Jacobs

M6 J33

Options report

21 January 2020

Lancashire County Council

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
1	21/01/20	Structure and first draft	ALG	ALG		
2	24/01/20	Noise contents	CB	ALG		
3	15/02/2020	TP contents	EP	ALG		
4	17/02/2020	AQ	SP	ALG		
5	18/02/2020	Final draft for revision	EP	ALG		
6	20/03/2020	Final, LCC comments addressed, Addendum 1 presented as a separate document	EP/ALG	ALG		
7	03/04/2020	LCC comments addressed	EP/ALG	ALG		
8	7/05/2020	LCC outstanding comments addressed, Addendum 2 presented as a separate document	EP/ALG	ALG		
9	26/05/2020	LCC comments addressed: Figures 5 - 10 corrected	EP/ALG	ALG		

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
1	18/02/2020	18/02/20	Niamh O'Sullivan	NOS, AK, VW provided comments and track changes

M6 Junction 33 Options report

Project No:	
Document Title:	M6 J33 Options report
Document No.:	Document No.
Revision:	1
Document Status:	Structure and First draft
Date:	21 January 2020
Client Name:	Lancashire County Council
Client No:	
Project Manager:	Angela Lopez Garces
Author:	Angela Lopez Garces
File Name:	M6 Options report

Contents

Figures

Tables

Executive Summary

Lancaster City Council publication Local Plan identifies potential housing and employment land to the south of Lancaster, on the west of the A6. In addition, Lancaster University are proceeding with plans to construct a new Health & Innovation Campus next to their existing site on the east of the A6. These developments would generate traffic on the A6 to M6 J33, in addition to the existing traffic to and from Lancaster from the motorway network to the south.

The existing A6 is constrained where it passes through Galgate, in particular at the signal controlled junction with Salford Road/Stoney Lane. There are limited opportunities to improve the junction because of the close proximity of properties, and this bottleneck results in frequent congestion on the A6, with long queues on the approaches. The additional traffic generated by the proposed developments could exacerbate this problem.

A broad corridor area and 6 possible route options within this broad area have been developed for M6 Junction 33 to alleviate the above problem. The broad corridor area also includes the spine road that will go through the Bailrigg Garden Village that is fixed in this location. Traffic, noise and air quality modelling is required to assess the performance of the 6 alternative route options.

The study area spans from the M6 Junction 34 down to Junction 33. This area is included in the already existing Lancaster Traffic Model, which provides an optimal tool to inform the traffic model of the preferred options.

The objective of this study is to produce a comparative assessment of the performance of each of the six route options including the following topics:

- Traffic Impact
- Noise Impact
- Air Quality Impact

A policy review to understand the fit of the each of the six route options with relevant policy was also undertaken.

Comparative assessment of the six possible route options has demonstrated that:

- From the traffic modelling point of view, the Central 1 option is the one that shows most potential to reduce traffic flow and alleviate congestion on the A6 through Galgate. The main disadvantage of Central 1 is that the junctions in the new infrastructure are showing to operate over capacity. A feasible design that provides enough capacity needs to be considered if the scheme is taken forward to subsequent stages. All other schemes achieve some reduction of flows in the A6 through Galgate however; these are not consistent for all directions of travel.

- The Noise analysis shows that for the short-term daytime period, West 2 is the most preferable option from a noise perspective, as it results in the least number of adverse impacts of minor magnitude and provides a substantial number of beneficial impacts of minor magnitude or more. In the long term, all options are considered comparable in terms of preference from a noise point of view. All schemes would be regarded as adverse owing to the larger numbers of adverse impacts of minor magnitude or more compared to the beneficial impacts of minor magnitude or more. There is not a large variation between the options in the long-term night-time, with Central 2 option predicted to experience the greatest number of long-term night time adverse impacts of minor magnitude or more and Central 1 predicted to experience the least number of long-term night time adverse impacts of minor magnitude or more.
- The Air Quality assessment indicates there would be an exceedance of the NO_2 AQO at one modelled human health receptor in the opening year Do-Minimum scenario. This receptor, which is located within the Galgate AQMA, is however modelled to experience a medium to large beneficial reduction in NO_2 concentrations in all DS options, resulting in the AQO being achieved at this receptor. NO_2 concentrations at all other human health receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, were modelled be within the relevant AQOs. In accordance with DMRB LA 105 (Highways England, 2019), this indicates that the air quality impacts of the proposed route options– can be considered beneficial. Furthermore, the results of the compliance risk assessment indicate that the proposed options is unlikely to have a significant effect on national compliance with the annual mean NO_2 EU Limit Value.

- The West 2 and Central 2 options have been found not to be a good fit with relation to the Green Spaces policy, DM25 Green Space Infrastructure in the DPD as they weave through ancient woodland - Old Park Wood and Park Coppice. The West 1 and East 1 options also cut across the canal, potentially creating a conflict with this policy. All of the 6 options have been found to potentially affect existing housing and will have to be integrated in the reconfiguration plans for the M6 J33. Similarly, there is an Agri-business Centre planned in the vicinity of the M6 J33 and some of the proposed alignments are in close proximity and potentially interfere with the proposed site. If this was the case, these options might not be a good fit with the Agri-business and Future Employment policies.

1. Introduction

1.1 Background

Lancaster City Council publication Local Plan identifies potential housing and employment land to the south of Lancaster, on the west of the A6. In addition, Lancaster University are proceeding with plans to construct a new Health & Innovation Campus next to their existing site on the east of the A6. These developments would generate traffic on the A6 to M6 J33, in addition to the existing traffic to and from Lancaster from the motorway network to the south. The existing A6 is constrained where it passes through Galgate, in particular at the signal-controlled junction with Salford Road/Stoney Lane. There are limited opportunities to improve the junction because of the close proximity of properties, and this bottleneck results in frequent congestion on the A6, with long queues on the approaches. The additional traffic generated by the proposed developments could exacerbate this problem.

A broad corridor area and 6 possible route options within this broad area have been developed for M6 Junction 33 to alleviate the above problem. The broad corridor area also includes the spine road that will go through the Bailrigg Garden Village that is fixed in this location. Traffic, noise and air quality modelling is required to assess the performance of the 6 alternative route options.

The study area spans from the M6 J34 down to Junction 33. This area is included in the already existing Lancaster Traffic Model, which provides an optimal tool to inform the traffic model of the preferred options.

The objective of this study is to produce a comparative assessment of the performance of each of the six route options including the following topics:

- Traffic Impact
- Noise Impact
- Air Quality Impact

1.2 The purpose of this Report

The purpose of this document is to report on the findings of the traffic, noise and air quality comparative assessments of the 6 routes options designed to alleviate congestion and improve air quality in the A6 along Galgate.

Besides this introduction, Chapter 2 focuses on the baseline situation and describes the route options; Chapter 3 contains a review of national and local policy and assess the performance of each of the route options with the relevant policies; Chapter 4 is about the traffic model, while Noise and Air Quality impact of each of the route options are described in Chapters 5 and 6. Conclusions are outlined in Chapter 7.

2. Baseline assessment and description of future year schemes

2.1 Base line description and evaluation

This section provides an overview of the traffic situation on the study area for the Baseline scenario, which describes the future year traffic conditions in the event the housing development and associated schemes would not take place. This assessment is based on the pre-existing Do Minimum Scenario (Scenario P) of the Lancaster Traffic Model and focus on the long term year scenario, 2040.

2040 modelled flows for the morning and evening peak hours are shown in Figure 1 and Figure 2 respectively:

- The greatest flows are observed in the Strategic Road Network, in the M6 between Junction 33 and 34. Which carries over 3600 Passenger Car Units (PCU) in each direction during the morning peak hour in each direction. In the evening peak hour, 3350 pcu are observed in the NB direction and 3600 in the SB direction.

- The A6 Lancaster Preston road experiences flows of up to 1200 pcu in the Scotforth Road sections during the morning peak and 900 pcu during the evening peak. Model flows in the vicinity to J33 are circa 1000 pcu.

- Flow on key links are shown in Table 2.1 - Baseline scenario, Flow on key links, 2040'. A map with the location of the key links can be found in Figure 11. The modelled flow in the A6 along Galgate is 1571 pcu in the morning peak and over 1700 in the evening peak. The volume over capacity plots are shown Figure 3 and Figure 4. Links with a volume over capacity ratio of over 85% are highlighted in red. A high over capacity volume ratio indicates that the junction is operating at capacity and it is prone to congestion.

In 2040, the model forecasts that the following sections would be operating at or over capacity:

- Some sections of the A6 Lancaster Preston Road new Galgate

- A6 Scotforth Road

- A6 near Royal Lancaster Infirmary

Figure 1: Baseline scenario, modelled flows, 2040, AM peak hour (PCU)

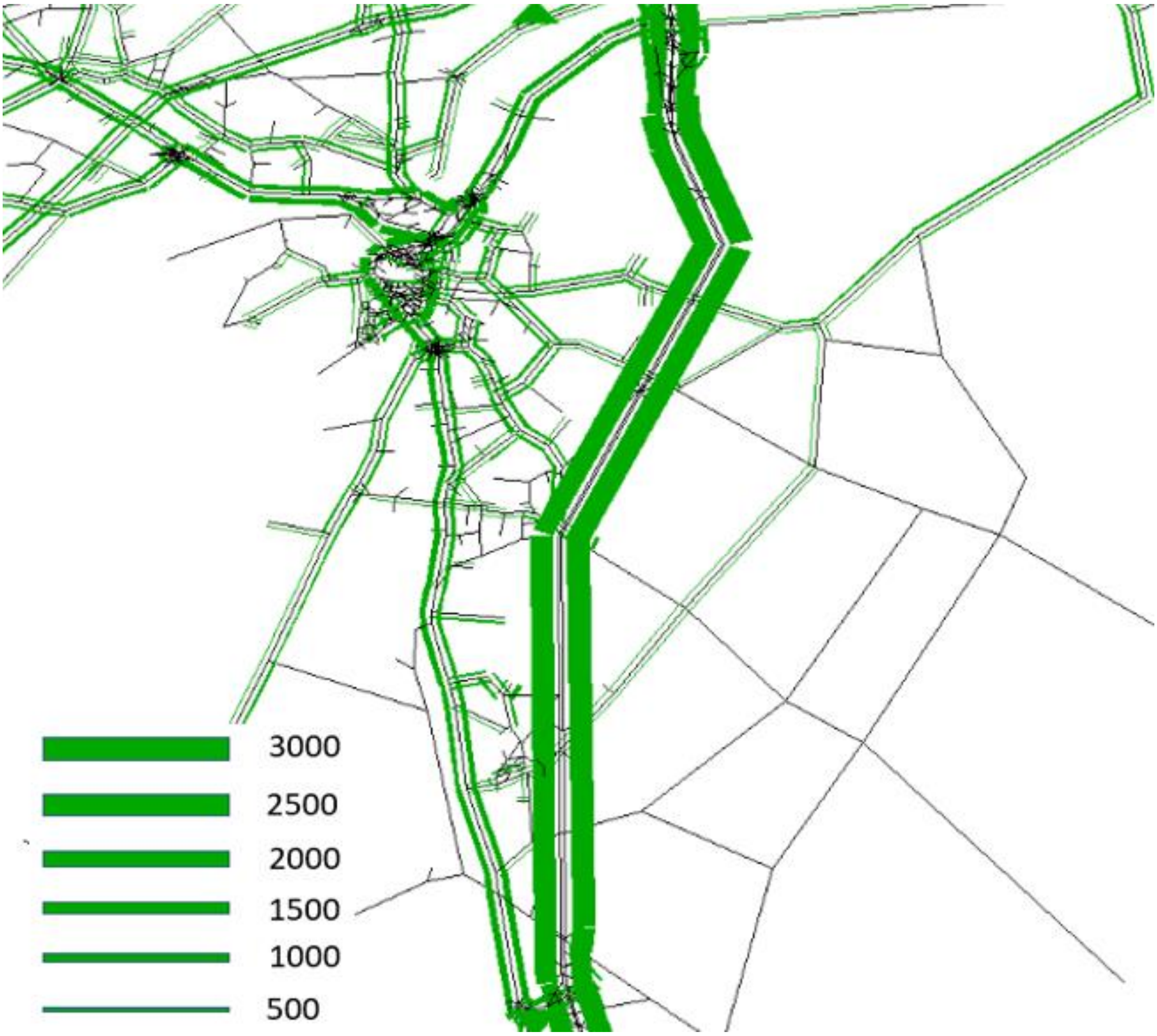


Figure 2: Baseline scenario, Modelled flows, 2040, PM peak hour (PCU)

Table 2.1: Baseline scenario, Flow on key links, 2040 (PCU)

	Road name	Between	Baseline (2040)		
			AM	IP	PM
1	A6	South of M6 J33	1310	1125	1314
2	A6	M6 J33 & Stoney Lane	1597	1373	1902
3	A6	Stoney Lane & Chapel Lane	1571	1210	1741
4	A6	Chapel Lane & Hazelrigg Lane	1408	1145	1506
5	A6	Hazelrigg Lane & Burrow Road	985	1088	1337
6	A6	Burrow Road & Ashford Road	1736	1479	1221
7	A6	Ashford Road & Ashton Road	1443	1407	1356
8	M6	J33 & J34	7263	7302	6986
9	Stoney Lane	A6 & Bay Horse Road	196	26	13
10	Bay Horse Road	Stoney Lane & Procter Moss Road	273	56	100
11	Langshaw Lane	Chapel Lane & Bay Horse Road	46	13	15
12	Hazelrigg Lane	A6 & Procter Moss Road	376	104	231
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	302	83	243
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	228	51	106
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	301	76	102
16	Bowerham Road	Barnton Road & A6	1234	811	1186
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	108	55	59
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	164	68	93
19	Birch Avenue	A588 & Highland Brow	104	89	82
20	A588	Birch Avenue & Tarnwater Lane	438	300	425
21	A588	Tarnwater Lane & Ashford Road	475	313	377
22	Ashton Road	Ashford Road & A6	733	426	560

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

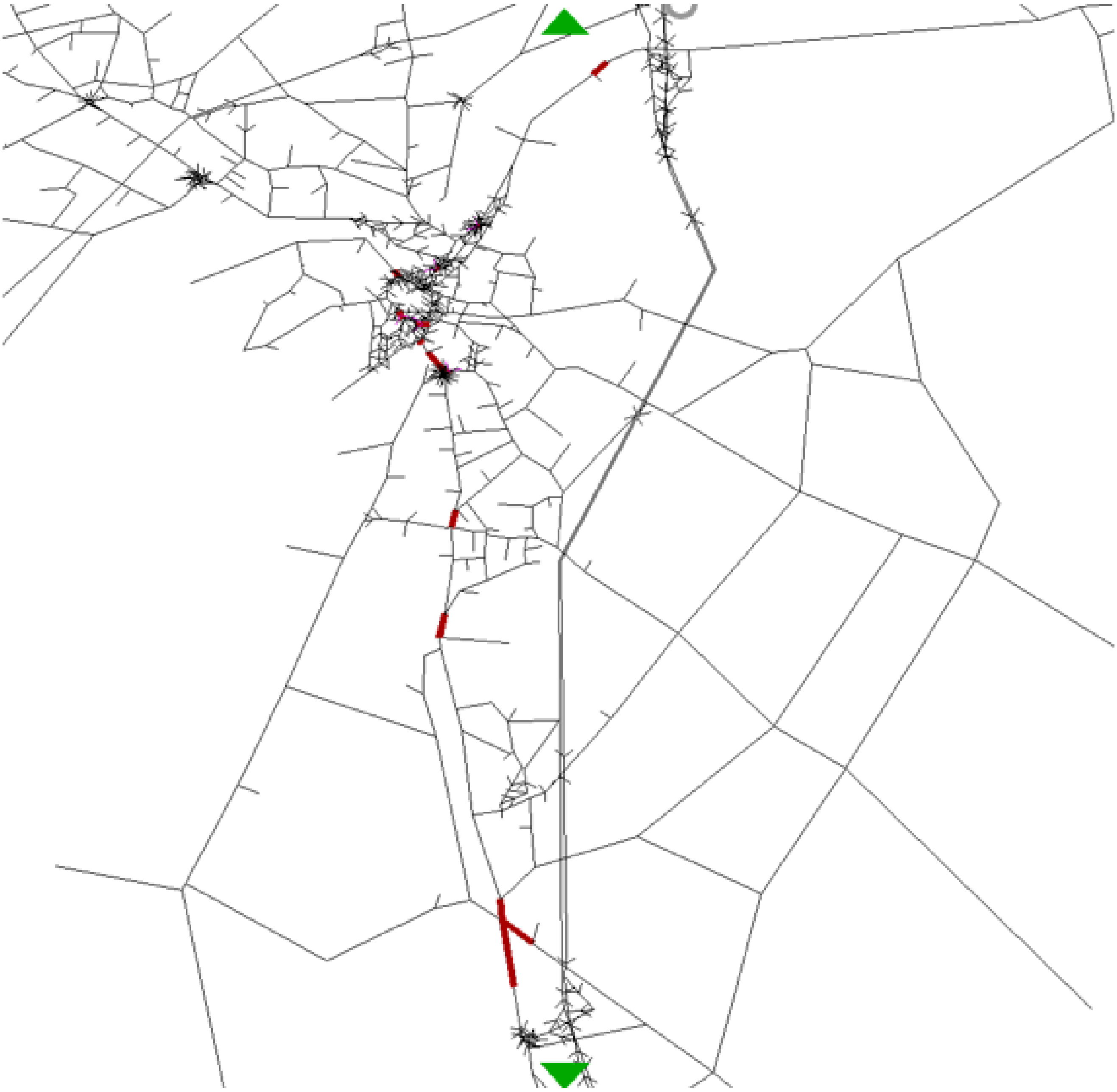


Figure 3: Baseline scenario, Volume over capacity ratio over 85%, 2040, AM peak hour

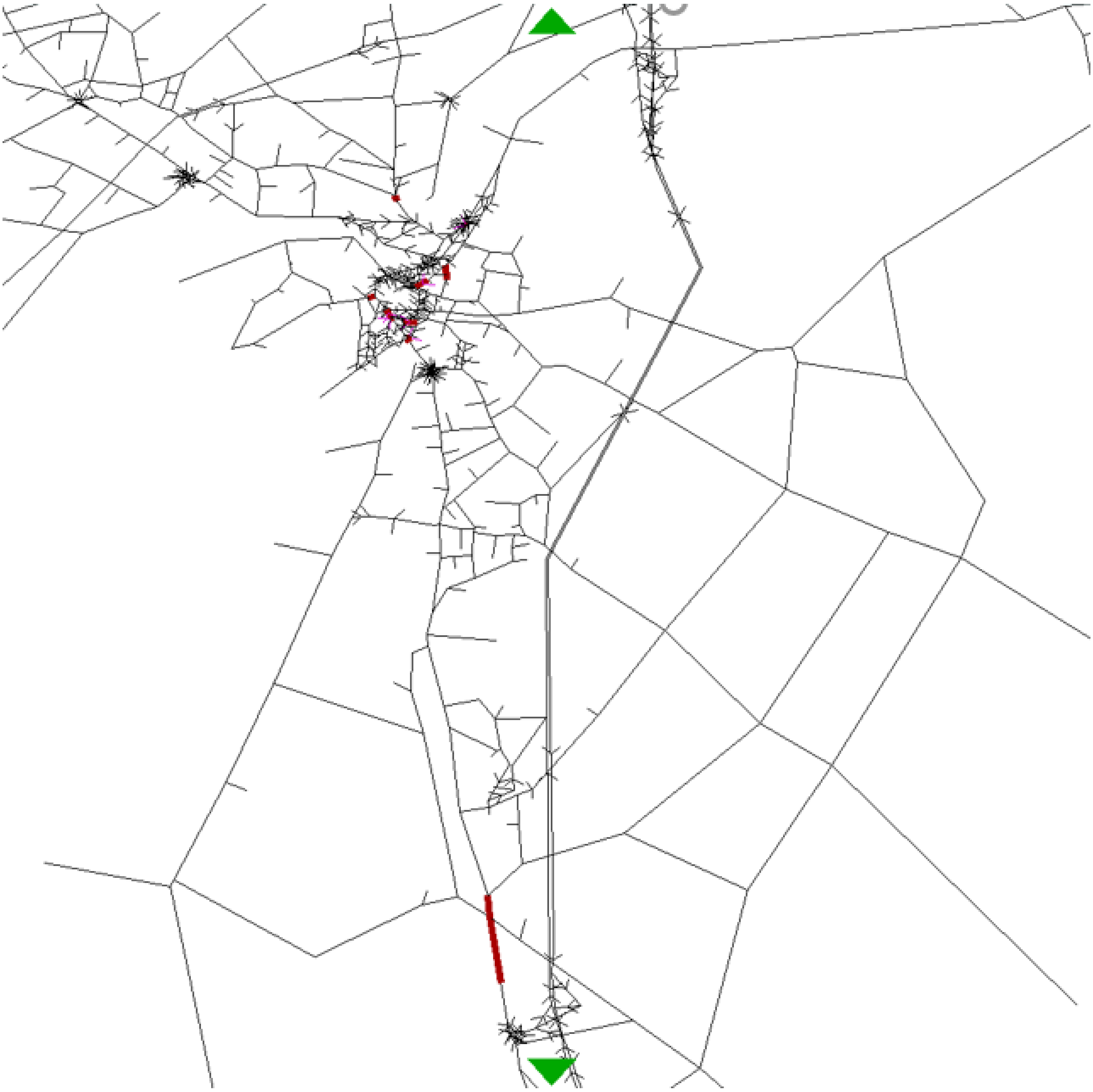


Figure 4: Baseline scenario, Volume over capacity ratio over 85%, 2040, PM peak

2.2 Schemes description

Six options aimed to provide additional capacity to accommodate new housing developments in the area and reduce congestion in Galgate have been considered in this study.

