

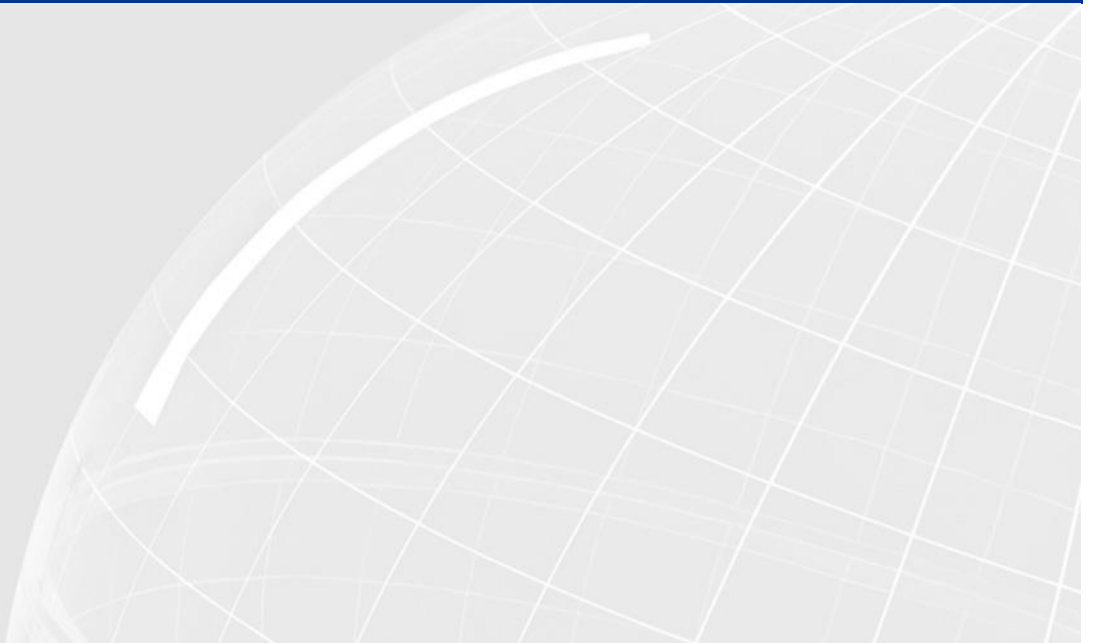


# Preston Western Distributor

Distributional Impacts Appraisal

January 2019

Lancashire County Council



**Preston Western Distributor**

Project no: B2237517  
Document title: Distributional Impacts Appraisal Report  
Document No.: 686/08/F/F  
Revision: 0  
Date: January 2019  
Client name: Lancashire County Council  
Client no: Lancashire County Council  
Project manager: Sergey Makov  
Author: Stuart Rees  
File name: C:\Users\makovs\Desktop\DI\PWD DI Report Rev 0d.docx

Jacobs U.K. Limited

© Copyright 2019 Jacobs U.K. Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This report has been prepared on behalf of, and for the exclusive use of Jacobs' Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

**Document history and status**

Revision	Date	Description	By	Review	Approved
0	08/01/2019	Draft for review	SR	SM	SM

## Contents

<b>1.</b>	<b>Introduction.....</b>	<b>1</b>
1.1	Background .....	1
1.2	Technical Standards.....	1
1.3	Structure .....	1
<b>2.</b>	<b>Scheme overview .....</b>	<b>2</b>
2.1	Scheme Description .....	2
2.2	Scheme Objectives.....	2
<b>3.</b>	<b>Methodology .....</b>	<b>4</b>
3.1	Introduction .....	4
3.2	Step 1: Screening Process .....	4
3.3	Step 2: Assessment.....	4
3.4	Step 3: Appraisal of Impacts .....	5
<b>4.</b>	<b>Screening Process (Step 1).....</b>	<b>6</b>
4.1	Introduction .....	6
4.2	Results of Screening Process .....	6
<b>5.</b>	<b>Distributional Impact of User Benefits .....</b>	<b>7</b>
5.1	Introduction .....	7
5.2	Step 2a: Confirmation of areas impacted by the intervention .....	7
5.3	Step 2b: Identification of Social Groups in the Affected Area .....	8
5.4	Step 2c: Identification of Amenities in the Affected Area .....	9
5.5	Step 3a: Core Analysis of Impacts .....	9
<b>6.</b>	<b>Distributional Impact of Personal Affordability.....</b>	<b>12</b>
6.1	Introduction .....	12
6.2	Step 2: Area of Impact, Social Groups and Amenities .....	12
6.3	Step 3a: Core Analysis of Impacts .....	12
<b>7.</b>	<b>Distributional Impact of Noise .....</b>	<b>14</b>
7.1	Introduction .....	14
7.2	Step 2a: Confirmation of Areas Impacted by the Intervention.....	14
7.3	Step 2b & 2c: Identification of Social Groups and Amenities in the Affected Area .....	15
7.4	Step 3a: Core Analysis of Impacts .....	18
<b>8.</b>	<b>Distributional Impact of Air Quality .....</b>	<b>21</b>
8.1	Introduction .....	21
8.2	Step 2a: Confirmation of Areas Impacted by the Intervention.....	21
8.3	Step 2b & 2c: Identification of Social Groups and Amenities in the Affected Area .....	22
8.4	Step 3a: Core Analysis of Impacts .....	23
<b>9.</b>	<b>Distributional Impact of Accidents .....</b>	<b>26</b>
9.1	Introduction .....	26
9.2	Step 2a: Confirmation of Areas Impacted by the Intervention.....	26
9.3	Step 2b: Identification of Social Groups in the Impact Area.....	26
9.4	Step 2c: Identification of Amenities in the Affected Area .....	27

9.5	Step 3a: Core Analysis of Impacts .....	29
9.5.1	Accident Impacts on Children.....	30
9.5.2	Accident Impacts on Older People .....	33
9.5.3	Accident Impacts on Young Male Drivers .....	36
9.5.4	Accident Impacts on Pedestrians .....	38
9.5.5	Accident Impacts on Cyclists.....	39
9.5.6	Accident Impacts on Motorcyclists .....	41
9.5.7	Accident Impacts on Deprived Areas .....	43
9.5.8	Summary of Accident Impacts Analysis .....	45
<b>10.</b>	<b>Full Appraisal of Distributional Impact and Input into AST .....</b>	<b>46</b>
10.1	Introduction .....	46
10.2	Conclusion.....	48

# **1. Introduction**

## **1.1 Background**

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.

Consideration of the DIs of transport schemes is a mandatory requirement of the Department for Transport's (DfT) Transport Analysis Guidance (WebTAG). The current guidance for DI appraisal is contained within TAG Unit A4.2 Distributional Impacts Appraisal. The additional guidance released by the Highways Agency (HA) which clarifies some of the requirements set out in WebTAG for the HA Schemes was also consulted on.

