptors have concentrations >40 $\mu g/m^3$.

Children receive disbenefit in NO_2 and PM_{10} levels at home in line with the overall population. One school and two nurseries receive a small increase in levels of NO_2, no school or nursery receives a perceptible change in levels of PM_{10}. A score of slight adverse has been awarded to Children and Young People in terms of NO_2, and a score of neutral for PM_{10}.

9 Distributional Impact of Severance

9.1 Introduction

Certain groups in society are potentially vulnerable to the effects of severance. Such groups include people without access to a car, older people, children, and people with disabilities and parents with pushchairs. Children are also considered to be potentially vulnerable to severance as they are more likely to cross the road at dangerous crossing points, and find it difficult to judge the speed of traffic, hence putting themselves at risk of road accidents. These groups often experience longer journey times, or are often required to use pedestrian routes that are inappropriate and difficult to use. Mitigation measures such as footbridges and underpasses can also cause severance, by creating longer journey times for users, compared with at grade crossings.

9.2 Step 2a: Area of Impact

The area of impact of the severance impact consists of the communities identified in the TAG worksheet, as reported in the Benefits Register:

- J19
- Boreham
- Hatfield Peverel
- J21
- Witham Bypass
- Eastways / Colchester Road
- Rivenhall End
- Essex Fire & Rescue HQ
- Kelvedon and Feering
- Inworth
- Easthorpe Road
- Marks Tey

9.3 Step 2b & 2c: Identification of Social Groups and Amenities in the Affected Area

As identified in the severance TAG worksheet and the Environmental Statement, no specific community facilities have been identified in the towns and villages alongside the A12 which would be impacted by a change in severance.

Data presented in the previous chapters of this report show no significantly high proportions of children or older people near the scheme.

9.4 Step 3a: Core Analysis of Impacts

Overall the scheme is expected to reduce severance; some locations are particularly affected by the current uncontrolled crossings across the A12 which would be replaced with bridges designed to be accessible to vulnerable users. No surveys have been undertaken to inform the actual proportion of users within various vulnerable groups (e.g. children, older people, disabled people). However, given the nature of the communities, it is not expected that one vulnerable group would be disproportionately represented.

Where improvements in severance are provided by replacing uncontrolled crossings of busy roads with bridges, if these bridges are difficult for older people or disabled people to use then those groups would not receive the same severance improvements as the wider population. However, on the A12 scheme all bridges are designed to be accessible to vulnerable users. Those vulnerable users would get the same severance benefits as the wider population.

A single score of Moderate Beneficial has therefore been assigned to all vulnerable groups, which is in line with the overall severance assessment score reported in the Appraisal Summary Table.

10 Conclusion and Input into AST

The analysis undertaken in Chapters 4 to 9 provides an assessment score for each indicator and each social group under consideration. The full appraisal also requires a qualitative assessment to be provided for each indicator to describe the key impacts in each case. These are summarised in a matrix in Table 10-1 and Table 10-2. They provide detail of the ‘winners’ and ‘losers’ from the scheme and the key issues of relevance.

They also provide an overall assessment score for each indicator which should be recorded in the Benefits Register.

Key

✓	Slight Beneficial
✓✓	Moderate Beneficial
✓✓✓	Large Beneficial
×	Slight Adverse
××	Moderate Adverse
×××	Large Adverse

Table 10-1: DI Appraisal Matrix – Income Groups

	Distributional impact of income deprivation					Are the impacts distributed evenly?	Key impacts – Qualitative statements	Overall assessment for comparison
	← Most Deprived				Least Deprived →			
	1	2	3	4	5			
	(0%-20%)	(20%-40%)	(40%-60%)	(60%-80%)	(80%-100%)			
User Benefits	✓✓	✓✓	✓✓	✓✓✓	✓✓	No	Beneficial impacts are forecast for all income groups.	Beneficial. Monetised in TUBA as £121.8m
Noise		×××	×××	××	×	No	The scheme results in noise disbenefit to all income quintiles. There are no receptors in the most deprived income quintile, however, the next two most deprived income quintiles both receive a greater disbenefit than their share of total population.	Adverse. Monetised as -£6.6m
Air Quality NO_2		××	×	×××	××	No	The scheme results in air quality disbenefits across all income quintiles for NO_2 and all but the middle quintile for PM_{10}. The most negatively impacted quintile is the second to least deprived.	Adverse. Monetised as -£16.3m
Air Quality PM_{10}		××	✓✓✓	×××	××	No		
Affordability	××	××	×	×××	××	No	Adverse impacts are forecast for all income groups. There are large adverse impacts for income group four. The magnitude of the disbenefits is small and the lowest income group, which is sensitive to baseline cost of travel, is not impacted in that respect.	Adverse

Table 10-2: AST Entry

Impact	AST entry										Qualitative statement (including any impact on residential population AND identified amenities)
	Social groups						User groups				
	Children & young people	Older people	Carers	Women	Disabled	BME	Pedestrians	Cyclists	Motorcyclists	Young male drivers	
Noise	Neutral	Neutral									Children and older people receive disbenefit in noise levels at home which is in line with the overall population. All school and care home receptors have negligible changes in noise.
Air Quality NO_2	×										Children receive disbenefit in NO_2 levels at home in line with the overall population. One school and two nurseries receive a small increase in levels of NO_2.
Air Quality PM_{10}	Neutral										Children receive disbenefit in PM_{10} levels at home in line with the overall population. No school or nursery receptors receive a perceptible change in levels of PM_{10}.
Accidents	Neutral	Neutral					Neutral	Neutral	Neutral	Neutral	No vulnerable group is expected to receive a particularly strong safety impact compared to the wider population.
Severance	✓✓	✓✓			✓✓						All vulnerable groups are expected to receive moderate reductions in severance. Uncontrolled crossings across the A12 would be replaced with bridges designed to be accessible to vulnerable users.