2.2.1 Central 1

The Central 1 route starts at the existing J33 and travels North immediately adjacent to the motorway to Hazelrigg Lane where there is a roundabout junction. Hazelrigg Lane is improved as part of this alignment, with links to the new motorway connection and the Bailrigg Spine Rd. The road between J33 and Hazelrigg is designed to 60MPH (100KPH) and has a verge on both sides; Hazelrigg is designed to 40MPH (70KPH). The design outline can be seen in Figure 5.

Figure 5: Central 1 Route Option

2.2.2 Central 2: A588

The Central 2 (A588) route is similar to Central 1, with the route starting at J33 and travelling north immediately adjacent to the motorway to Hazelrigg Lane where there is a roundabout junction. Hazelrigg Lane is also improved as part of this alignment and there is an additional new road linking the Bailrigg Spine Road and Hazelrigg Lane with the A588, as it can be seen in Figure 6.

Figure 6: Central 2 (A588) Route Option

2.2.3 West 1

The route alignment goes from the roundabout on the A6 at J33 west of Galgate and meeting the Bailrigg Spine Road about half way along its length. This road is designed to 50MPH (85KPH) and has verge and combined footway/cycleway along the full length. An image of the design can be seen in Figure 7.

Figure 7: West 1 Route Option

2.2.4 West 2

The route for West 2 scheme starts south of Galgate and travels west of the village meeting the Bailrigg Spine Road where it passes under the west coast railway. This road is designed to 50MPH (85KPH) and has a verge and combined footway/cycleway along the full length, as it can be seen in Figure 4.

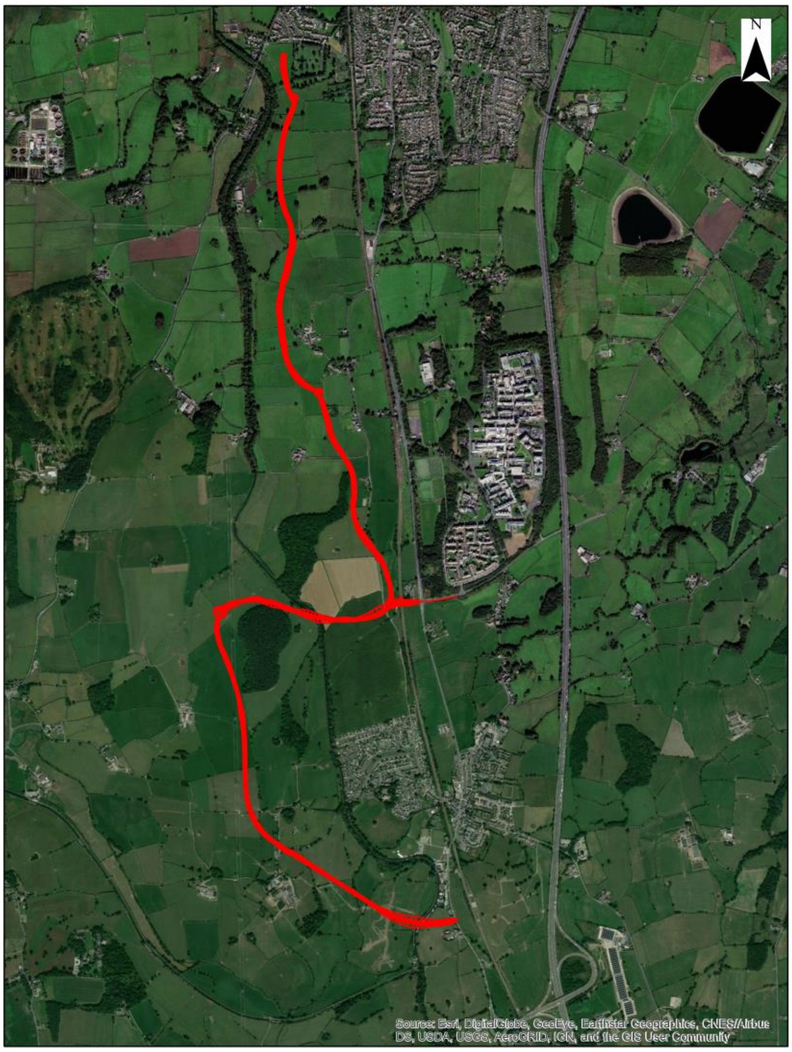


Figure 8: West 2 Route Option

2.2.5 East 1

Traveling from an improved J33 this alignment moves further East to avoid ancient woodland and goes north towards Hazelrigg Lane, Hazelrigg Lane is also improved as part of this alignment to include links to the new motorway connection and the Bailrigg Spine Road. The road between J33 and Hazelrigg is designed to 60MPH (100KPH) and has a verge on both sides; Hazelrigg is designed to 40MPH (70KPH). The route option design can be seen in Figure 9.

Figure 9: East 1 Route Option

2.2.6 East 2

Travelling north from an improved J33, towards Hazelrigg Lane, however this alignment option lies further East than East 1, this is presented as a further eastern alternative, as presented in Figure 11. Hazelrigg Lane is also improved as part of this alignment to link with the new motorway connection and the Bailrigg Spine Road.

Figure 10: East 2 Route Option

3. Policy review

3.1 Methodology

The objective of the policy review is to identify the key policies that apply in the study area and assess if the proposed route options are in accordance or not with the policy objectives. To this effect, the following documents have been reviewed:

- A Local Plan for Lancaster District, 2011 - 2031, Part One: Strategic Policies and Land Allocations DPD, and Part 2: Main modifications, and Policy Map;
- District of Lancaster, Highways and Transport Masterplan, October 2016;
- Lancaster Air Quality Action Plan;
- Galgate Air Quality Action Area;
- Lancaster Core Strategy (2003 – 2021); and,
- Strategic Policies and Land Allocations DPD.

In addition, the Local Plan Policies Map has been used to assess how the proposed route option layouts interact with current policies and in particular, if any of the route options interferes with any of the following elements:

- Existing housing
- Housing delivery and distribution
- Agribusiness centre
- Open spaces
- Green Spaces

A comprehensive review of national policies has also been produced, namely, the National Planning Policy Framework (2019 revised).

The relevant policies are described in the next section, and the fit of each route option to the policies is defined in Section 3.3.

3.2 Relevant policies

3.2.1 A Local Plan for Lancaster District 2011 – 2031

Table 3.1 shows a list of the key policies referred to in the document “A Local Plan for Lancaster District”, Part 1.

Table 3.1: Policies in "A Local Plan for Lancaster, Part 1"

Chapter and page	Policy	Key paragraph
Chapter 8, page 34	Housing delivery and distribution (Policy SP6)	Between 2011/12 and 2033/34 the Council will seek to deliver a net minimum delivery of 522 new dwellings per annum over a 23-year delivery period, equivalent to 12,000 new dwellings.
Chapter 11, page 43	Improving Transport Connectivity (Policy SP10)	LCC has prepared a published Highways and Transport Masterplan for Lancaster district. The core elements of this masterplan are to address existing issues with the local and strategic transport network and to identify future improvements necessary to facilitate strategic development growth within the district.
Chapter 18, page 96	Future Employment Growth (Policy EC2)	The Council anticipates that a further 46.2 hectares of employment land for B1 (Office), B2 (General Industrial) and B8 (Storage and Distribution) will be required to meet employment and economic needs through the plan period up until 2031.
Chapter 18, page 98	Junction 33, Agri-Business Centre, South Galgate (Policy EC3)	The Council will support the development of this site for a new Agri-Business Centre. The suitable and accessible land is located adjacent to the M6 J33, south of Galgate and will have direct access to J33 both NB and SB to reduce the level of HGV movements travelling through the city centre and residential areas.
Chapter 23, page160	Open Space, Recreation and Leisure (Policy SC3)	These sites have been identified on the Local Plan Policies Map and will be protected from inappropriate development in accordance with relevant national and local planning policy.
Chapter 23, pages159 and 161	Green Space (Policy SC2 and SC4)	These areas have been identified on the Local Plan Policies Map. Inappropriate development will not be permitted within a Local Green Space except for very special circumstances; development that will enhance, support and facilitate the sustainability of the community needs. For areas to be accepted as Green Space, they must meet requirements set by the NPPF.

Chapter 24, page162	Transport, Accessibility and Connectivity (Policy T1, T2 and T4)	All policies should enhance Lancaster and frame it as an attractive location to work, live and trade. Improvements on transport, accessibility and connectivity all aim to promote growth, improve connectivity and promote Lancaster as an economic and business hub.

Table 3.2: Policies in "A Local Plan for Lancaster, Part 2"

Chapter and page	Policy	Key paragraph
Chapter 5, Page 13	New Residential Development and Meeting Housing Needs (DM1)	The Council will support proposals for new residential developments that: • Ensure available land is used efficiently and viably; • Located in accordance to relevant policies.
Chapter 12, Page 92	Green Infrastructure and The Protection and Enhancement of Biodiversity (DM43/44)	The primary objective is to conserve or enhance bio/geo diversity and the natural environment whilst supporting and managing developments.
Chapter 8, Page 60	Open Space, Sports and Recreational Facilities (DM27)	The Council will not permit the loss of designated open spaces, sport and recreational facilities unless sufficient assessments and/ or mitigation has been undertaken.
Chapter 17, Page 137	Transport Efficiency and Travel Plans (DM63)	The Council will support development proposals that show an appropriate contribution to sustainable travel and bringing improvements to the Lancaster network.
Chapter 6, Page 40	Proposals Involving Employment Land and Premises	Proposals for new employment premises should preferably be located on allocated employment sites, as identifies in EC1 of the DPD.

In addition, key transport linkages are referred to in Section 2.5, page 12:

- Key transport linkage 1 in our study area
- Key transport linkage 2 in our study area

3.2.2 District of Lancaster, Highways and Transport Masterplan

Our study area lays entirely within the District of Lancaster. The Highways and Transport Masterplan for the district contains the following policies:

Table 3.3: Policies in "Lancaster Highways and Transport Masterplan"

Policies in "Lancaster Highways and Transport Masterplan"**Chapter and page**	**Policy**	**Key paragraph**
Page 13	M6 J33 reconfiguration	Our vision also includes the reconfiguration of M6 Junction 33 to support the significant growth potential of South Lancaster including developments such as the proposed Health Innovation Campus at Lancaster University and housing at Whinney Carr and Bailrigg.
Page 15	A6 corridor	The A6 corridor linking South Lancaster with Lancaster city centre will become increasingly important as housing developments and the expansion of Lancaster University begin to take effect.
Page 20	Impacts of M6 J33 reconfiguration	Changes to the M6 Junction 33 would remove significant levels of traffic from the centre of Galgate however there is concern that the relocation of the junction would disadvantage residents of the area south of Galgate.

3.2.3 National Planning Policy Framework 2019)

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

Paragraph 103 of the NPPF states:

'The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.'

Paragraph 104 b of the NPPF states planning policies should:

'Be prepared with the active involvement of local highways authorities, other transport infrastructure providers and operators and neighbouring councils, so that strategies and investments for supporting sustainable transport and development patterns are aligned.'

Paragraph 91b of the NPPF states:

'Planning policies and decisions should aim to achieve healthy, inclusive and safe places which are safe and accessible, so that crime and disorder, and the fear of crime, do not undermine the quality of life or community cohesion – for example through the use of clear and legible pedestrian routes, and high quality public space, which encourage the active and continual use of public areas.'

3.2.4 Lancaster Air Quality Action Plan (2007)

Section 4.1.2 in the Lancaster Air Quality Action Plan [AQAP] states:

"The AQAP will help deliver against Local Plan aims although it is noted that the Local Plan addresses transport, access and economic prosperity issues as well as environmental and sustainability ones. No specific conflicts have been identified." Galgate Air Quality Action Area (2010)

Between 2006-2009 NO_2 levels were recorded in and around Galgate and subsequently, an Air Quality Management Area [AQMA] was established in Galagate in 2009/2010 at the focused at the cross roads of Main Road/ Salford Road /Stoney Lane. It is stated that:

"The Further Assessment concluded that a significant action to relive traffic emissions within the AQMA was required to meet compliance with air quality objectives."

3.2.5 Lancaster Core Strategy (2003 – 2021)

Adopted in 2008, the Core Strategy was designed to outline a spatial vision of a sustainable District. The Core Strategy contains the following relevant policies:

Table 3.4: Policies in the Core Strategy

Policy	Key Objective
Meeting the Districts housing requirements (SC4)	To set out the principles which will ensure that housing needs are met through housing allocations and through determining planning applications in a way which builds sustainable communities.
Recreation and Open Space Provision (SC8)	To build sustainable communities by ensuring that existing and future residents and visitors have access to sports facilities, greenspaces and greenspace networks.
Employment Land Allocations (ER3)	To promote regeneration by defining spatial roles for the District's city, town and local shopping centres.
Transportation Measures (E2)	To support the District's Regeneration, improve Resident's Quality of Life and minimise the environmental impact of traffic.

3.2.6 Strategic Policies and Land Allocations Development Plan (DPD)

DPDs are planning policy documents which make up the Local Plan. They help guide development within a local planning authority area by area by setting out the detailed planning policies. Lancaster City Council adopted the

Development Management DPD in December 2014 that align with the Local Plan for Lancaster District 2011 – 2031. Relevant policies in the DPD are as follows:

Table 3.5: Policies in the DPD

Chapter and page	Policy	Key paragraph
Chapter 8.26 - Page 47	Development in the Green Belt (DM11)	The council seek to manage development in the Green Belt to avoid inappropriate development, consistent with the NPPF.
Chapter 10.5 – Page 60	Proposals Involving Employment Land and Premises (DM15)	Proposals which re-use previously developed land and/ or existing buildings for employment purposed which are not formally designated for employment will be supported in principal by the council.
Chapter 12.9 – Page 84	Transport Efficiency and Travel Plans (DM23)	The council will support proposals which maximise opportunities for the use of sustainable modes of travel, development proposals should make appropriate contributions.
Chapter 15.8 – Page 92	Green Infrastructure (DM25)	The integrity and connectivity of the Green Infrastructure network will be managed, maintained, protected and enhanced.
Chapter 15.15 – Page 95	Open Space, Sports and Recreational Facilities (DM26)	Open space which the council views to have an environmental, economic or community value will be protected from development proposals which would result in their loss, either partially or fully.
Chapter 18.24 – Page 135	Air Quality Management and Pollution (DM37)	The largest AQMA is located in the centre of Lancaster where emissions from vehicles, particularly from HGVs on the one-way system contribute toward high levels of nitrogen dioxide levels.
Chapter 20.15 – Page 149	New Residential Development (DM41)	Residential development will be supported where it represents sustainable development.

3.3 Fit of the schemes with relevant policies

The overriding feel for all local policies is that any changes within Lancaster should aim to promote growth, improve connectivity and promote Lancaster as an economic and business hub. With that in mind and looking specifically at the key policies that have been identified above, each scheme has been reviewed to give a comprehensive overview on how the route options would align with the aims and objectives set out within local policies.

3.3.1 Central 1

Central 1 is the first of two route options designed that's primary location is central and adjacent to the M6, namely J33. This route option does not interfere with any green spaces or networks; however, it does pass close by the Environmentally Important Area, Park Coppice (EIA). Referring to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the Central 1 route option. Although no new housing will be affected, there is a potential impact to existing housing settlement located to the East of the M6 off Burrow Road/ Leach House Lane as the scheme passes close to an existing housing site.

Currently, the exact location of the J33 Agri-Business Centre is unknown and as this is a high scope review, it is assumed that any route option that runs adjacent to or takes access of the West of the M6 J33 is potentially impacting the development of the business centre, this is reflected in Central 1 being regarded as a potential conflict to the J33 Agri-Business Centre Policy brought forward in local documentation.

The Highways and Transport Masterplan has policies in place that are dedicated to the reconfiguration of the M6, J33 (Policies SG1/ SG3). Although the plans for the reconfiguration are not made abundantly clear in the Masterplan, as the Central 1 route option takes access directly off the M6 J33, it is deemed that Central 1 could interfere with the key transport policy by restricting the ability to deliver key strategic infrastructure due to its interaction with the slips.

With reference to the policies map, no open spaces, recreation and leisure allocations have been made within the scheme path of Central 1. The only listed employment opportunity within the area is the Agri-Business Centre. As there is potential that Central 1 will interfere with the Agri-Business Centre, this means that there is a knock on effect to other Employment opportunities.

3.3.2 Central 2

Central 2 is the second of two route options designs that's primary location is central and adjacent to the M6, namely J33. This route option does not cross through any Green Space or Environmentally Important Areas, however, it does weave between two EIAs, Old Park Wood and Park Coppice (Policy Reference EN9 – Biological Heritage Sites), due to this, it has raised a conflict with Policy DM25 in the DPD (Green Infrastructure) as the option route breaks the connectivity and integrity of the greenspace.

Mirroring Central 1; in reference to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the Central 2 route option. Although no new housing will be affected, there is a potential impact to existing housing settlement located to the East of the M6 off Burrow Road/ Leach House Lane as the route option passes close to an existing housing site.

As the exact location of the J33 Agri-Business Centre is unknown and this is a high scope review, it is assumes that any route options that runs to the West of the M6 J33 is potentially impacting the development of the business centre, this is reflected in Central 2 being regarded as a potential conflict to the J33 Agri-Business Centre Policy brought forward in local documentation.

The Highways and Transport Masterplan has policies in place that are dedicated to the reconfiguration of the M6, J33 (Policies SG1/ SG3). Although the plans for the reconfiguration are not made abundantly clear in the Masterplan, as the Central 2 route option takes access directly off the M6 J33, it is deemed that Central 2 could interfere with the key transport policy by restricting the ability to deliver key strategic infrastructure due to its interaction with the slips.

With reference to the policies map, no open spaces, recreation and leisure allocations have been made within the scheme path of Central 2. The only listed employment opportunity within the area is the Agri-Business Centre. As there is potential that Central 2 will interfere with the Agri-Business Centre, this means that there is a knock on effect to other Employment opportunities. Within Galgate, the Galgate Silk Mill is due to be regenerated, however, the site is already established and although within close proximity of the Central 2 route option, it will not prevent the delivery of the regeneration and this is supported by policy DM15 in the DPD.