Therefore the DI Appraisal for the Preston Western Distributor followed the general principles set out within TAG Unit A4.2 but also considered the recommendations of the HA guidance where applicable.

## **1.2 Technical Standards**

This report has been produced in line with best practice DfT / HA guidance set out within the following:

- TAG Unit A.4.2: Distributional Impact Appraisal (DfT, December 2015);
- WebTAG Requirements for the Social and Distributional Impact Analysis of Transport Schemes – TAME Group Advice on Application to HA Major Schemes (Nick Corby, May 2012).

## **1.3 Structure**

The remainder of this report is structured as follows:

- Chapter 2: Scheme Overview
- Chapter 3: Appraisal Methodology Overview
- Chapter 4: Screening Process (Step 1)
- Chapter 5: Distributional Impact of User Benefits
- Chapter 6: Distributional Impact of Personal Affordability
- Chapter 7: Distributional Impact of Noise
- Chapter 8: Distributional Impact of Air Quality
- Chapter 9: Distributional Impact of Accidents
- Chapter 10: Full Appraisal of Distributional Impact and Input into AST

## 2. Scheme overview

### 2.1 Scheme Description

The PWD is a key component of the programme of measures set out in the Central Lancashire Highways and Transportation Masterplan (CLTHM) that collectively will support the scale of development set out in the approved Central Lancashire Core Strategy and will mitigate its impact on the transport network.

The PWD consists of construction of a new 4.3km dual carriageway road to support delivery of the North West Preston strategic housing location (more than 5,000 dwellings) and improve access to both the Strategic Road Network in Northwest Preston, and to/from the Enterprise Zone at Warton.

The scheme includes a new all moves junction with the M55 (Junction 2). It also provides direct links into existing Cottam development areas, the potential Cottam Parkway Rail Station, and direct connection to the East West Link Road.

As part of the scheme several minor roads (e.g. Lea Road, Sidgreaves Ln) will be altered in the provision of a new roundabout to connect north/south and to/from the East West Link Road. The East West Link Road provides the spine through the Strategic Housing Development and therefore providing connectivity to the PWD of the 5000+ houses proposed. Additionally it connects the PWD scheme directly with existing highway network at Lightfoot Lane.

The scheme is one of the four major highways schemes in the Preston, South Ribble and Lancashire City Deal and is in TfL's agreed and prioritised Investment Programme.



Figure 2-1: Preston Western Distributor Scheme & EWL Connection

### 2.2 Scheme Objectives

The confirmed scheme objectives as defined in the PWD Strategic Case are split into two tiers. The three primary objectives are critical to delivery of the Core Strategy and are identified within the CLTHM. The eight

supporting objectives relate to the current and future problems within the PWD area of impact. The full set of objectives is listed below:

**A. Primary Objectives**

1. Unlock capacity for 5,000+ dwellings and their residents in North West Preston;
2. Improve access to the Warton Enterprise Zone site; and
3. Reduce congestion on arterial and radial routes to/from Preston.

**B. Supporting Objectives**

1. Facilitate access to the proposed Cottam Parkway rail station;
2. Facilitate the implementation of bus priority measures;
3. Facilitate the provision of enhanced walking and cycling networks;
4. Facilitate enhancement of the public realm and local centres;
5. Improve road safety;
6. Improve air quality and reduce noise pollution;
7. Support further housing and employment growth potential in Central Lancashire; and
8. Support the future delivery of a new Ribble Crossing joining with the A582 and A59 routes west of Penwortham.



## 3. Methodology

### 3.1 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; and
- Accidents

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

The full 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.

### 3.2 Step 1: Screening Process

In order to ensure a proportionate approach to the appraisal WebTAG 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.

### 3.3 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.

## 3.4 Step 3: Appraisal of Impacts

Step 3 provides an assessment of the impact of the intervention on each indicator's social groups for input in to the AST and is divided in to 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 Figure 3-1 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.

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 x
Adverse and the population impacted is broadly in line with the proportion of the population of the group in the total population	Moderate Adverse xx
Adverse and the population impacted is significantly greater than the proportion of the group in the total population	Large Adverse xxx

Figure 3-1: System for grading DIs

## **4. Screening Process (Step 1)**

### **4.1 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 included in this report as Appendix A.

### **4.2 Results of Screening Process**

Column d of the screening proforma demonstrates that five DI indicators fulfil the criteria to be taken to Step 2 of the Appraisal. These are:

- User Benefits;
- Affordability;
- Noise;
- Air Quality; and
- Accidents.

The results of Screening are consistent with the HA guidance, which recognises that Major Highways Schemes will always have an impact on User Benefits, Noise, Air Quality, Accidents and Affordability, may or may not have an impact upon Severance, but should never have anything more than, at most, a negligible impact upon Security and Accessibility.

The five indicators which passed Step 1 have been taken forward to the next step of appraisal, known as Assessment (Step 2) and are discussed in the following chapters of the report individually.

## 5. Distributational Impact of User Benefits

### 5.1 Introduction

The User Benefits indicator concerns the travel time and vehicle operating cost (VOC) benefits of the scheme. These benefits are calculated using the industry standard software TUBA in accordance with TAG Unit A1.3. The DI appraisal of User Benefits only considers the travel time and VOC benefits for home-based non-business car trips within the affected area.

### 5.2 Step 2a: Confirmation of areas impacted by the intervention

WebTAG suggests that the impact area for User Benefits should be 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. The HA Guidance clarifies WebTAG 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.

The core modelled area of the CLTM which was used for the economic assessment of the Preston Western Distributor is defined in the Local Model Validation Report (LMVR) issued in December 2018 and is shown in Figure 5-1. For the purpose of DI appraisal of user benefits all the model zones which lie fully or partially within the core modelled area form the User Benefits area of impact. This area is demonstrated in Figure 5-1 next to the Core modelled area.

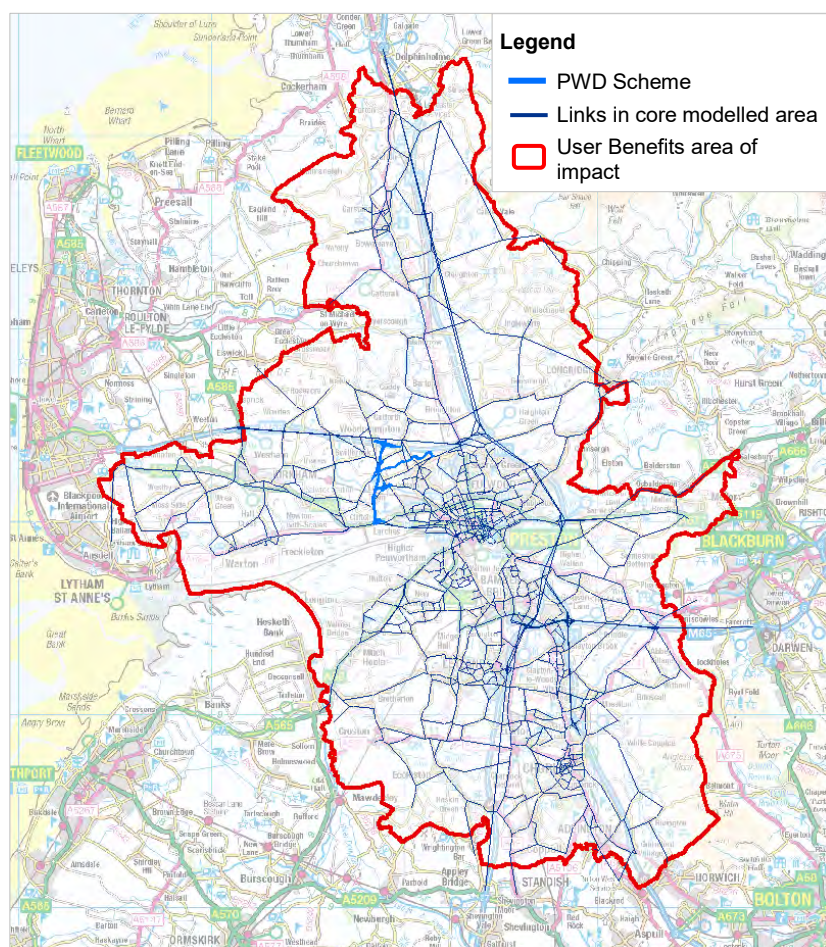


Figure 5-1: Core Modelled Links and User Benefits Affected Area



To make sure the identified area of impact accounts for the majority of User Benefits provided by the scheme the spatial analysis of the TUBA benefits has been undertaken which showed that the zones within the core modelled area receive over 70% of the total benefits.

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

In line with WebTAG 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 area or model zone within the impact area.

The income segmentation is based upon the 2015 Indices of Income Deprivation at the LSOA level. Using the national deprivation ranking (as a proxy for income), the Lower Super Output Areas (LSOAs) have been divided into 5 quintiles. Quintile 1 represents the 20% most deprived LSOAs whereas quintile 5 represents the 20% least deprived LSOAs.

Table 5-1 shows the number of LSOAs by income quintile in the User Benefits affected area. The map of LSOAs by income quintile in the User Benefits affected area is demonstrated in Figure 5-2.

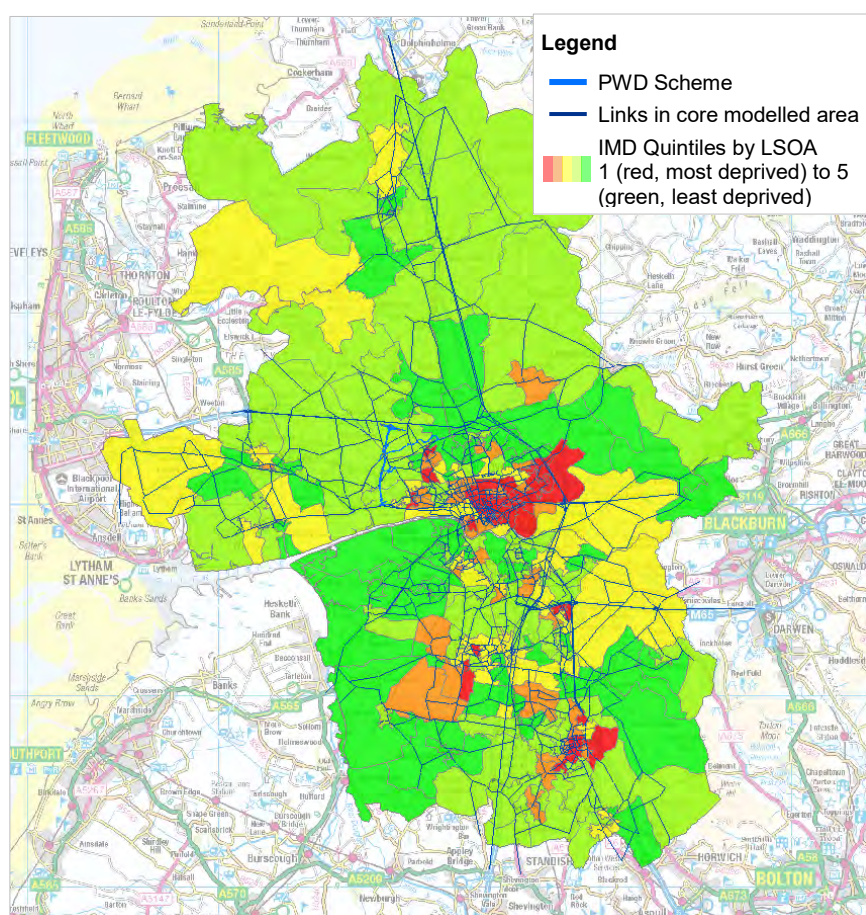


Figure 5-2: LSOAs by income quintile in the User Benefits Affected Area

The Ordnance Survey Address Point Data has been used to estimate the population within each of the LSOAs and the total population by income quintile within the User Benefits affected area. The population has been estimated by multiplying the number of dwelling address points within each LSOA by the average number of residents per dwelling 2.36 (2011 Census data).

Population estimates for each of the Income Quintiles within the User Benefits Affected Area are summarised in Table 5-1. It shows that the population living in the area of impact is distributed among all 5 quintiles, with 24.6% living in the least deprived LSOAs and 17.1% in the most deprived areas.

Table 5-1: LSOAs and Population by Income Group

	Income Quintiles					Totals
	Most Deprived ←		→Least Deprived			
	1	2	3	4	5	
No of LSOAs in Affected Area	40	40	45	64	66	255
No of Dwellings in Affected Area	29,783	28,721	31,718	41,217	42,951	174,390
Population in Affected Area (2.35 factor)	70,288	67,782	74,854	97,272	101,364	411,560
	17.1%	16.5%	18.2%	23.6%	24.6%	100%

## 5.4 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.

## 5.5 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. The TUBA analysis undertaken as part of the Preston Western Distributor Full Business Case economic assessment calculated User Benefits for the following time periods using appropriate assumptions regarding the annualisation of benefits for the modelled time periods:

- Morning (AM) weekday peak hour between 08:00 and 09:00;
- An inter-peak weekday hour representing an average hour between 10:00 and 16:00;
- Evening (PM) weekday peak hour between 17:00 and 18:00.

For the purposes of the DI appraisal, benefits for all of the above time periods were considered.

The analysis has been undertaken for the standard 60 year appraisal period and assumes the opening year of 2022 and the horizon year of 2081.