3.3.3 West 1

West 1 is the first of two route options designs that is aligned to the M6 and utilises space to the West of Galgate and J33. This route option does not cross through any Green Space or Environmentally Important Areas; however, it does cut across the canal at the South end of the route option, hence the potential conflict.

Referring to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the West 1 route option. Although no new housing will be affected, there is a potential impact to existing housing located to the East of the M6 off Burrow Road/ Leach House Lane as the route option passes close to an existing residential area.

As the exact location of the J33 Agri-Business Centre is unknown and this is a high scope review, it is assumes that any that runs to the West of the M6 J33 is potentially impacting the development of the business centre, this is reflected in West 1 being regarded as a potential conflict to the J33 Agri-Business Centre Policy brought forward in local documentation.

Although there is not a finalised design in place, it is considered that the West 1 scheme layout could be integrated within the reconfiguration plans for the M6 J33.

With reference to the policies map, no open spaces, recreation and leisure allocations have been made within the scheme path of West 1. The only listed employment opportunity within the area is the Agri-Business Centre. As there is potential that West 1 will interfere with the Agri-Business Centre, this means that there is a knock on effect to other Employment opportunities.

3.3.4 West 2

West 2 is the second of two route options designs that is aligned to the M6 and utilises space to the West of Galgate and J33. This route option does not cross through any Green Space or Environmentally Important Areas, however, it does cut across the canal at the South end of the route option and as seen in Figure 8, it weaves between two EIAs, Old Park Wood and Park Coppice (Policy Reference EN9 – Biological Heritage Sites), it has raised a conflict with Policy DM25 in the DPD (Green Infrastructure) as the option route breaks the connectivity and integrity of the greenspace.

Referring to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the West 1 route option. Although no new housing will be affected, there is a potential impact to existing housing located to the East of the M6 off Burrow Road/ Leach House Lane as the route option passes close to an existing housing site, portraying the same proximal issue as West 1.

The West 2 route option alignment takes direct access of the A6, north of the M6 J33, therefore it might not be compatible with the reconfiguration of the M6 J33.

As West 2 starts North of J33, this also removes the potential for it to impact with the J33 Agri- Business Centre and as it stands, no further future employment sites are currently active in the route option area, so it also does not affect these policies.

3.3.5 East 1

East 1 is one of two route options designs that is focused aligned to the M6 and to the East of it. Out of all route options, the East routes are most dispersed across the largest areas. This route option does not interfere with any green spaces or networks; however, it does pass close by the EIA Park Coppice. Referring to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the

Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the East 1 route option. Although no new housing will be affected, there is a potential impact to existing housing settlement located to the East of the M6 off Burrow Road/ Leach House Lane as the scheme passes close to an existing housing site and also passes close to a small farm settlement to the West of Galgate, on Burrow Heights Lane.

The Highways and Transport Masterplan has policies in place that are dedicated to the reconfiguration of the M6, J33 (Policies SG1/ SG3). Although the plans for the reconfiguration are not made abundantly clear in the Masterplan, as the Central 2 route option takes access directly off the M6 J33, it is deemed that East 1 could interfere with the key transport policy by restricting the ability to deliver key strategic infrastructure due to its interaction with the motorway connection on and off the M6 J33 As East 1 starts North of J33, this also removes the potential for it to impact with the J33 Agri- Business Centre and as it stands, no further future employment sites are currently active in the route option area, so it also does not affect these policies, nor are there any open spaces that have come forward from local policies that East 1 would conflict with.

3.3.6 East 2

East 2 is the second of two route options designs that is focused aligned to the M6 and to the East of it; very similar in design to East 1 however the alignment moves further east. Out of all route options, the East route options are dispersed across the largest areas.

This route option does not interfere with any green spaces or networks; however, it does pass close by the EIA Park Coppice. Referring to Policy SP6: The Delivery of New Homes in A Local Plan for Lancaster Part 1, Strategic Policies and Land Allocations DPD and the Local Plan Policies Map, no new housing developments are being brought forward that may interfere with the East 2 route option. Although no new housing will be affected, there is a potential impact to existing housing settlement located to the East of the M6 off Burrow Road/ Leach House Lane as the route option passes close to an existing housing site and passes close to a small farm settlement to the West of Galgate, on Burrow Heights Lane.

The Highways and Transport Masterplan has policies in place that are dedicated to the reconfiguration of the M6, J33 (Policies SG1/ SG3). Although the plans for the reconfiguration are not made abundantly clear in the Masterplan, as the Central 2 route option takes access directly off the M6 J33, it is deemed that East 2 could interfere with the key transport policy by restricting the ability to deliver key strategic infrastructure due to its interaction with the motorway connections on and off the M6 J33. As East 2 starts North of J33, this also removes the potential for it to impact with the J33 Agri- Business Centre and as it stands, no further future employment sites are currently active in the route option area, so it also does not affect these policies, nor are there any open spaces that have come forward from local policies that East 2 would conflict with.

3.3.7 Summary

Table 3.6 summarises the information presented in the section above. Green cells represent a good fit with the relevant policy, amber means potential conflict while red signifies that the route option has a conflict with policy is not a good fit.

Three of the route options have been found not be a good fit for some policies:

- The West 2 route option compromises the Green Space and Green Space Networks policies as it cuts across the canal at the South end of the scheme. West 2 lies further West than West 1 as seen in Figure 8, it weaves between two EIAs, Old Park Wood and Park Coppice (Policy Reference EN9 – Biological Heritage Sites), it has raised a conflict with Policy DM25 in the DPD (Green Infrastructure) as the option route breaks the connectivity and integrity of the

- The Central 2 route option weave between two EIAs, Old Park Wood and Park Coppice (Policy Reference EN9 – Biological Heritage Sites), raising a conflict with Policy DM25 in the DPD (Green Infrastructure) as the option route breaks the connectivity and integrity of the greenspace.

All of the route options have been found to potentially affect existing housing and will have to be integrated in the reconfiguration plans for the M6 J33. Similarly, there is an Agri-business Centre planned in the vicinity of the M6 J33 and some of the route option alignments are in close proximity and potentially interfere with the proposed site. If this was the case, these route options might conflict with the Agri-business and Future Employment policies.

Table 3.6: Fit of the route options with relevant policies

	Green Space & Green Space Networks	Housing delivery & distribution	Existing Housing	J33, Agri-Business Centre	M6 J33 Re-configuration	Transport, Accessibility & Connectivity	Open Space, recreation & leisure	Future Employment & Growth	NPPF Policies
West 1									
West 2									
Central 1									
Central 2									
East 1									
East 2									

4. Traffic modelling

4.1 Methodology

4.1.1 Lancaster traffic model

The Lancaster Traffic model has been used to test the six proposed route options. It is a Saturn model originally developed in preparation of a Business Case in support of the M6 Junction 33 (M6 J33) improvement scheme, which will support primarily the development of a new Garden Village (GV) site (Bailrigg Garden Village) south of Lancaster.

The scenarios assessed as part of this study are:

- Baseline: without development demand and without scheme.
- Do Minimum: with development demand and without scheme.
- Do Something: with development demand and with the 6 scheme options.

The existing Lancaster Traffic model Scenario P has been used as a Baseline scenario for this project. This has been used to comment on the business as usual traffic situation in the future (i.e. without the scheme and without development), as reported in Section 2.1 of this report.

A Do Minimum scenario with development but without the scheme has been developed to understand which of the options best support the development. This Do Minimum scenario is used as the base of all comparisons reported in this section. The Do Minimum and Do Something comparisons were designed so that the effect of the scheme options could be isolated from the effect of the demand change, in accordance with WebTAG Guidance for Option development assessment.

The model peak hours will be AM – 08:00 – 09: 00, PM – 17:00 – 18:00 and IP of average hour of 10:00 to 16:00, and two forecast years: 2025 and 2040. Our analysis includes model runs for all peak periods and years available, with and without all proposed route options.

The coding of each of the six schemes is presented in Appendix A. Route Options coding has been undertaken following the route options alignment drawings provided by LCC and presented in Section 2.2 and mirroring the coding style present in the Lancaster Traffic Model.

Comparative assessment of flows and volume over capacity ratio has been used to differentiate the performance of each of the proposals.

4.1.2 Section structure

Chapter 2 provided an overview of the traffic conditions on the study area in the event that no transport schemes were implemented. As the development is dependent of the possibility of building the schemes, the baseline scenario reported in Chapter 2 also includes no development flows.

The evaluation now turns to analyse the traffic conditions in the event that the route options and associated development demands take place. This analysis includes years 2025 Scenario and 2040 Design Year Scenario.

For each of the 6 route options, the following outputs are presented:

- Flow difference plots (standard SATURN output), comparing the flows with and without the route options. In these plots, links with a blue band represent a flow decrease in the with route option scenario, while links with a green bar signify that flow goes up in those links when the route option is implemented.

- Volume over capacity v/c plots showing links where the ratio is over 85% (standard SATURN output)
- Flow on the key links as shown in
- Figure 11 'Key links' give a portrayal of alternative routes as well as those leading to the new infrastructure:
    - Key links 1 to 7 run along the A6, with key link 3 representing its Galgate section;
    - Key link 8 represents the M6. Key links 9 to 18 represent road network to the east of the M6, with link 12 representing Hazelrigg Lane; and,
    - Key links 19 to 22 refer to those situated west of the M6, in particular the A588.

Section 4.2 presents and discusses the results for 2025. Similar outputs for 2040 are presented in Section 4.3. A summary is outlined in Section 4.4.

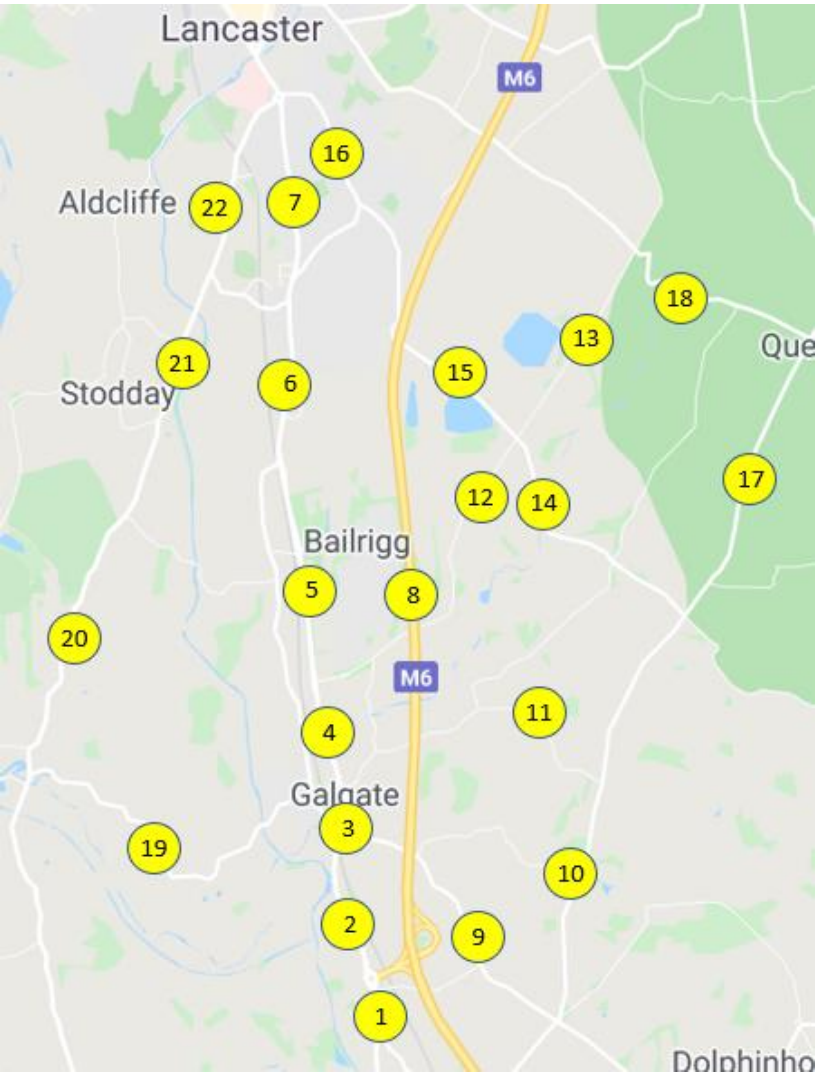


Figure 11: Key links

4.2 Forecast flow changes with Route Options – Year 2025

4.2.1 Do minimum

Figure 12, Figure 13 and Figure 14 show the traffic flow on the transport network without any of the route options but including all the development demand, for AM, IP and the PM peak. Table 4.1 shows the forecast flow in the key links. This scenario is the starting point to assess the potential of each of the route options to reduce congestion.

In the DM scenario, flows of over 6500 pcu travel along the M6, while the A6 carries flows of 1546 pcu in the morning peak and 1659 in the evening peak along Galgate. Hazelrigg Lane experiences lower flows of 379 pcu in the AM and 244 in the PM, as it can be seen in Figure 11, which shows the modelled flows in key links.

Links where a volume over capacity ratio exceeds 85%, indicating congested traffic conditions, are presented in Figure 15, Figure 16 and Figure 17, and include the following locations:

- A6 Lancaster Preston Rd & Stoney Lane junction at Galgate
- A6 along Bailrigg

Figure 12: Do Minimum, Modelled Flow, 2025, AM Peak (PCU)

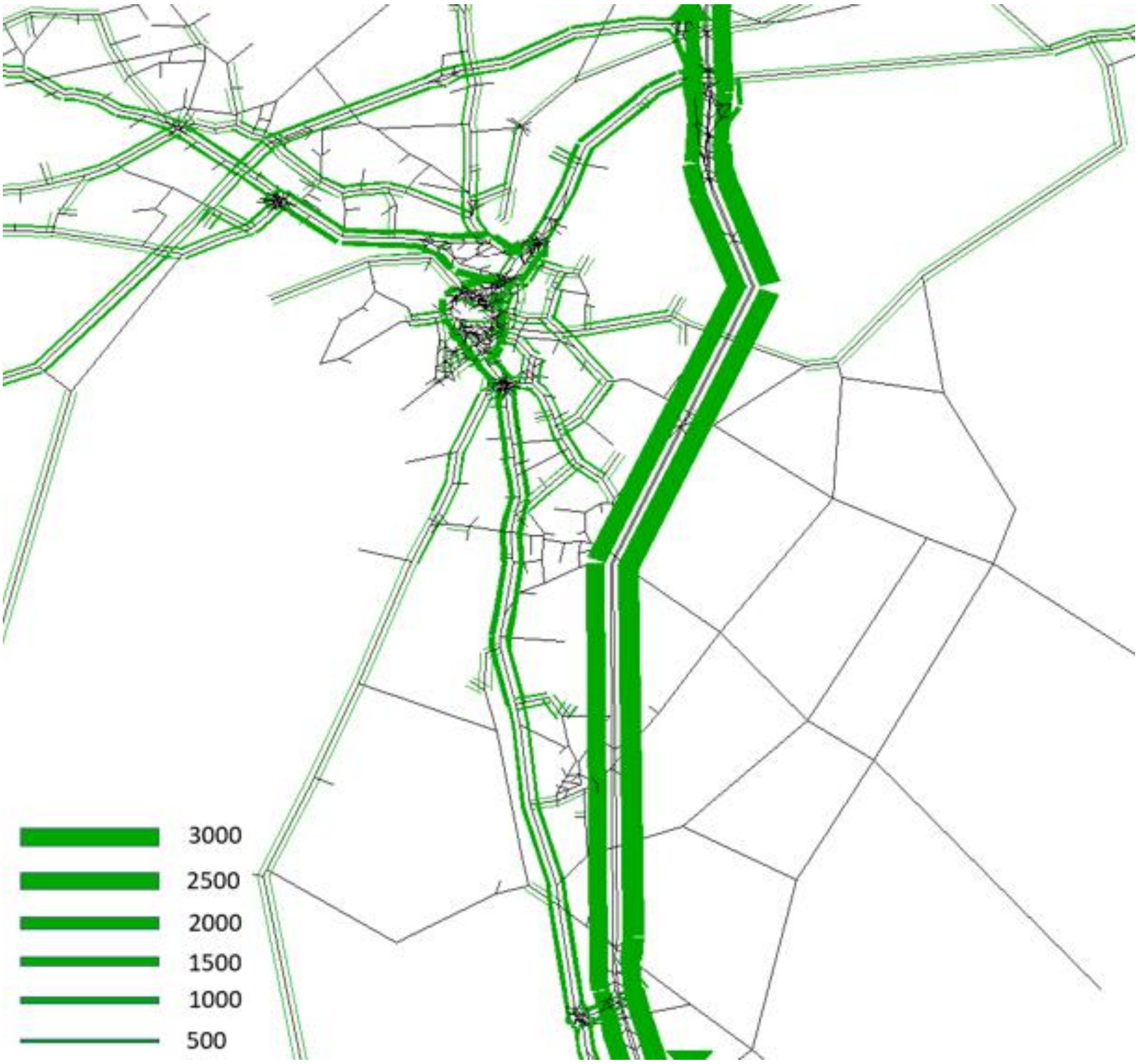


Figure 13: Do Minimum, Modelled Flow, 2025, Interpeak (PCU)

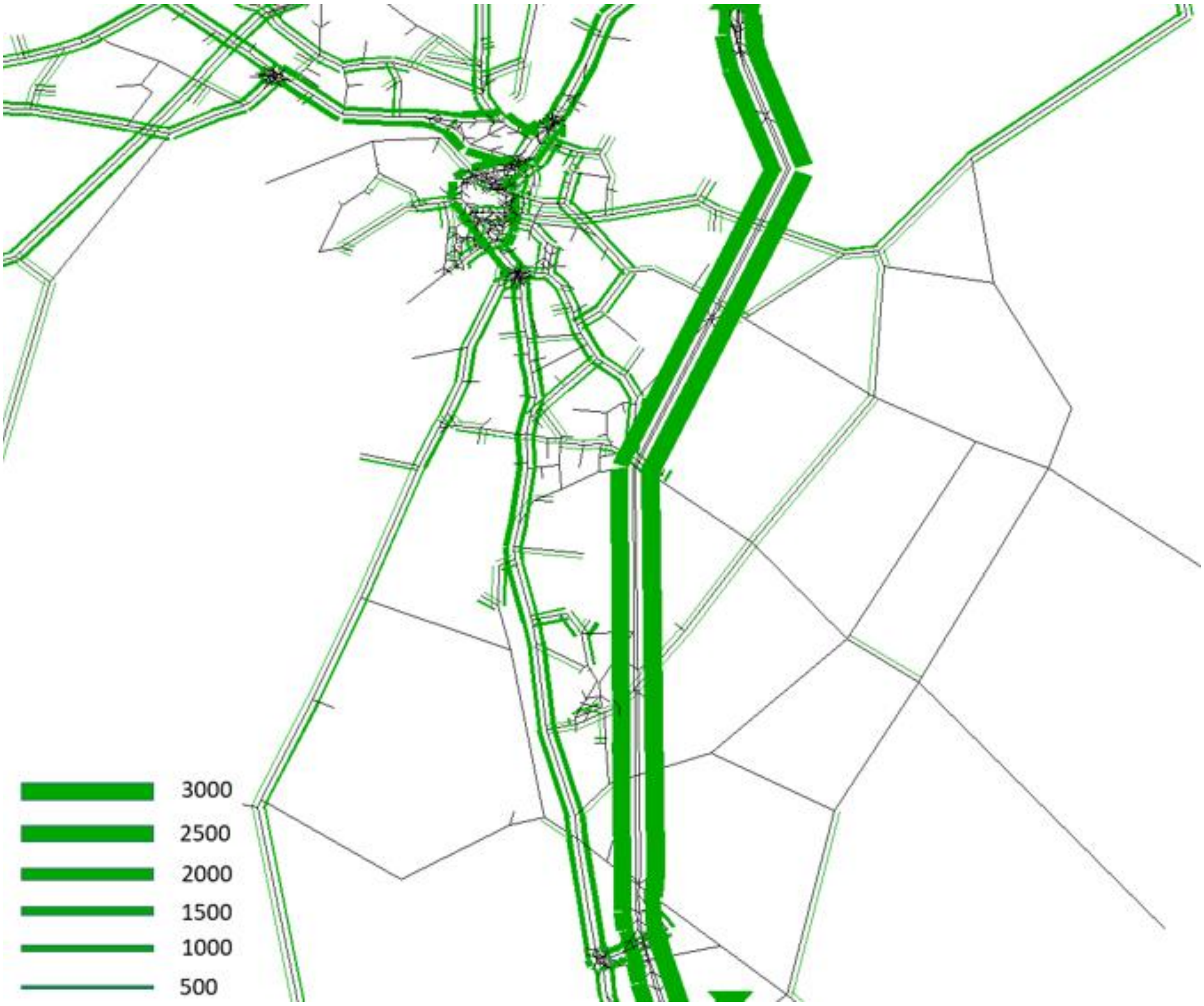


Figure 14: Do Minimum, Modelled Flow, 2025, PM Peak (PCU)

Table 4.1: Do Minimum, Flow in key links, 2025 (PCU)

	Road name	Between	Without scheme (2025)		
			AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220
2	A6	M6 J33 & Stoney Lane	1590	1321	1794
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293
6	A6	Burrow Road & Ashford Road	1906	1585	1357
7	A6	Ashford Road & Ashton Road	1459	1416	1385
8	M6	J33 & J34	6548	6559	6286
9	Stoney Lane	A6 & Bay Horse Road	214	26	77
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128
16	Bowerham Road	Barnton Road & A6	1208	814	1207
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91
19	Birch Avenue	A588 & Highland Brow	91	86	79
20	A588	Birch Avenue & Tarnwater Lane	416	283	410
21	A588	Tarnwater Lane & Ashford Road	442	299	389
22	Ashton Road	Ashford Road & A6	839	501	685

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

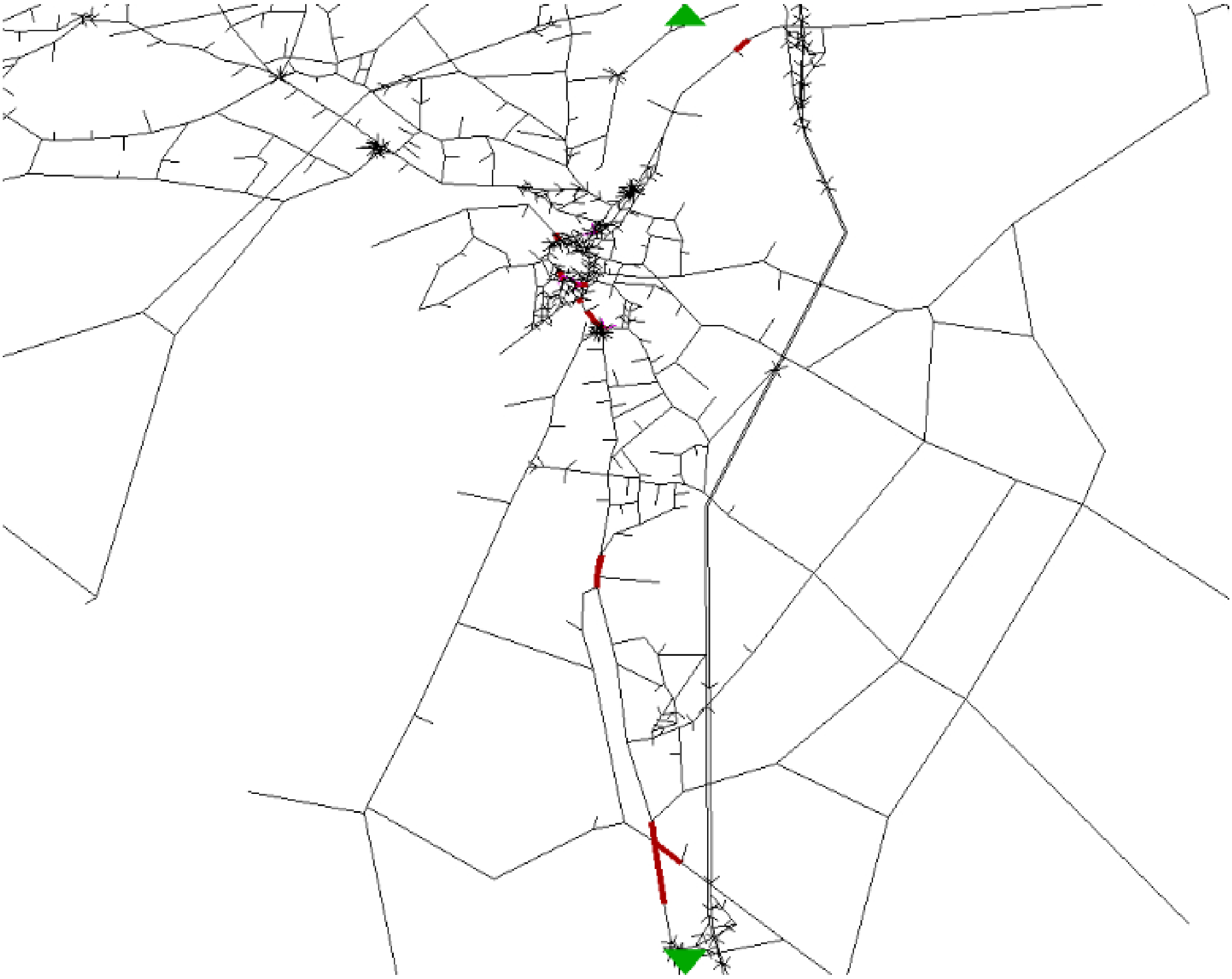


Figure 15: Do Minimum, Volume Over Capacity Ratio (over 85%), 2025, AM Peak

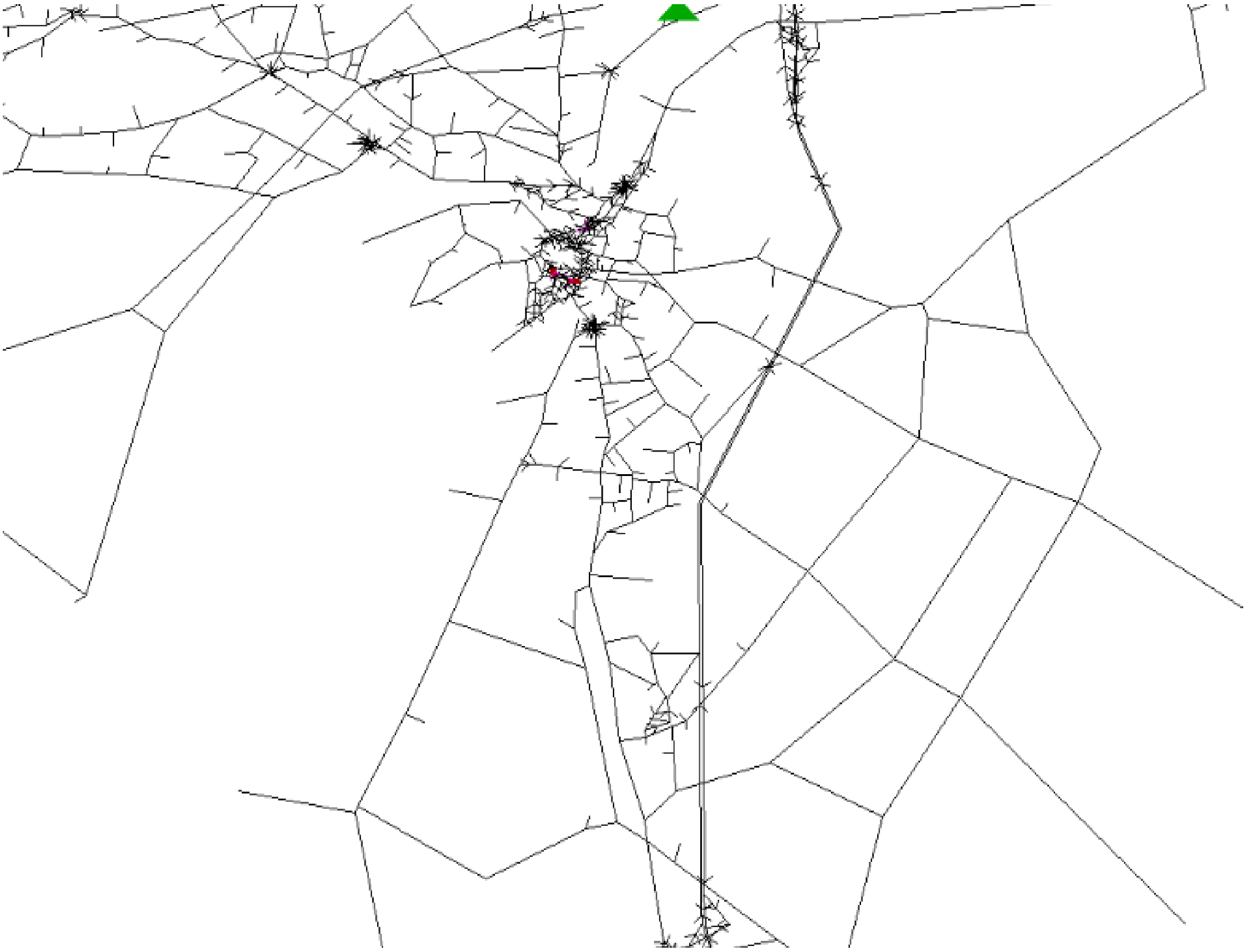


Figure 16: Do Minimum, Volume Over Capacity Ratio (over 85%), 2025, Interpeak

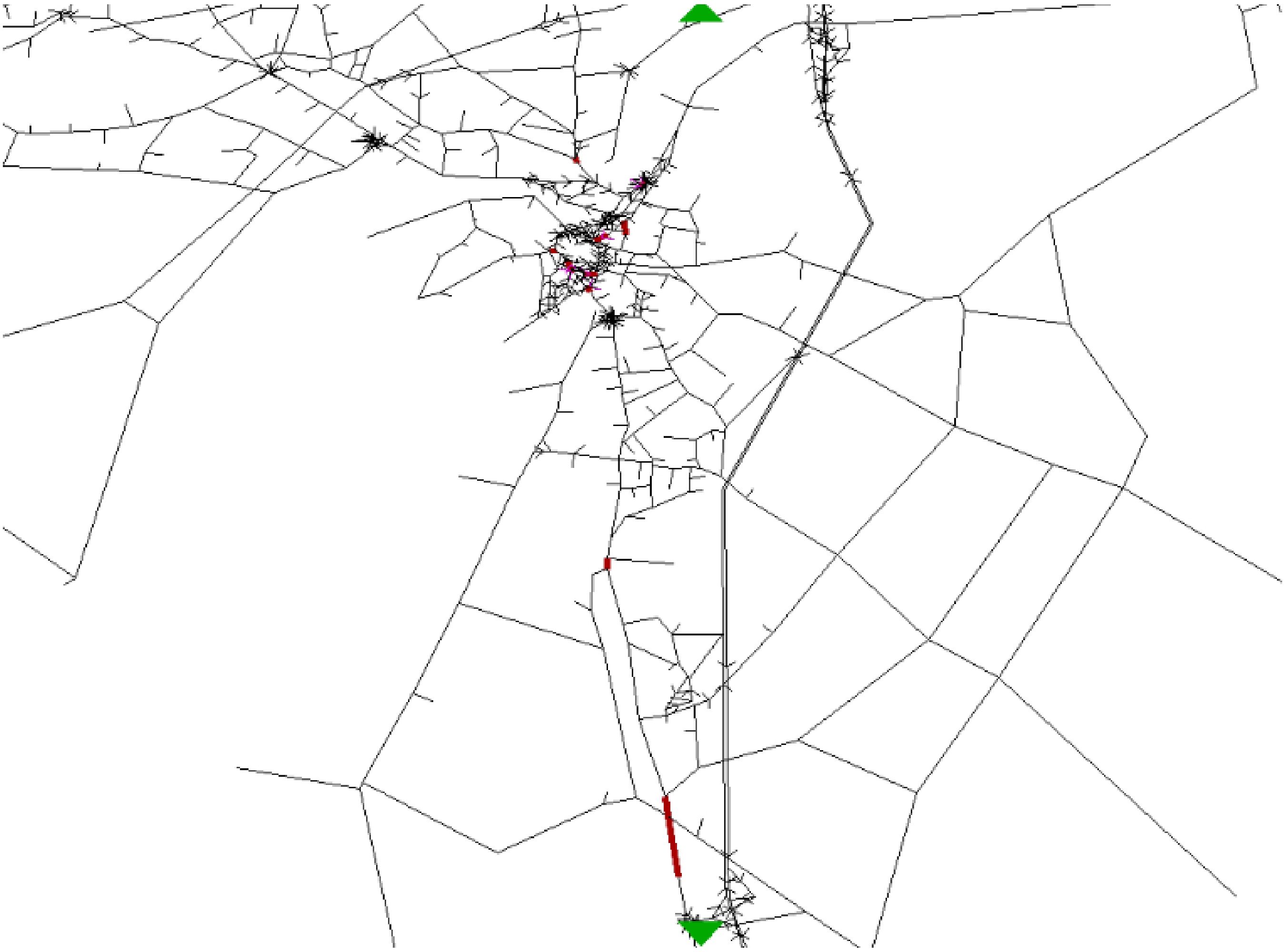


Figure 17: Do Minimum, Volume Over Capacity Ratio (over 85%), 2025, PM Peak

4.2.2 Central 1

Figure 18, Figure 19 and Figure 20 shows the traffic flow changes that occur on the transport network when Central 1 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the Central 1 route option. Links with a blue bar signify those sections of the network where flow decreases because of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

The same flow change pattern repeats during the three hours modelled, although the magnitude of change is larger in the evening peak. As vehicles travel on the new infrastructure provided by the Central 1 route option, which connects with the Bailrigg Spine Road (linking to Ashford Road in 2025) a flow reduction is observed in the following routes:

- A6, including sections through Galgate;
- Bayhorse Road, Rigg Lane, Postern Gate Road to the east of the model network;
- A588 between Birch Avenue and Ashford Road to the west of the model network;

On the other hand, flow increases on those sections connecting with the new infrastructure:

- Hazelrigg Lane, in the section linking Bailrigg Spine Road and the Central 1 road, and in the sections immediately to the north and Blea Tarn Road, as vehicles modify their routeing to make use of the new road;
- A6 between Hazelrigg and Burrow Lane;
- M6, as access and egress from the motorway is facilitated by the new motorway connection leading to and from Hazelrigg Lane;
- A588 south of Birch Avenue and Birch Avenue, as vehicles travel along that route to use the new road;
- Ashton Road also experiences a flow increase in 2025, when the Bailrigg Spine Road has a north connection to Ashford Road, as it becomes a link between the new route and Lancaster.

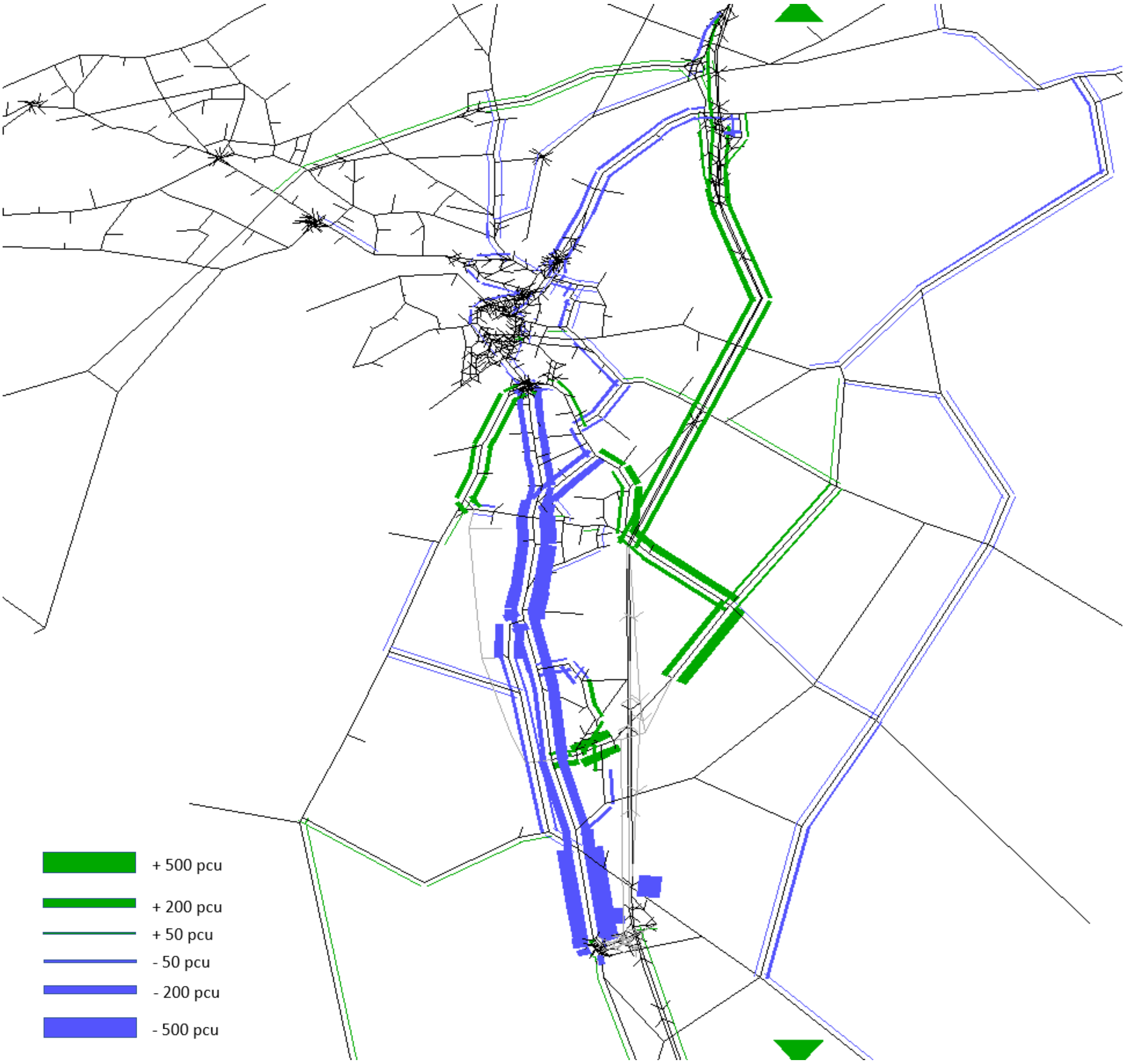


Figure 18: Central 1 vs DM: Flow Comparison, 2025, AM Peak

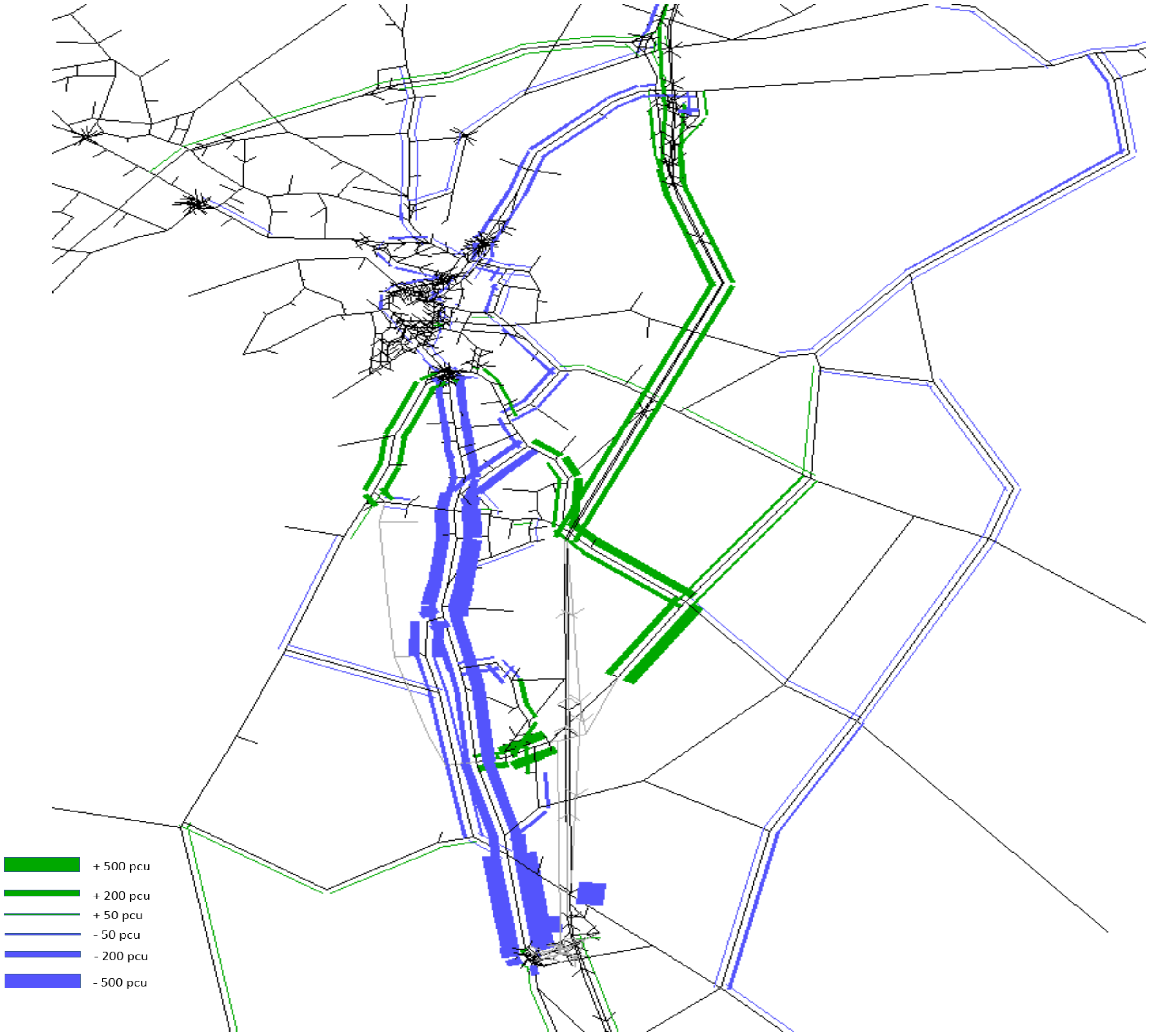


Figure 19: Central 1 vs DM: Flow Comparison, 2025, Interpeak (PCU)