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 core analysis needs to identify the benefits within each LSOA by aggregating or disaggregating benefits for individual TUBA zones within the area. The LSOA benefits are then reported based on the national income quintile.

As clarified in the HA guidance DIs of User Benefits are only concerned with home based non-business car trips (i.e. Car Commute and Car Other journey purposes) within the area of impact. Therefore, it is important that these benefits are isolated from the other TUBA benefits in three stages.

The first stage in the process is 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 556 zones. Out of these, 496 are in the User Benefits affected area and the remaining 60 are external to the area of impact. The TUBA output was extracted for the 556 sectors comprising both affected and external zones. All the benefits associated with the external to external zone trips were removed from the analysis.

The second stage in the process is to filter out the business trips and non-car trips from the detailed TUBA output. This has been done by exporting the detailed TUBA output into Microsoft Access and removing then any benefits associated with the Business trip purpose. The same has been done for non-car trips leaving only the Time and VOC benefits associated with non-business car trips, i.e. Car Commute and Car Other trips purposes.

The third stage in the process is to filter out the non-home based trips from the detailed TUBA output. As the TUBA assessment is based on OD matrices rather than PA matrices, the origin is not necessarily home. Thus, to overcome this issue the HA guidance note suggests that the zonal benefits in the AM Peak should be the total of the benefits from that zone and in the PM Peak the zonal benefits should be the total of the benefits to that zone. For the Inter Peak period 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.

After User Benefits in the affected area were isolated from the other TUBA benefits they needed to be aggregated or disaggregated to calculate User Benefits per 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 the LSOA the zone boundaries do not always match the LSOA boundaries. Therefore the Ordnance Survey Address Point Data has been used to allow for the TUBA zonal benefits to be converted into LSOA benefits.

By using the spatial join function in GIS the number of dwellings per TUBA zone was derived. The zonal User Benefits were then divided by the number of dwellings to calculate the User Benefits for each individual Address Point dwelling in the Affected Area. The Address Points were then overlain on the LSOA boundaries, allowing the total benefits to be summed across each LSOA.

The total home-based non-business car trip benefits (Time and VOC) for each LSOA within the affected area are presented in Appendix B.

A summary of the DI assessment for User Benefits, reported per income quintile, is provided in Table 5-2. This has been based upon the DI assessment requirements as set out within Table 7 of TAG Unit A4.2.

In line with the WebTAG 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.

The result of the assessment shows that all income groups will benefit from the scheme. For Quintile 4, however, the proportion of benefits (31.6%) is significantly greater (e.g. more than 5%) than the proportion of the income group in the total population (23.6%). Based on the criteria set out in TAG Unit A4.2 Quintile 4 benefits in both absolute and relative terms and, therefore, receives a score of Large Beneficial.

All the other income quintiles receive a moderate beneficial score, except for income quintile 1 which receives a slight beneficial score.

Table 5-2: Summary of User Benefits DI Analysis. All benefits discounted to 2010 in 2010 prices

User Benefits	National Income Quintile					
	Most Deprived ←			→ Least Deprived		
	1 (0% - 20%)	2 (20% - 40%)	3 (40% - 60%)	4 (60% - 80%)	5 (80% -100%)	Total
Benefits (£) [A]	11,371,300	15,813,500	25,941,900	39,474,800	32,143,400	124,744,900
Share of overall benefits [B] = [A] / Σ[A]	9.1%	12.7%	20.8%	31.6%	25.8%	
Population [C]	70,300	67,800	74,900	97,300	101,400	411,700
Share of overall population [D] = [C] / Σ[C]	17.1%	16.5%	18.2%	23.6%	24.6%	
Share of overall benefits - Share of overall population [B] - [D]	-8.0%	-3.8%	2.6%	8.0%	1.1%	
Assessment	Slight Beneficial ✓	Moderate Beneficial ✓✓	Moderate Beneficial ✓✓	Large Beneficial ✓✓✓	Moderate Beneficial ✓✓	



## 6. Distributional Impact of Personal Affordability

### 6.1 Introduction

Personal Affordability is concerned with out-of-pocket non-business user costs. As the scheme under analysis 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 Affordability DI analysis is based on the results of the same TUBA assessment which was used for the User Benefits indicator, excluding travel time benefits (i.e. considering VOCs only).

### 6.2 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 5.2 to 5.4 of the report and the impact area is presented in Figure 5-1.

### 6.3 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 using the address point data in the same way as it has been done for the User Benefits analysis.

The affordability benefits for each LSOA within the affected area are presented in Appendix C.

A summary of the DI assessment for Personal Affordability is provided in Table 6-1. The assessment scores have been derived using the same grading system as for User Benefits.

The results show that income Quintiles 1 to 5 within the Impact Area receive an overall affordability disbenefit, therefore in absolute terms each of these income groups receives an adverse score. For Quintiles 3 and 4, however, the proportion of disbenefits is significantly (e.g. more than 5%) greater than the proportion of the income group in the total population, therefore they receive a Large Adverse score. On the contrary, the proportion of disbenefits on Quintiles 1 and 2 is significantly (more than 5%) smaller than its population proportion, thus they receive a Slight Adverse score. Income quintile 5 receives a moderate adverse score.

Table 6-1: Summary of Personal Affordability DI Analysis. All benefits discounted to 2010 in 2010 prices

Affordability		National Income Quintile					Total
		Most Deprived ←			→ Least Deprived		
		1 (0%-20%)	2 (20%-40%)	3 (40%-60%)	4 (60%-80%)	5 (80%-100%)	
User Charges (£) [A]	Increase	407,700	1,293,200	5,316,400	7,345,000	3,518,800	17,881,100
	Decrease						
Share of overall user charge [B]=[Ai]/Σ[Ai]	Increase	2.3%	7.2%	29.7%	41.1%	19.7%	
	Decrease						
Population [C]	Incr. in user charges	70,300	67,800	74,900	97,300	101,400	411,700
	Decr. in user charges						
Share of overall population [D]=[Ci]/Σ[Ci]	Incr. in user charges	17.1%	16.5%	18.2%	23.6%	24.6%	
	Decr. in user charges						
Share of overall benefits - Share of overall population [B] - [D]		-14.8%	-9.2%	11.5%	17.4%	-5.0%	

Assessment	Slight Adverse x	Slight Adverse x	Large Adverse xxx	Large Adverse xxx	Moderate Adverse xx	
------------	------------------------	------------------------	-------------------------	-------------------------	---------------------------	--

## **7. Distributional Impact of Noise**

### **7.1 Introduction**

According to WebTAG 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. Whilst there is no clear evidence of particular impacts on other social groups, the guidance recommends considering the distributional impacts of changes in noise for different income groups.

### **7.2 Step 2a: Confirmation of Areas Impacted by the Intervention**

The impact area for the Noise indicator has been defined through the noise assessment undertaken in accordance with the requirements of TAG Unit A3 Environmental Impact Appraisal and Volume 11 of the Design Manual for Roads and Bridges, Section 3, Part 7, Noise and Vibration (DMRB 11.3.7).

The first step in identifying the affected area involves 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. The project boundary is the line around the carriageway edges of these routes. A 1 km zone is then defined from the project boundary.

'Affected routes' are 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.

The result of the TAG / DMRB assessment is the identification of all receptors (properties) within the affected area that are likely to experience a change in noise levels ( $>\pm 1\text{dB}$ ) as a result of changes in traffic flow.

Figure 7-1 shows the impact area for the Noise Indicator.

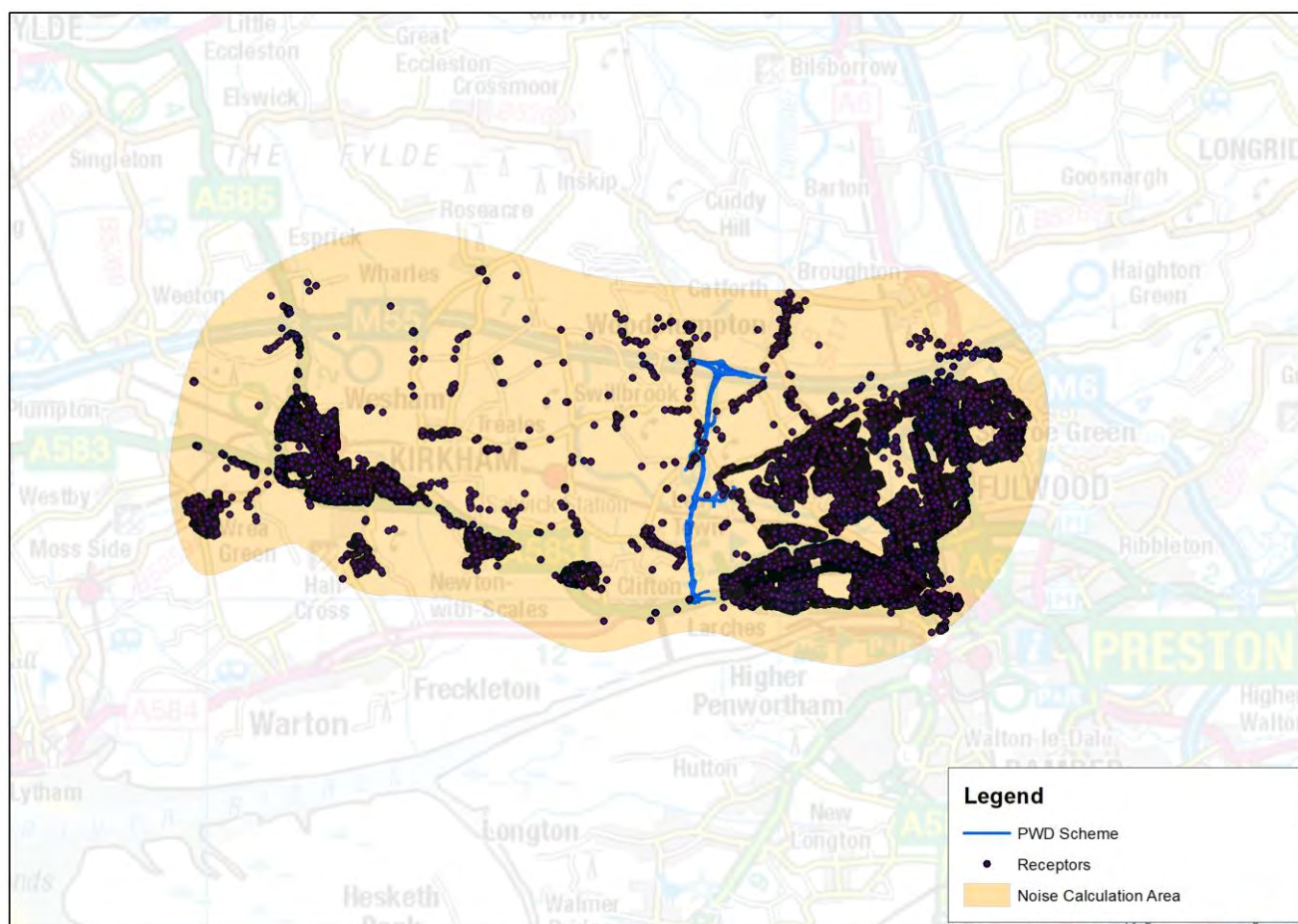


Figure 7-1: Impact area for noise indicator

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

WebTAG recommends undertaking the analysis of noise impacts experienced by households with different levels of income based on the national income quintile ranking system described in Section 5.3 of this report. The DI analysis therefore requires the identification of the population of each income quintile that would experience an increase, decrease or no change in noise as a result of the scheme.

The TAG noise assessment provides the number and location of affected households (dwellings) and estimated population (assuming 2.35 residents per household, as per the 2011 census). These numbers are based on the comparison of noise levels in With and Without Scheme scenario in the design year (2037).

Each household and its associated noise impact have been plotted in GIS, along with the LSOA boundaries and their associated income quintile. Figure 7-2 shows that all income quintiles are present in the affected area. The most deprived income group is the smallest within the area of impact (7%) whilst proportions of the other four income groups vary between 21% and 26%.