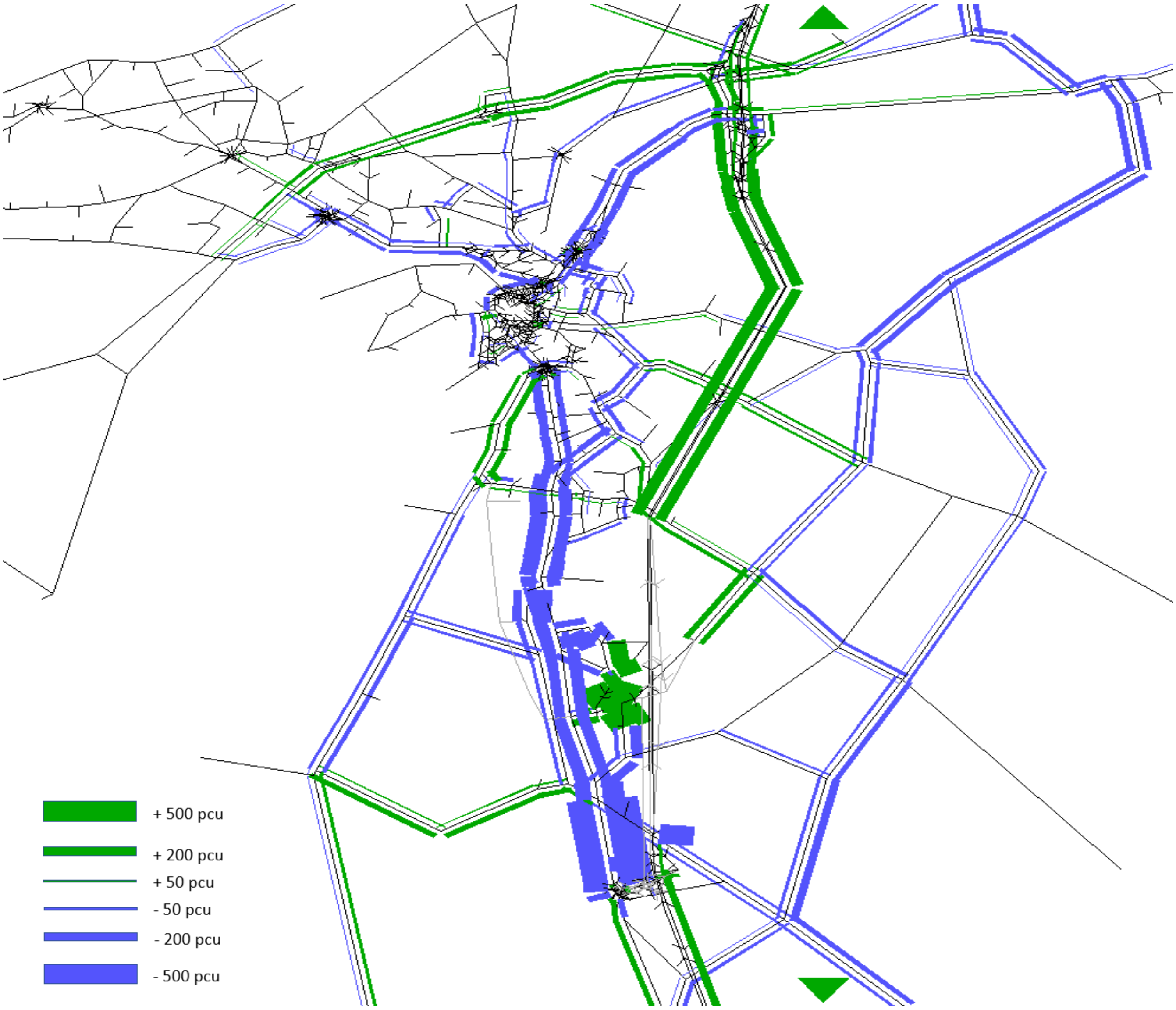


Figure 20: Central 1 vs DM: Flow Comparison, 2025, PM Peak (PCU)

Table 4.2 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the Central 1 route option results in a significant flow reduction along the A6, with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road.

With respect to the links located east of the A6, flow increases in Blea Tarn Road and Hazelrigg Lane, as this link directly to the new road. Although the highest proportional increase is observed in the Interpeak, the highest flow registered in Hazelrigg Lane is 602 pcu during the AM peak.

In contrast, flow on roads that form part of alternative routes like Postern Gate Road and Quernmore Road decreases as vehicles switch to the new road.

The same pattern is observed in links located to the west of the A6, with flow increasing on those that form part of a route leading to and from the new road like Birch Avenue and Ashton Road; and decreasing in the route that competes with the new road, in this case the A588 between Birch Road and Ashford Road.

Table 4.2: Central 1 vs DM, Flow on key links, 2025 (PCU)

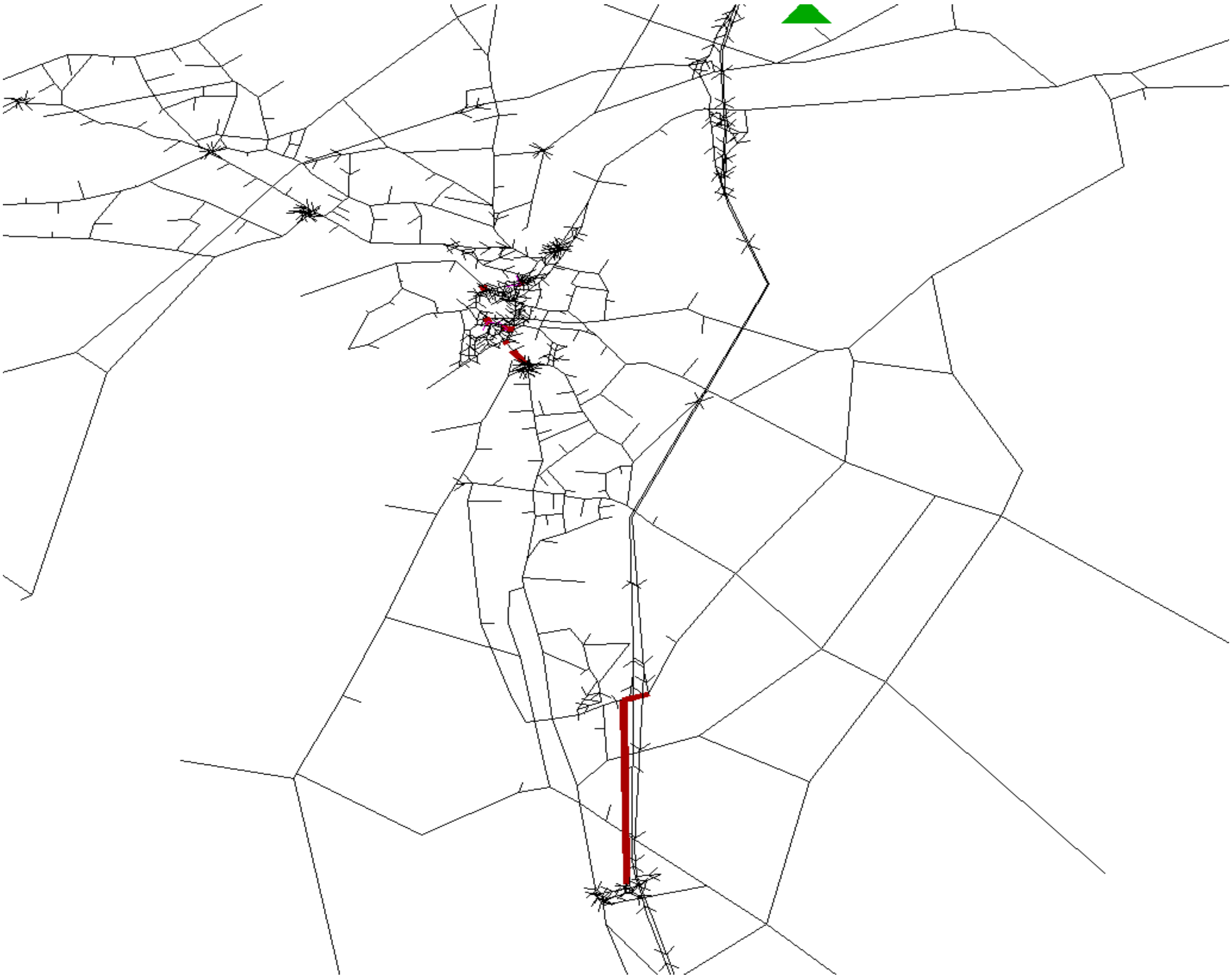
	Road name	Between	Without scheme (2025)			With scheme Central 1 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1430	1099	1297	7%	2%	6%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1009	790	886	-37%	-40%	-51%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1103	865	1097	-29%	-25%	-34%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1066	851	1083	-23%	-22%	-24%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	956	804	960	-1%	-21%	-26%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1563	1167	917	-18%	-26%	-32%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	1331	1223	1135	-9%	-14%	-18%
8	M6	J33 & J34	6548	6559	6286	6779	6676	6627	4%	2%	5%
9	Stoney Lane	A6 & Bay Horse Road	214	26	77	55	26	11	-75%	-2%	-86%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	27	9	15	-89%	-81%	-89%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28	43	14	11	11%	24%	-60%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	603	368	417	59%	232%	70%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	251	136	220	-18%	53%	-17%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	61	34	52	-70%	-31%	-61%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	398	255	213	44%	238%	66%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1109	771	1069	-8%	-5%	-11%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	20	19	20	-81%	-58%	-66%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	77	92	0%	1%	1%
19	Birch Avenue	A588 & Highland Brow	91	86	79	181	111	190	98%	28%	140%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	375	279	319	-10%	-2%	-22%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	387	277	328	-12%	-7%	-16%
22	Ashton Road	Ashford Road & A6	839	501	685	1046	628	822	25%	25%	20%
All values expressed in PCU's. All values are two-way link flows.											
* The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 21, Figure 22 and Figure 23 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In both AM and PM peaks, the model predicts some congestion on the NB approaches to Hazelrigg, while it relieves congestion on the A6:

- In the AM, the new road junction with Hazelrigg Lane is showing some congestion, derived from the additional flows travelling on it. On the other hand, the route option has the potential to alleviate congestion in the A6 junctions at Galgate and Burrow Lane.

- The same trend is observed in the PM peak, although the highest V/C is experienced in the Hazelrigg/Chapel Lane junction. As in the AM, the route option shows potential to relieve congestion on the A6 junctions at Galgate and Burrow Lane, which do now operate under capacity.



-

Figure 21: Central 1, Volume over Capacity Ratio over 85%, 2025, AM peak

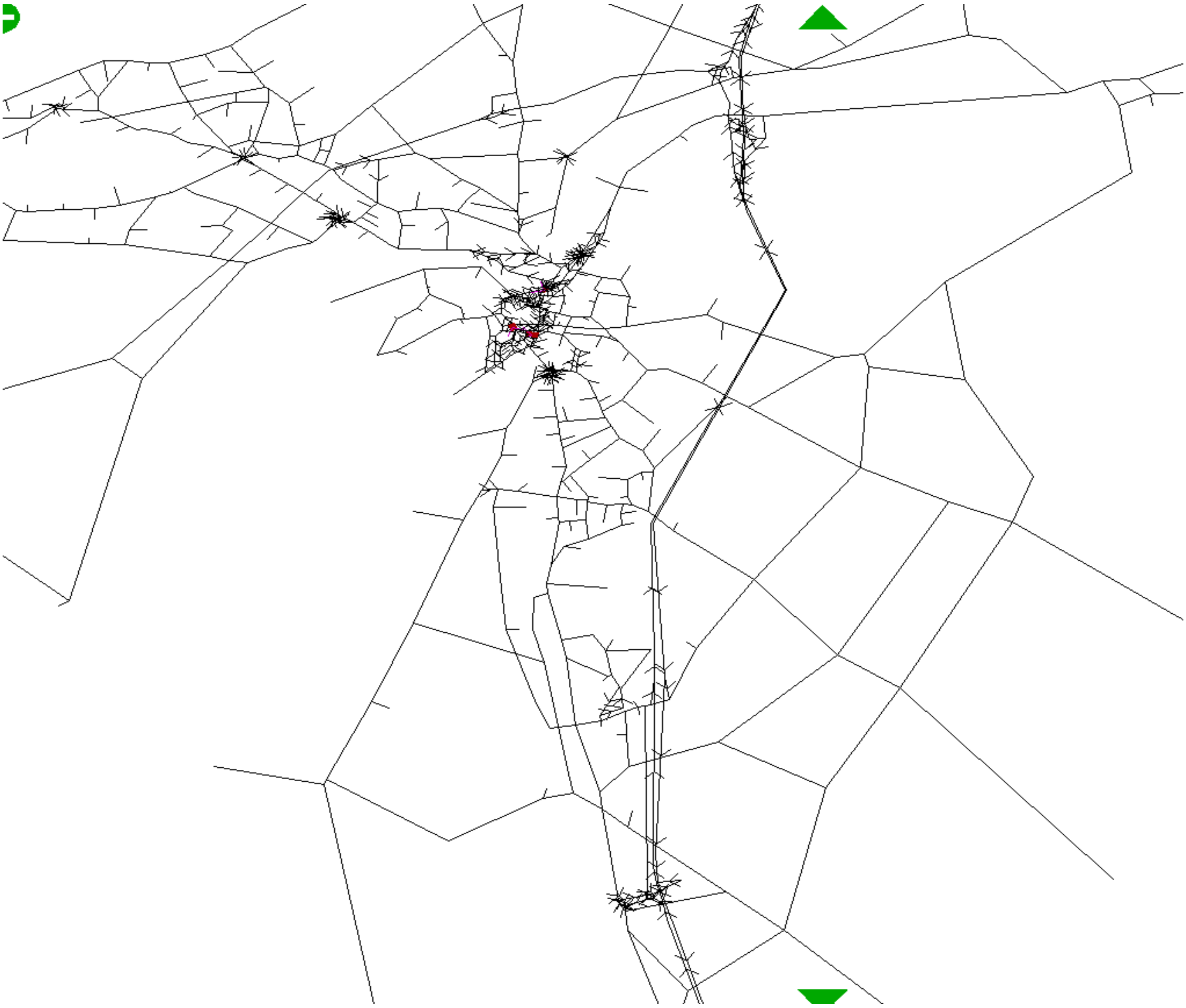


Figure 22: Central 1, Volume over Capacity Ratio over 85%, 2025, Interpeak

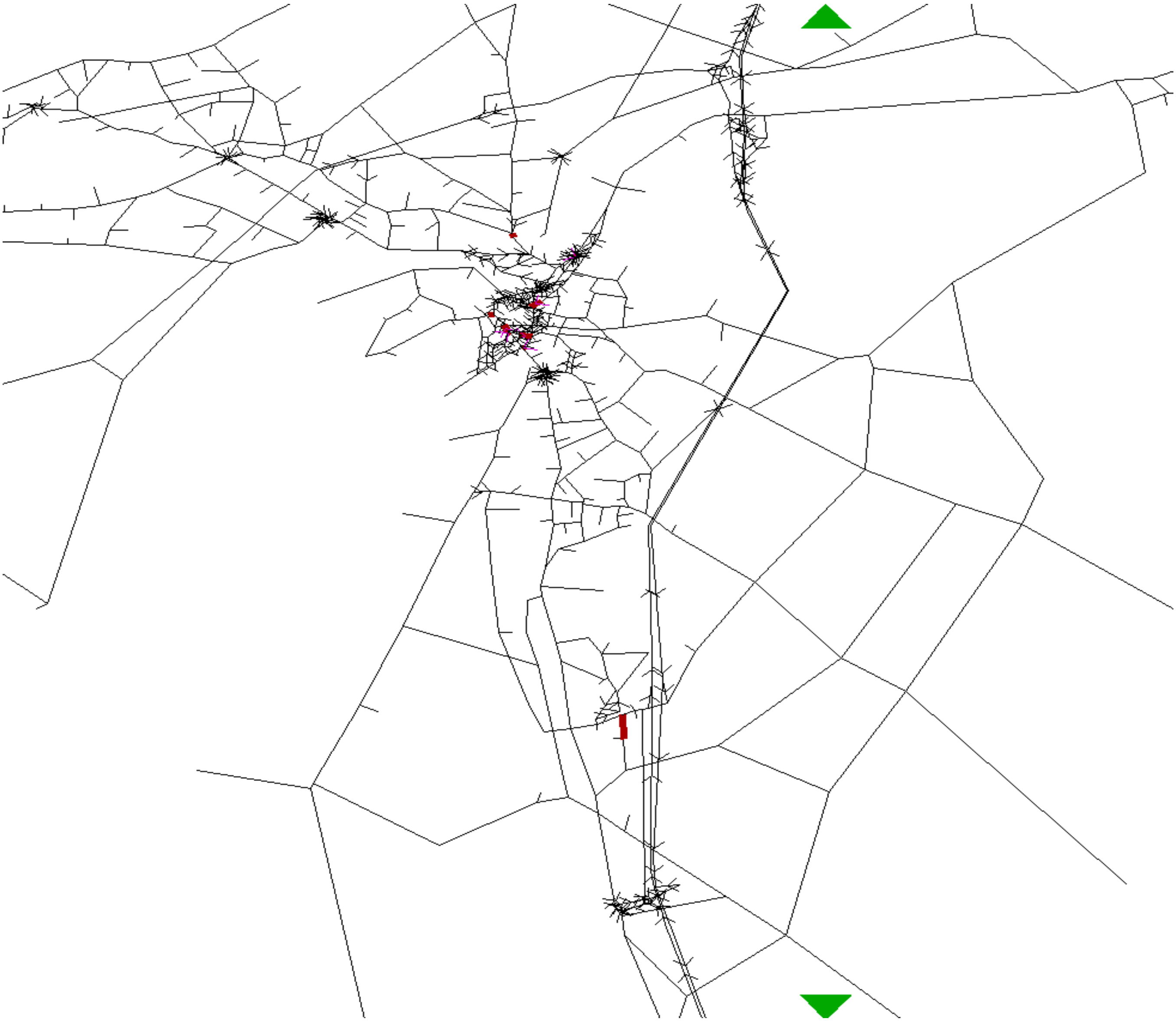


Figure 23: Central 1, Volume over Capacity Ratio over 85%, 2025, PM peak

4.2.3 Central 2

Figure 24, Figure 25 and Figure 26 shows the traffic flow changes that occur on the transport network when Central 2 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the Central 2 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route options implementation, while links with a green bar are those sections where flows go up once the route options is in place.