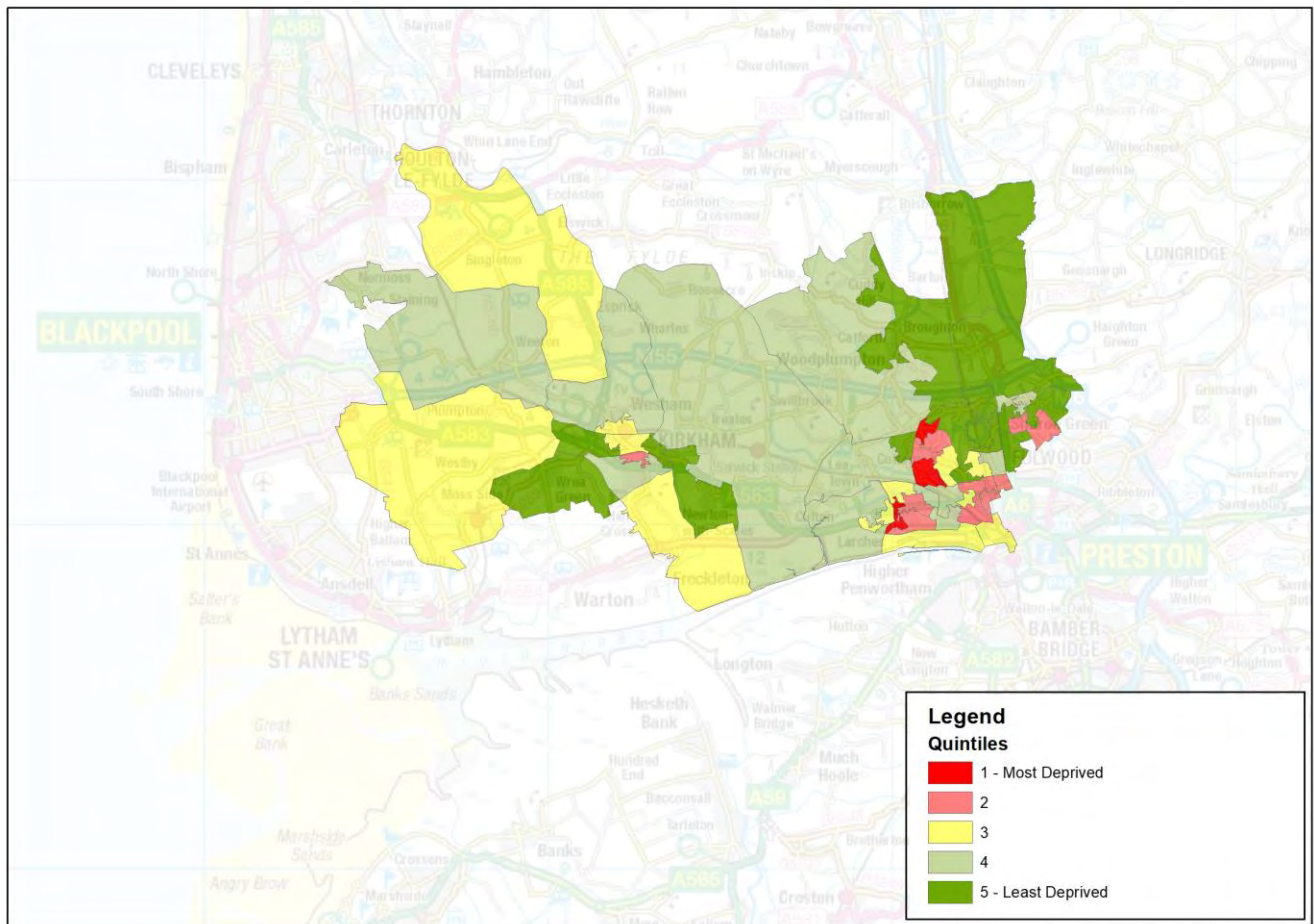


Figure 7-2: Income quintiles in study area

Sensitive receptors such as schools and hospitals 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 Figure 7-3. There are 4 hospitals and 53 schools in the noise impact area. Other locations where children or older people could spend time (parks, playgrounds, care homes) have been omitted due to the large number of those locations.



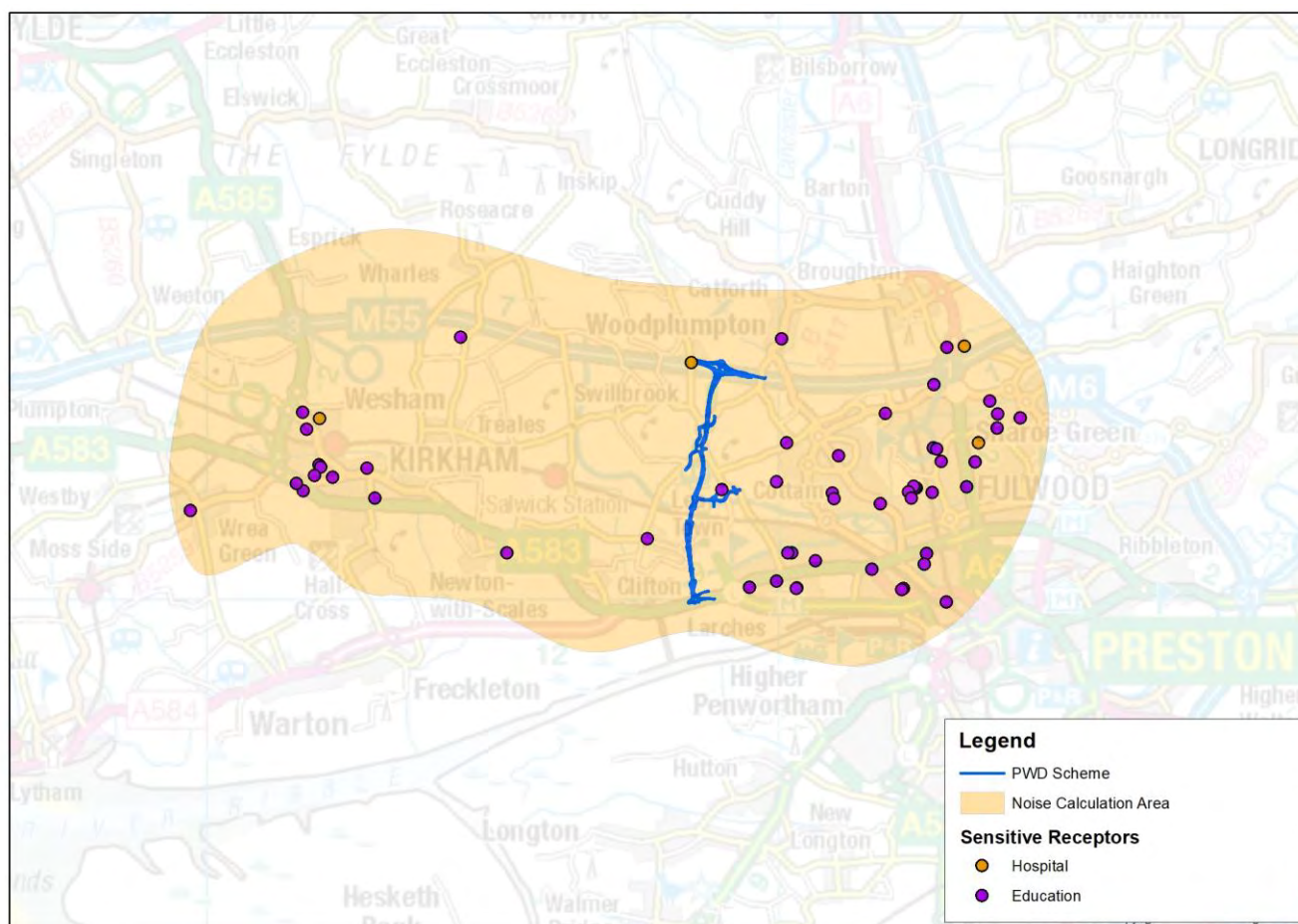


Figure 7-3: Location of receptors within study area

In addition, in line with WebTAG Unit A4.2 Section 3.3.3, areas with large populations of children and elderly residents have also been identified using LSOA mid-2017 population estimate data. Figure 7-4 displays the 9 LSOAs within the study area which have more than 400 residents aged 65 or above. Figure 7-5 shows the 6 LSOAs with over 400 residents aged 16 years or below.

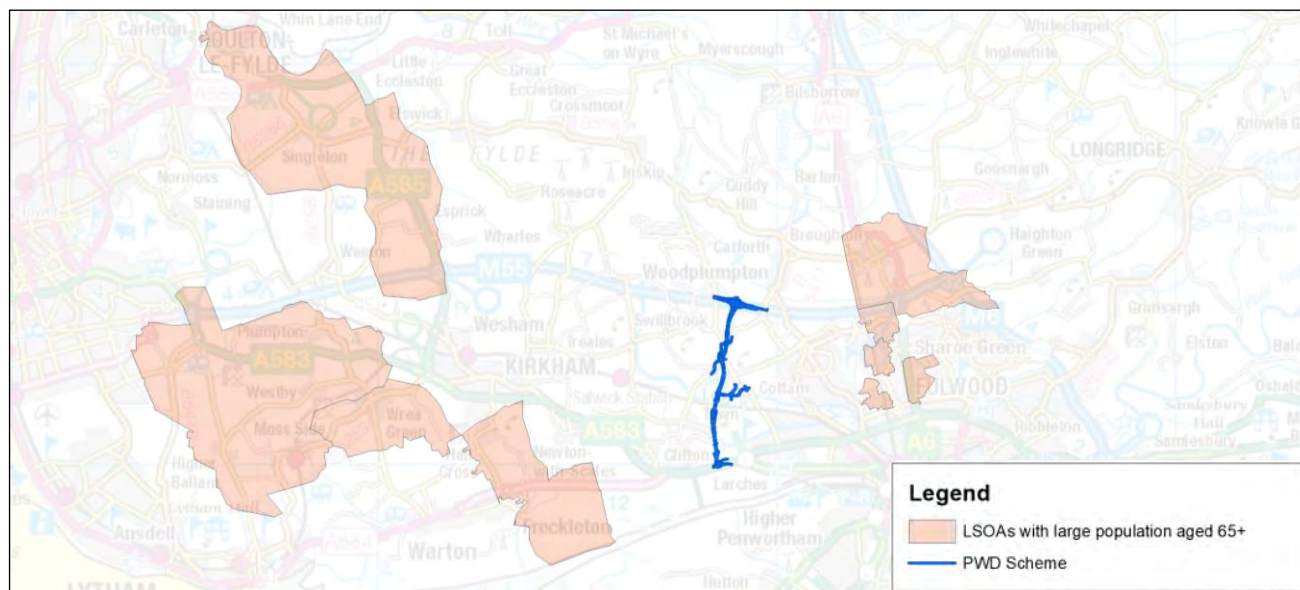


Figure 7-4: LSOAs with large elderly population within study area

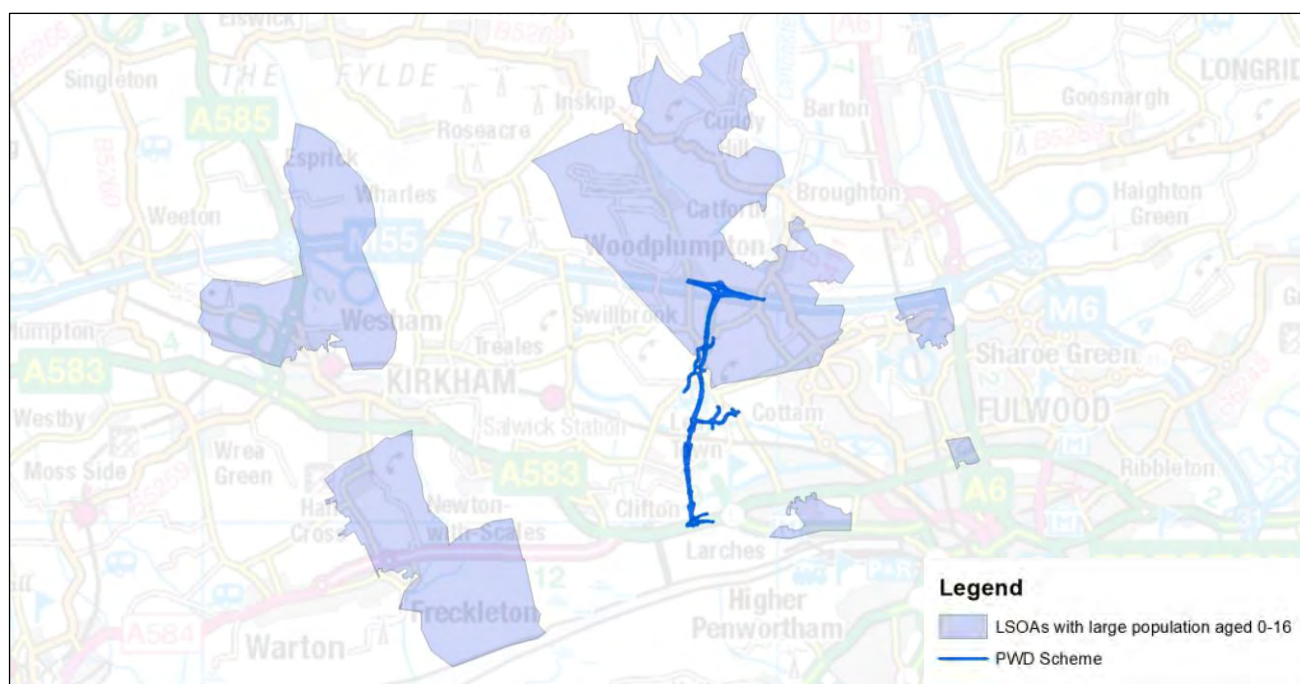


Figure 7-5: LSOAs with large young population within study area

## 7.4 Step 3a: Core Analysis of Impacts

The results of the TAG assessment show that across the noise impact area 5,619 people will experience an increase in noise, 11,207 people will benefit from a decrease in noise while the vast majority (54,635 people) will experience imperceptible change in noise as a result of the scheme. Only within income group 1 there are more losers than winners in terms of changes in noise levels as a result of the scheme. For all other income groups, the scheme will have a positive noise impact. The households in the affected area with improvement, worsening and no change in noise are shown in Appendix D.



The results of the DI Appraisal for Noise indicator are summarised in Table 7-1. 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.

The results show that there is an overall decrease in noise across income quintiles 2 to 5. However, in relative terms the impact varies across each group.

Income quintile 5 has 25.6% share of the population and 74% of the 'net winners' in terms of decreased noise levels. Hence, the overall noise impact for quintile 5 is beneficial and its proportion is significantly greater than the proportion of the group in the total population. An assessment score of Large Beneficial has therefore been awarded to income group 5. On the other hand, the proportion of net winners in income groups 2 and 4 is significantly lower than the proportion of its population in the impact area and therefore Slight Beneficial Score has been awarded to income groups 2 and 4.