The general pattern of change repeats during the three hours modelled, although the magnitude of change is larger in the evening peak. As drivers travel on the new infrastructure provided by the Central 2 route option, which connects with the Bailrigg Spine Road (linking to Ashford Road in 2025) and the A588, a flow reduction is observed in the following routes:

- A6, including sections through Galgate;
- Bayhorse Road, Rigg Lane, Postern Gate Road to the east of the model network;
- A588 between Tarnwater Lane and Ashford Road;
- Birch Avenue and Tarnwater Lane, as this scheme offers an alternative new connection with the A588.

On the other hand, flow increases on those sections connecting with the new infrastructure:

- Hazelrigg Lane, in the section linking Bailrigg Spine Road and the Central 2 road, and in the sections immediately to the north and Blea Tarn Road, as vehicles modify their routeing to make use of the new road;
- M6, as access and egress from the motorway is facilitated by the new motorway slips leading to Hazelrigg Lane;
- Ashton Road also experiences a flow increase in 2025, when the Bailrigg Spine Road has a north connection to Ashford Road, as it becomes a link between the new route and Lancaster.

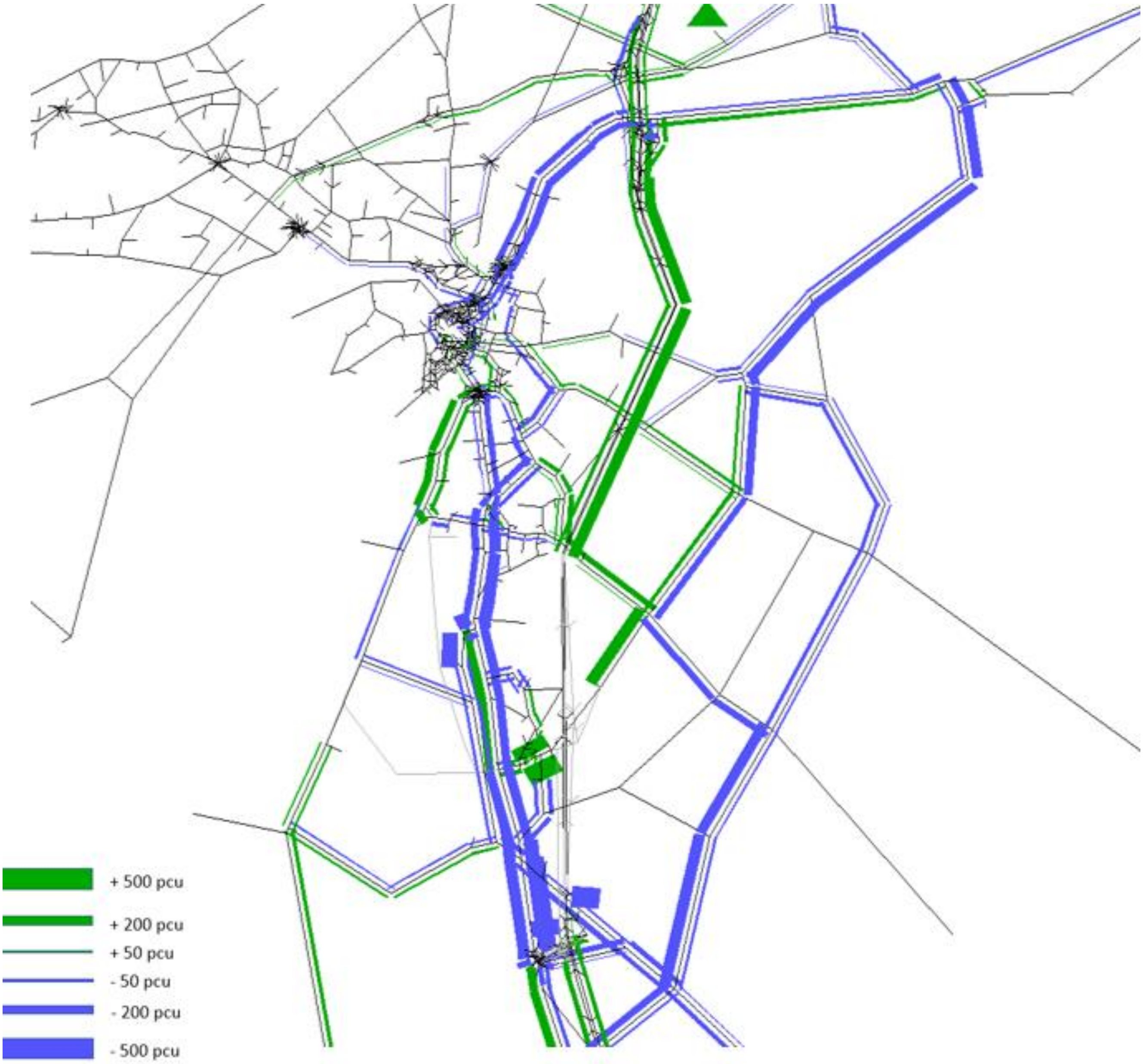


Figure 24: Central 2 vs DM, Flow comparison, 2025, AM peak (PCU)

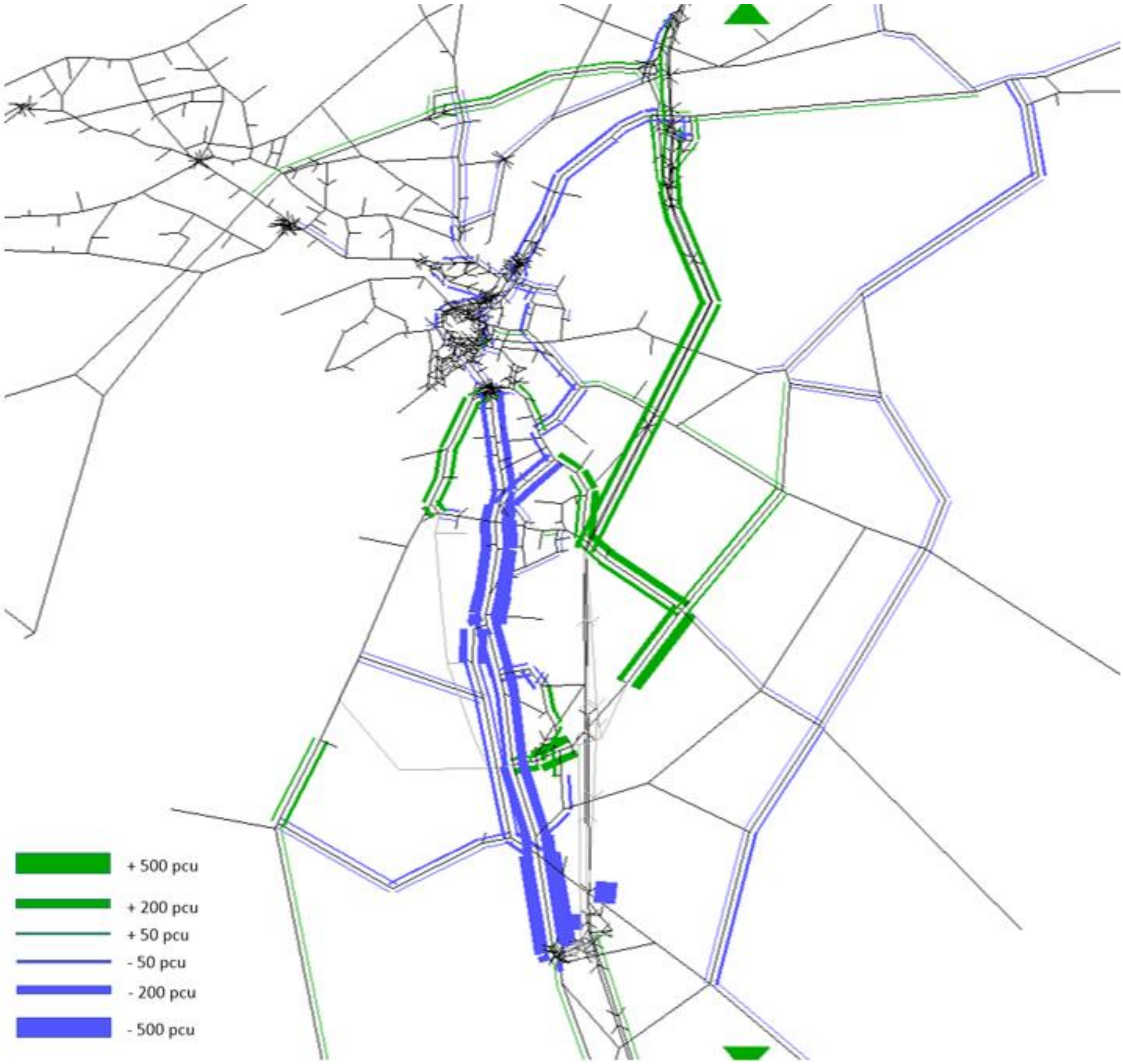


Figure 25: Central 2 vs DM, Flow comparison, 2025, Interpeak (PCU)

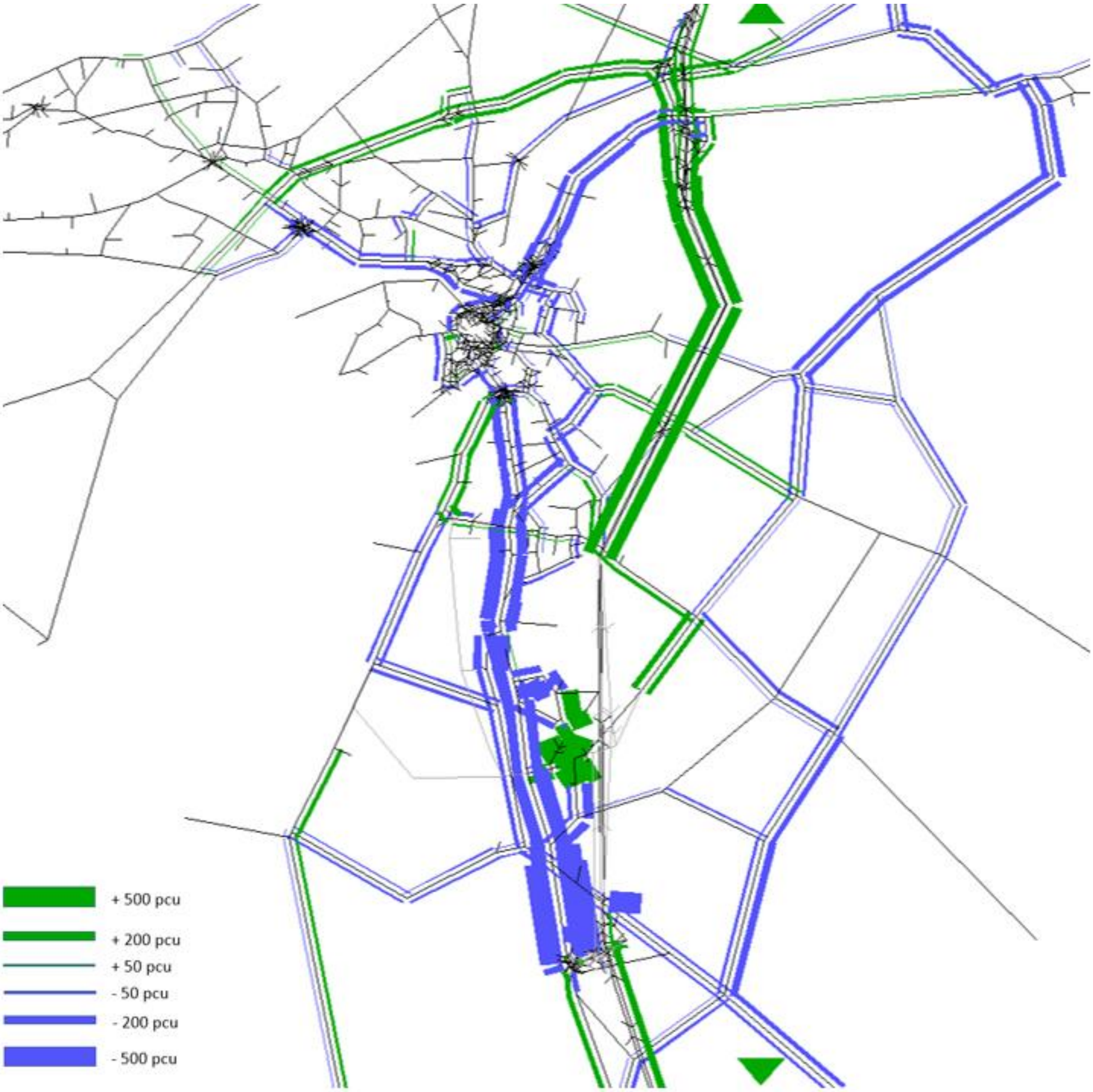


Figure 26: Central 2 vs DM, Flow comparison, 2025, PM peak (PCU)

Table 4.3 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the Central 2 route option results in a significant flow reduction along the A6 with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road.

The reduction of flows on Galgate is 2% higher than that achieved by Central 1 during the AM, 5% in the Interpeak and 6% in the PM peak. The reason is that Central 2 also offers a connection to the A588 achieving a further reduction of flows in the A6 through Galgate.

With respect to the links located east of the A6, flow increases in Blea Tarn Road and Hazelrigg Lane, as this link directly to the new road. Although the highest proportional increase is observed in the Interpeak, the highest flow registered in Hazelrigg Lane is 602 pcu during the AM peak.

In contrast, flow on roads that form part of alternative routes like Postern Gate Road and Quernmore Road decreases as vehicles switch to the new road.

The same pattern is observed in links located to the west of the A6, with flow increasing on those that form part of a route leading to and from the new road like Birch Avenue and Ashton Road; Flow on the A588 also increases between Birch Avenue and Tarnwater Lane, as this segment becomes more accessible thanks to the new A588 connection.

Table 4.3: Central 2, 2025, Modelled flows (PCU)

	Road name	Between	Without scheme (2025)			With scheme Central 2 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1432	1099	1293	7%	2%	6%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1046	806	927	-34%	-39%	-48%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1065	811	1000	-31%	-30%	-40%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1029	799	976	-25%	-27%	-32%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	957	808	978	-1%	-21%	-24%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1565	1170	935	-18%	-26%	-31%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	1332	1224	1151	-9%	-14%	-17%
8	M6	J33 & J34	6548	6559	6286	6790	6688	6640	4%	2%	6%
9	Stoney Lane	A6 & Bay Horse Road	214	26	77	55	26	18	-74%	0%	-76%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	27	9	12	-89%	-81%	-91%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28	43	14	11	11%	25%	-60%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	602	367	404	59%	231%	65%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	251	136	223	-18%	53%	-15%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	60	34	51	-70%	-31%	-62%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	397	253	197	43%	236%	54%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1108	772	1055	-8%	-5%	-13%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	20	19	18	-81%	-58%	-69%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	77	93	0%	1%	1%
19	Birch Avenue	A588 & Highland Brow	91	86	79	90	41	31	-1%	-53%	-61%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	465	349	476	12%	23%	16%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	407	293	318	-8%	-2%	-18%
22	Ashton Road	Ashford Road & A6	839	501	685	1037	615	805	24%	23%	18%
All values expressed in PCU's. All values are two-way link flows. * The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 27, Figure 28 and Figure 29 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In both AM and PM peaks, the model predicts some congestion on the NB approaches to Hazelrigg, while it relieves congestion on the A6. Similarly, to what it was observed in Central 1, in the AM, the new road junction with Hazelrigg Lane is showing some congestion, derived from the additional flows travelling on it. On the other hand, the route option has the potential to alleviate congestion in the A6 junctions at Galgate and Burrow Lane.

The same trend is observed in the PM peak, although the highest V/C is experienced in the Hazelrigg/Chapel Lane junction. As in the AM, the scheme shows potential to relieve congestion on the A6 junctions at Galgate and Burrow Lane, which do now operate under capacity.

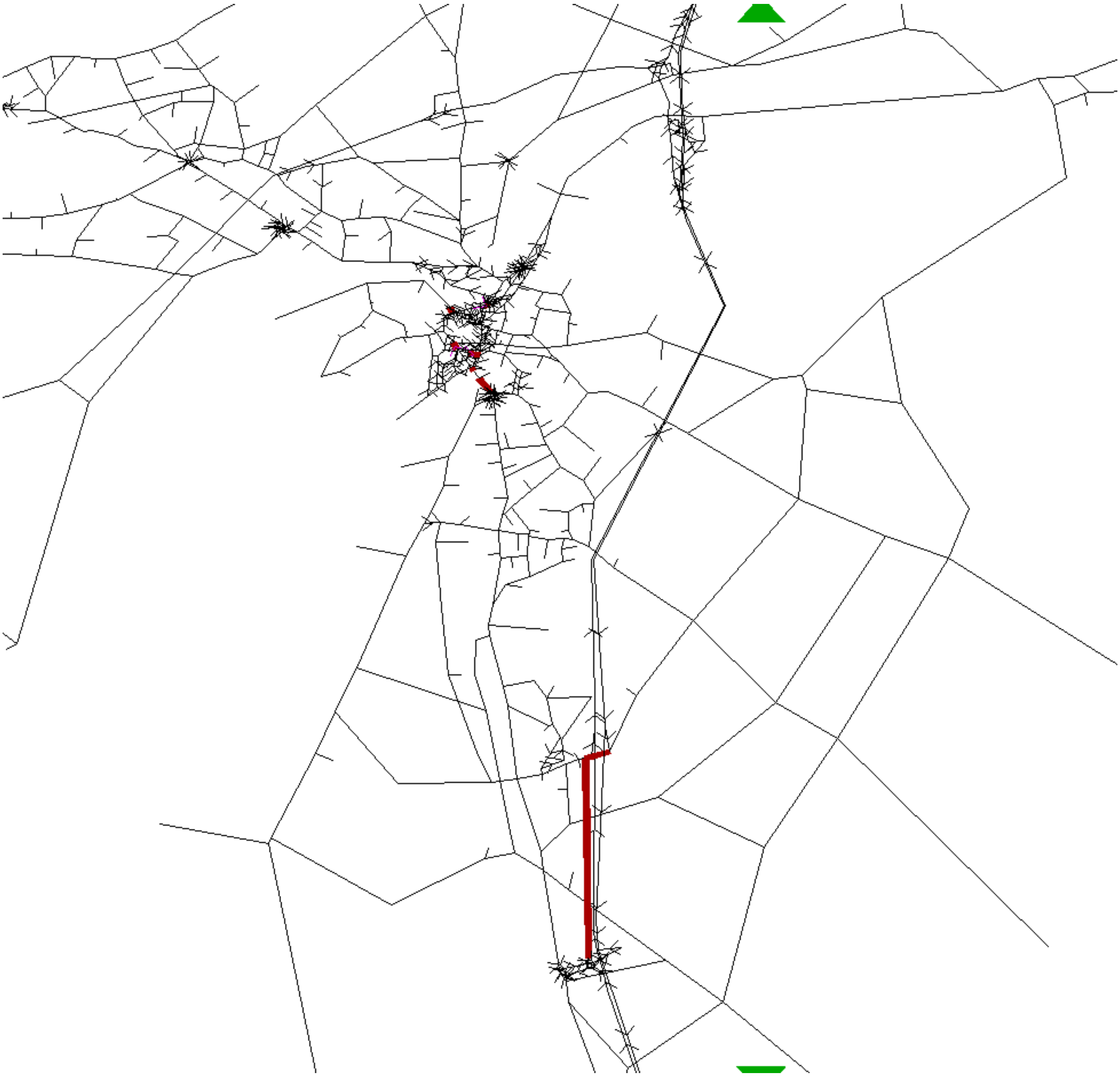


Figure 27: Central 2, Volume over Capacity (ratio over 85%), 2025, AM Peak

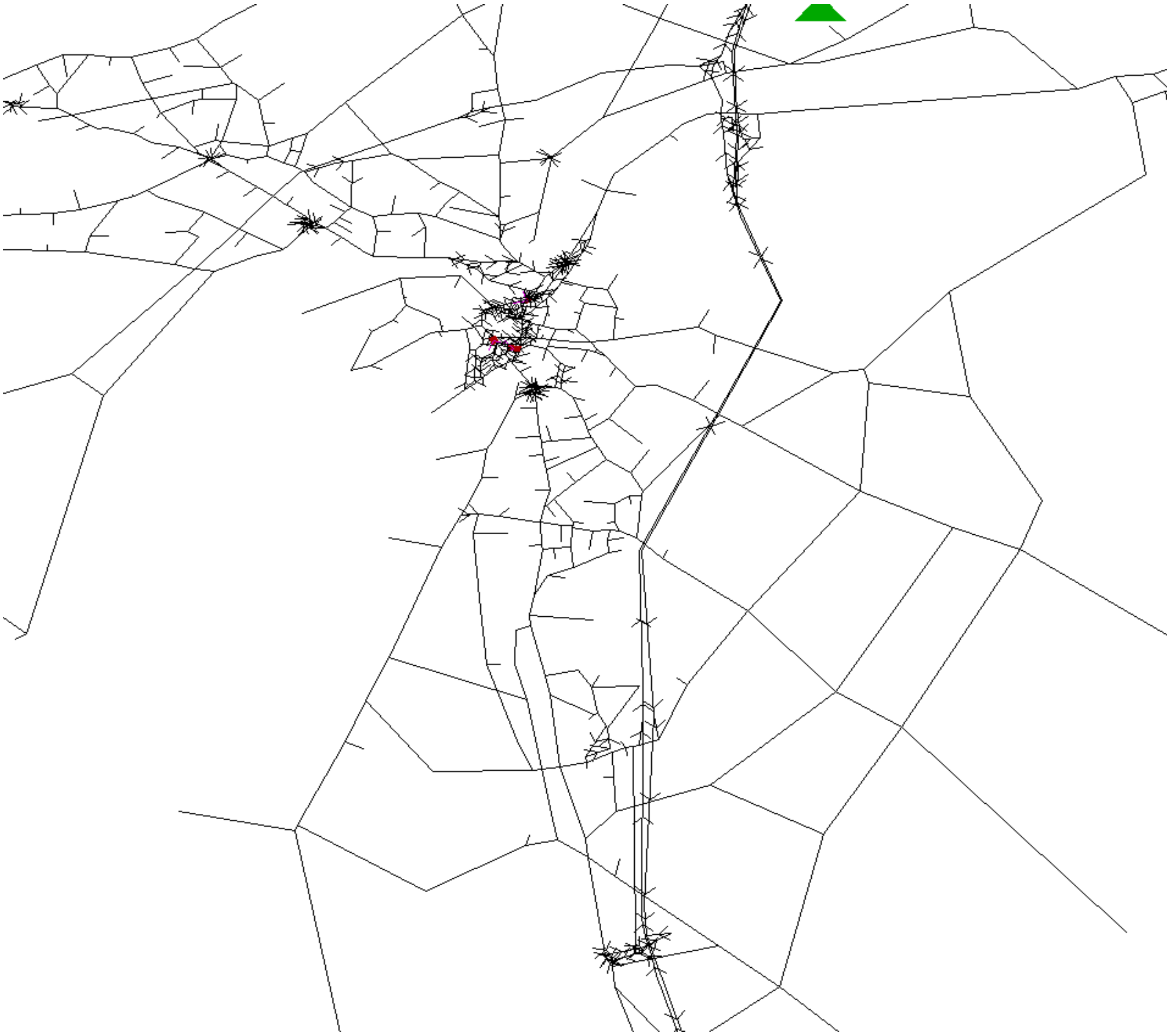


Figure 28: Central 2, Volume over Capacity (ratio over 85%), 2025, Interpeak

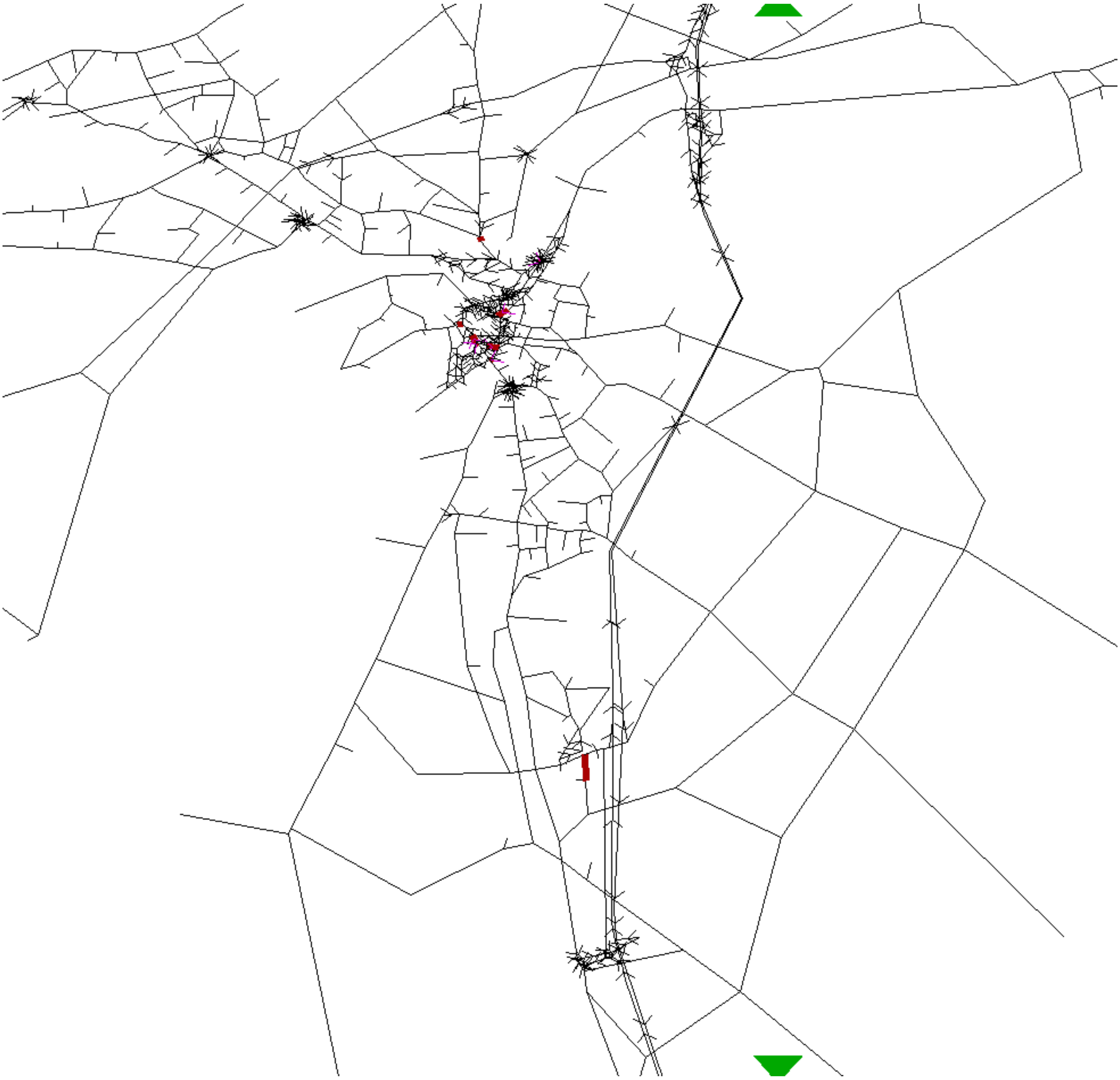


Figure 29: Central 2, Volume over Capacity (ratio over 85%), 2025, PM

4.2.4 West 1

Figure 30, Figure 31 and Figure 32 show the traffic flow changes that occur on the transport network when the West 1 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the West 1 route option. Links with a blue bar signify those sections of the network where flow decreases because of the route option implementation, while links with a green bar are those sections where flows go up once the s route option is in place.

The general pattern of change repeats during the three hours modelled. As drivers travel on the new infrastructure provided by the West 1 route option, which links the M6 J33 with the Bailrigg Spine Road in a new junction, flow reductions are observed in the following routes:

- A6, including sections through Galgate;
- Bayhorse Road, Rigg Lane, Postern Gate Road to the east of the model network;

On the other hand, flows increase on those sections connecting with the new infrastructure:

- Ashton Road also experiences a flow increase in 2025, when the Spine Road has a north connection to Ashford Road, as it becomes a link between the new route and Lancaster.

Flow on the M6 and the A588 remains largely unchanged.

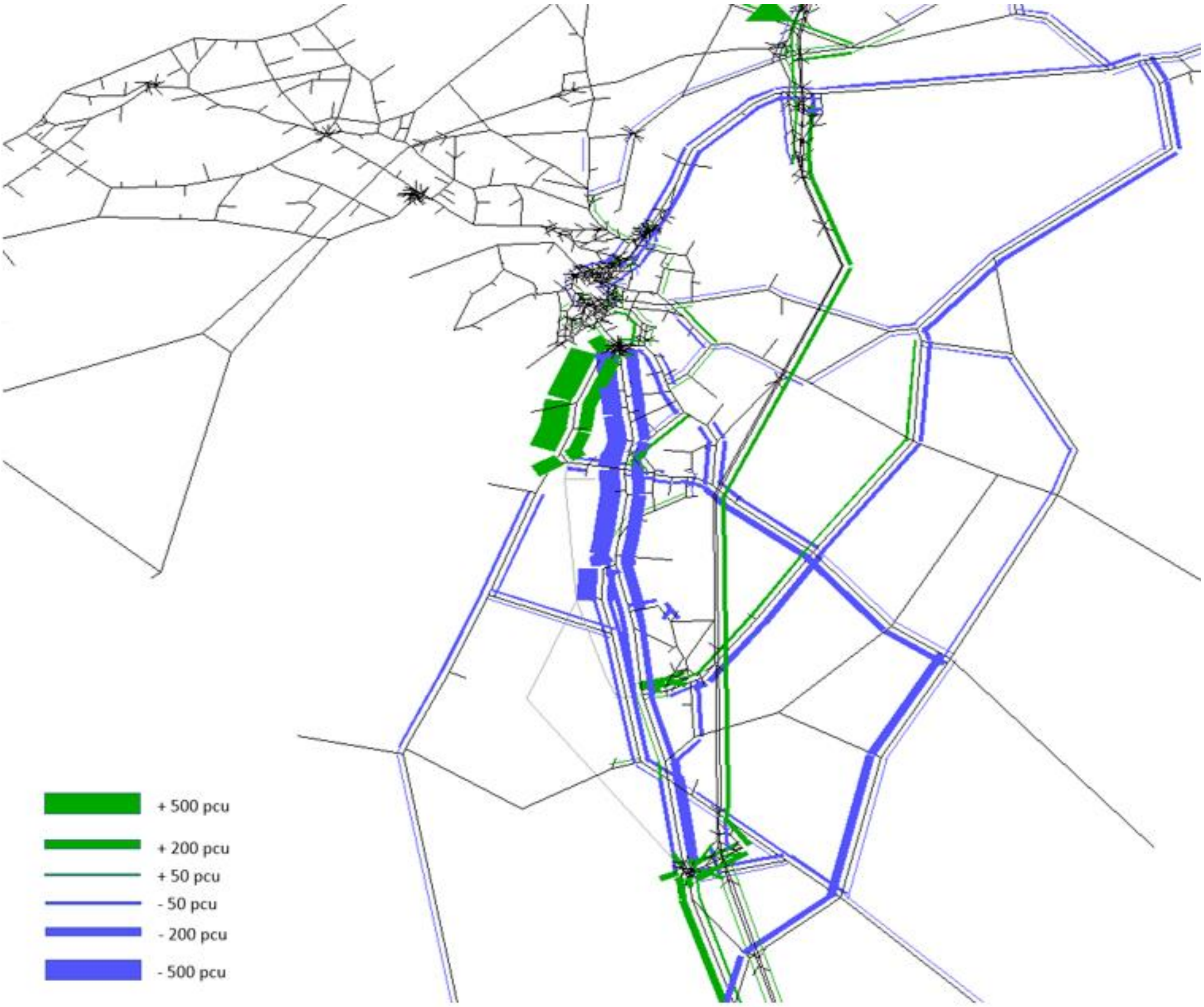


Figure 30: West 1 vs DM, Flow Comparison, 2025, AM Peak (PCU)

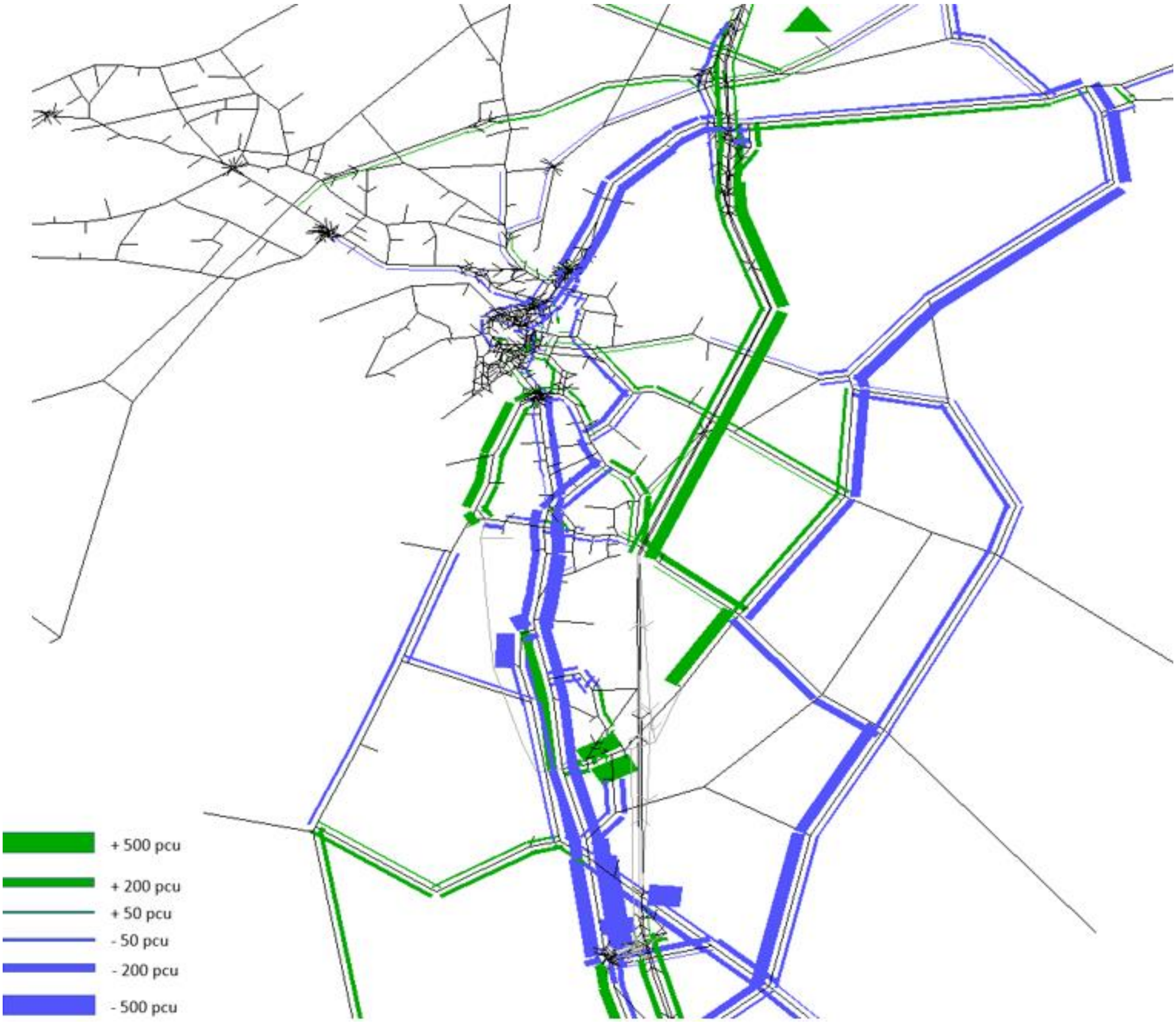


Figure 31: West 1 vs DM, Flow Comparison, 2025, AM Peak (PCU)

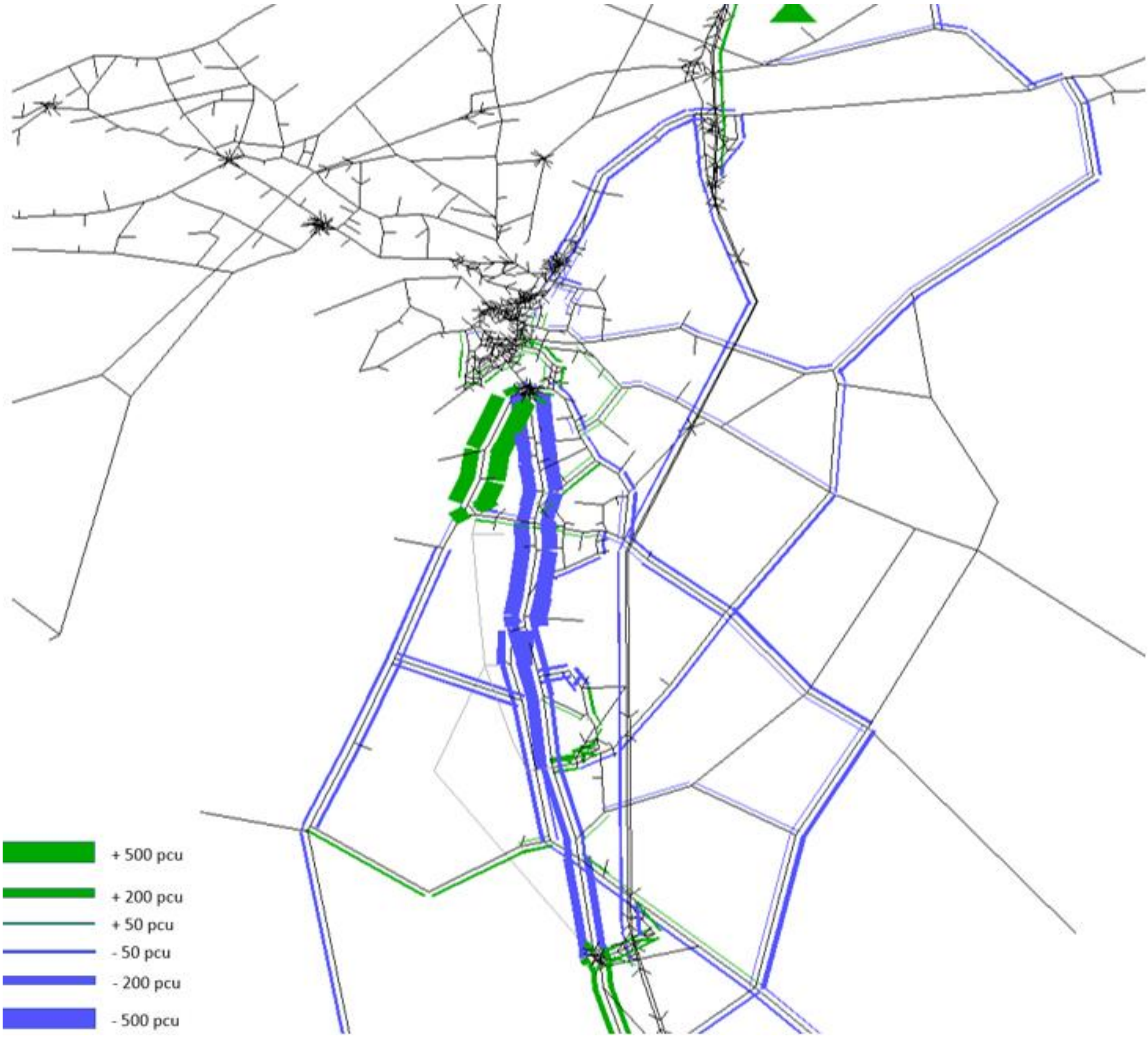


Figure 32: West 1 vs DM, Flow Comparison, 2025, AM Peak (PCU)

Table 4.4 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the West 1 scheme results in reduction of flows along the A6 with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road. The flow reduction along Galgate varies from 7% and 8% in the AM and PM peaks, to 17% in the Interpeak.