Income groups 2 and 4 have 23.4% and 23.2% share of the overall population respectively and the proportion of net winners for these groups is in line with their share of population. A Moderate Beneficial score is therefore awarded to those groups.

Income group 3 has 20.6% share of the overall population and the proportion of net winners for this group is in line with their share of population. A Moderate Beneficial score is therefore awarded to this group.

Finally, income group 1 is awarded a Large Adverse score as the impact on noise for this group is negative and significantly larger than its share of the population.

Table 7-1: Summary of noise DI analysis

	IoD Income Domain					Total
	Most deprived ←————→ Least deprived					
	1 (0-20%)	2 (20-40%)	3 (40-60%)	4 (60-80%)	5 (80-100%)	
Population in each group with increased noise [A]	1,203	717	1,429	1,979	291	5,619
Population in each group with decreased noise [B]	7	1,633	2,780	2,371	4,416	11,207
Population in each group with no change in noise [C]	3,939	14,361	10,516	12,215	13,604	54,635
Net no of Winners / Losers in each group [D] = [B] – [A]	-1,196	917	1,351	392	4,124	5,588
Total number of Winners / Losers across all groups [E] = $\Sigma[D]$						5,588
Net winners/losers in each area as percentage of total [F] = [D] / [E]	-21.4%	16%	24%	7%	74%	
Share of total population in the impact area	7.2%	23.4%	20.6%	23.2%	25.6%	
Assessment	***	✓	✓✓	✓	✓✓✓	

Out of 53 schools in the calculation area, five will receive negative noise impact as a result of the scheme whilst 10 schools will experience a decrease in noise. For the remaining 38 schools the change in noise will be imperceptible once the PWD is built. In addition, out of the 6 LSOAs with a large young population, five LSOAs have a larger proportion of receptors recording a decrease compared to an increase in noise pollution. The overall score for children is therefore Slight Beneficial.

The hospitals located in the affected area will not be affected by change in noise. In addition, out of the 9 LSOAs with large elderly populations, 5 of the LSOAs experience a decrease in noise, while the other 4 experience no change. The score for older people therefore is slight beneficial.

## 8. Distributional Impact of Air Quality

### 8.1 Introduction

As stated in TAG Unit A4.2 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: Confirmation of Areas Impacted by the Intervention

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 and DMRB 11.3.1.

For all the links that are identified as being affected by the scheme, a buffer zone of 200m from the centre of the carriageway is 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<sub>2</sub> and PM<sub>10</sub> pollutant concentrations) as a result of changes in traffic flow.

Figure 8-1 shows the affected links and receptors which were used to define the affected area for the Air Quality indicator.

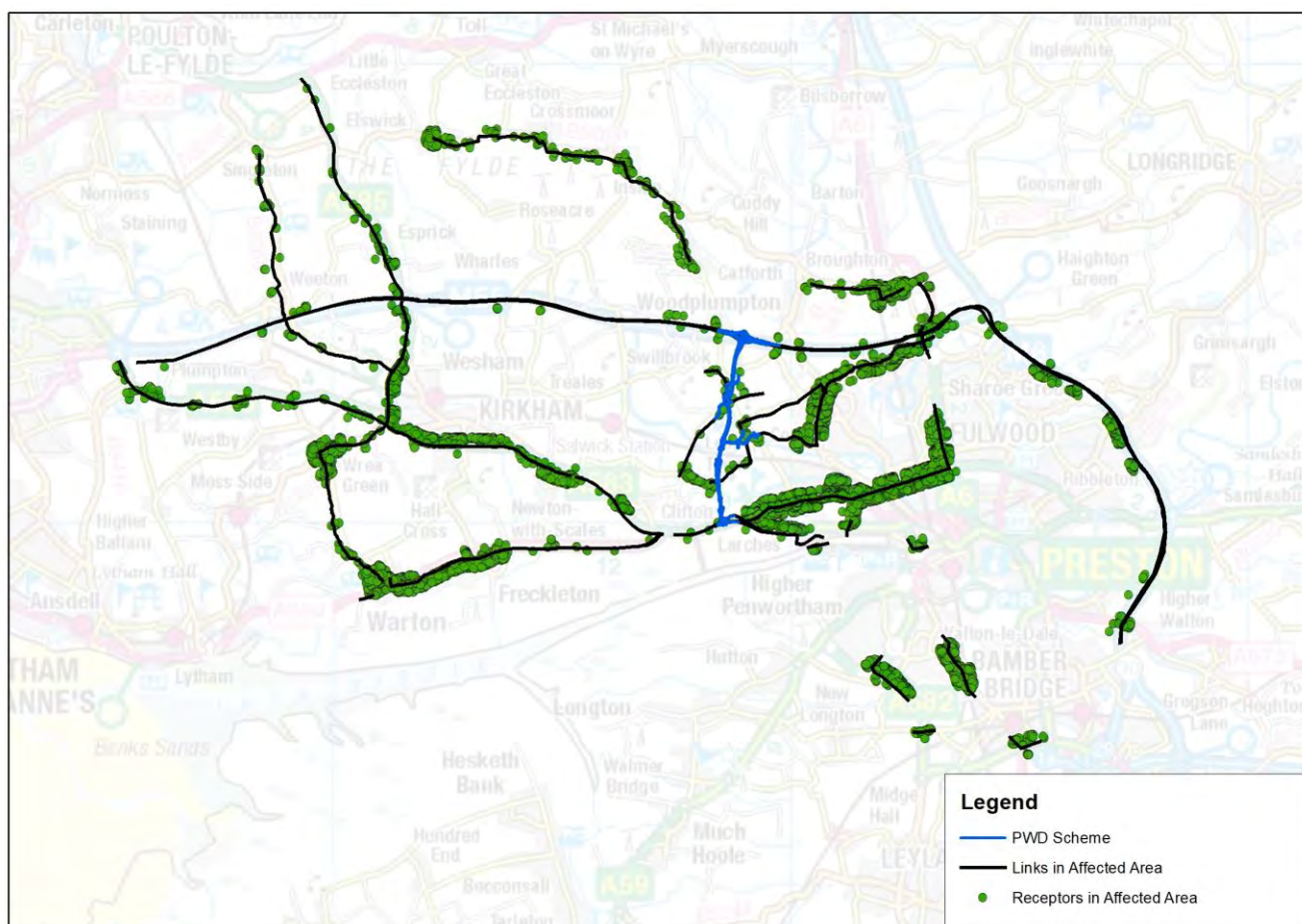


Figure 8-1: Air Quality Affected Area and Affected Receptors

An Air Quality Management Area (AQMA) in close proximity to the scheme has also been identified and included in the area of impact.