With respect to the links located east of the A6, the route option achieves a reduction of flows in the whole area, as it is able to attract some longer distance trips; The route option has a very limited effect on motorway traffic, and the roads west of the model area, with the exception of some flow increases in Ashton Road, as it forms part of the route between the new infrastructure and Lancaster.

Table 4.4: West 1, 2025, Modelled flows (PCU)

	Road name	Between	Without scheme (2025)			With scheme West 1 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1484	1118	1358	11%	4%	11%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1378	1058	1550	-13%	-20%	-14%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1439	959	1520	-7%	-17%	-8%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1320	901	1283	-4%	-17%	-10%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	788	808	1051	-18%	-21%	-19%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1374	1163	858	-28%	-27%	-37%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	980	1089	922	-33%	-23%	-33%
8	M6	J33 & J34	6548	6559	6286	6595	6565	6253	1%	0%	-1%
9	Stoney Lane	A6 & Bay Horse Road	214	26	77	176	26	54	-18%	-1%	-30%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	98	18	59	-61%	-64%	-56%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28	36	12	13	-7%	4%	-52%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	311	124	210	-18%	11%	-14%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	271	100	223	-11%	13%	-15%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	74	33	67	-63%	-33%	-51%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	118	59	61	-57%	-21%	-52%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1136	784	1187	-6%	-4%	-2%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	79	31	52	-24%	-34%	-9%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	76	91	0%	0%	0%
19	Birch Avenue	A588 & Highland Brow	91	86	79	102	90	120	12%	4%	52%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	380	274	335	-9%	-3%	-18%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	374	272	317	-15%	-9%	-18%
22	Ashton Road	Ashford Road & A6	839	501	685	1476	864	1239	76%	72%	81%
All values expressed in PCU's. All values are two-way link flows.											
* The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 33, Figure 34 and Figure 35 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In both AM and PM peaks, the model predicts some congestion on the Bailrigg Spine Road with Ashford Road, as increasing numbers travel through these sections. One significant aspect is that there is still some congestion on the A6 at Galgate, visible in the AM and PM peaks, which shows that the West 1 scheme has only a limited effect relieving congestion at Galgate.

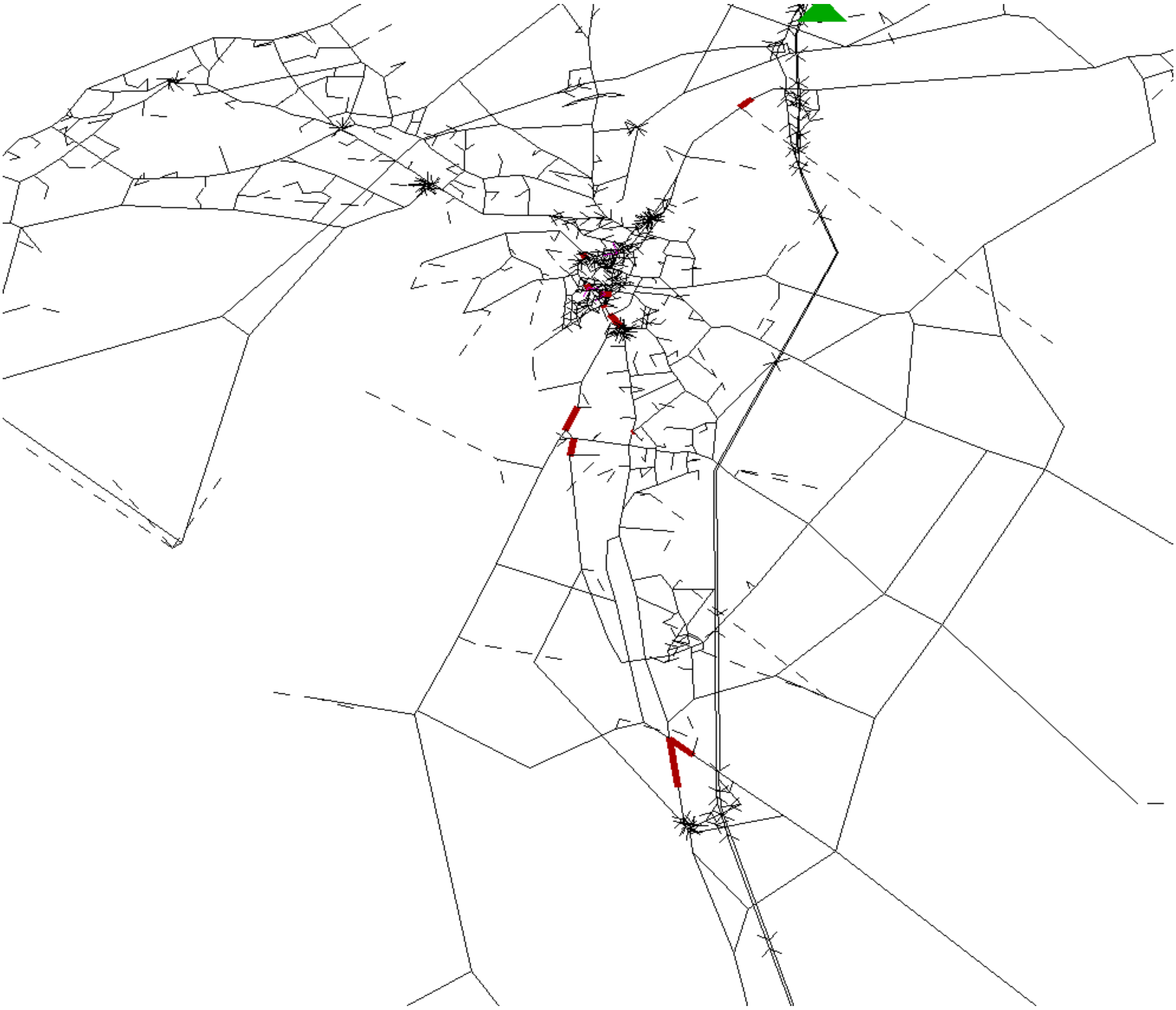


Figure 33: West 1, Volume over Capacity Ratio over 85%, 2025, AM peak

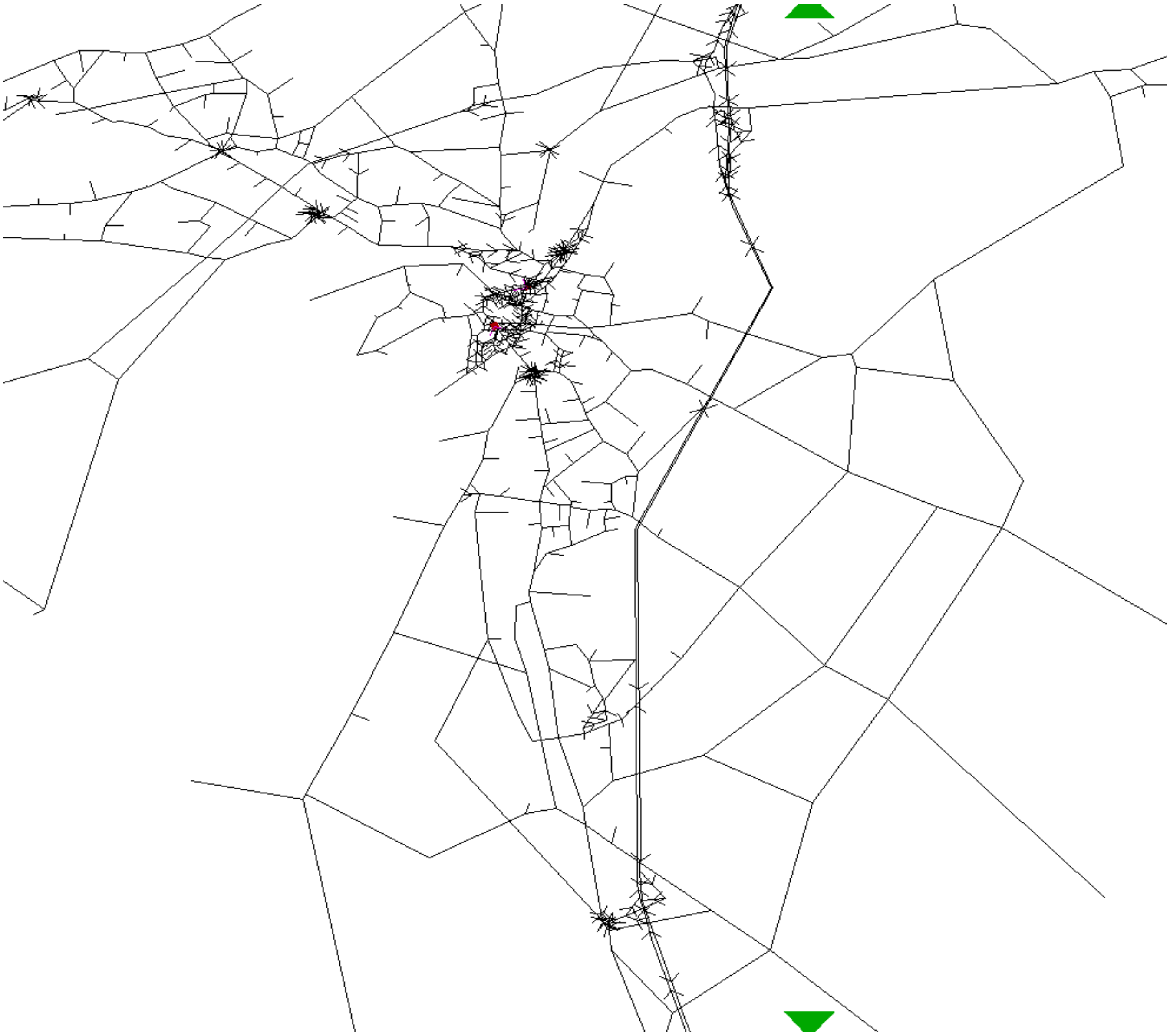


Figure 34: West 1, Volume over Capacity Ratio over 85%, 2025, Interpeak

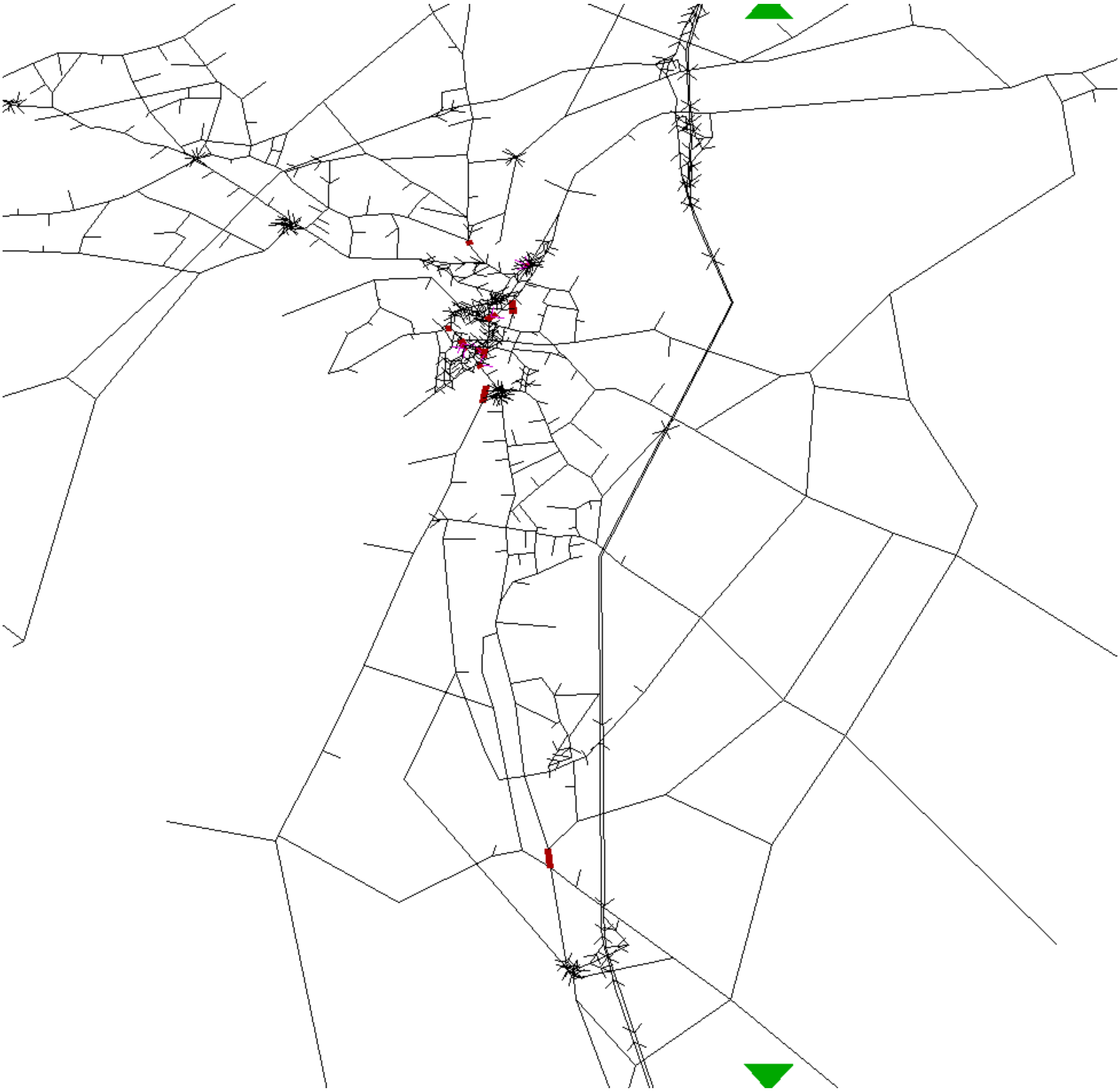


Figure 35: West 1, Volume over Capacity Ratio over 85%, 2025, PM peak

4.2.5 West 2

Figure 36, Figure 37 and Figure 38 show the traffic flow changes that occur on the transport network when the West 2 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the West 2 route option. Links with a blue bar signify those sections of the network where flow decreases because of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

The general pattern of change repeats during the three hours modelled. As vehicles travel on the new infrastructure provided by the West 2 route option, which links the A6 north of J33 with Hazelrigg Lane on its junction with the Bailrigg Spine Road, a flow reduction is observed in the following routes:

- A6, including sections through Galgate, except in the Interpeak;
- M6 SB direction as vehicles leave the motorway on J34 to take advantage of the new infrastructure.

On the other hand, flow increases on:

- Ashton Road as it becomes a link between the new route and Lancaster;

The route option has mixed impact on the roads to the east of the A6, which experience flow increases or decreases in different periods and directions. Flow on A588 remains largely unchanged.

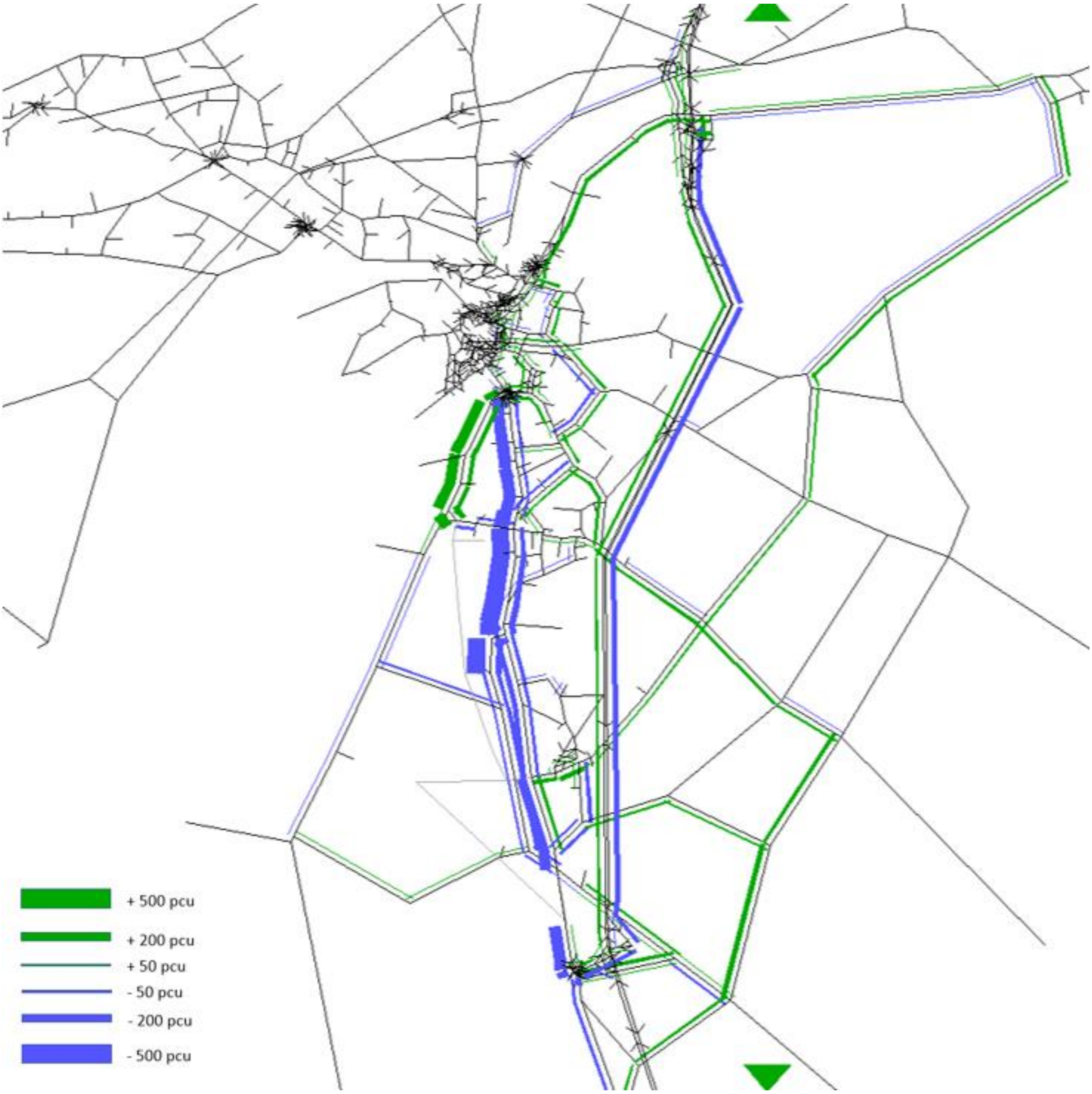


Figure 36, West 2 vs DM: Flow Comparison, 2025, AM Peak (PCU)

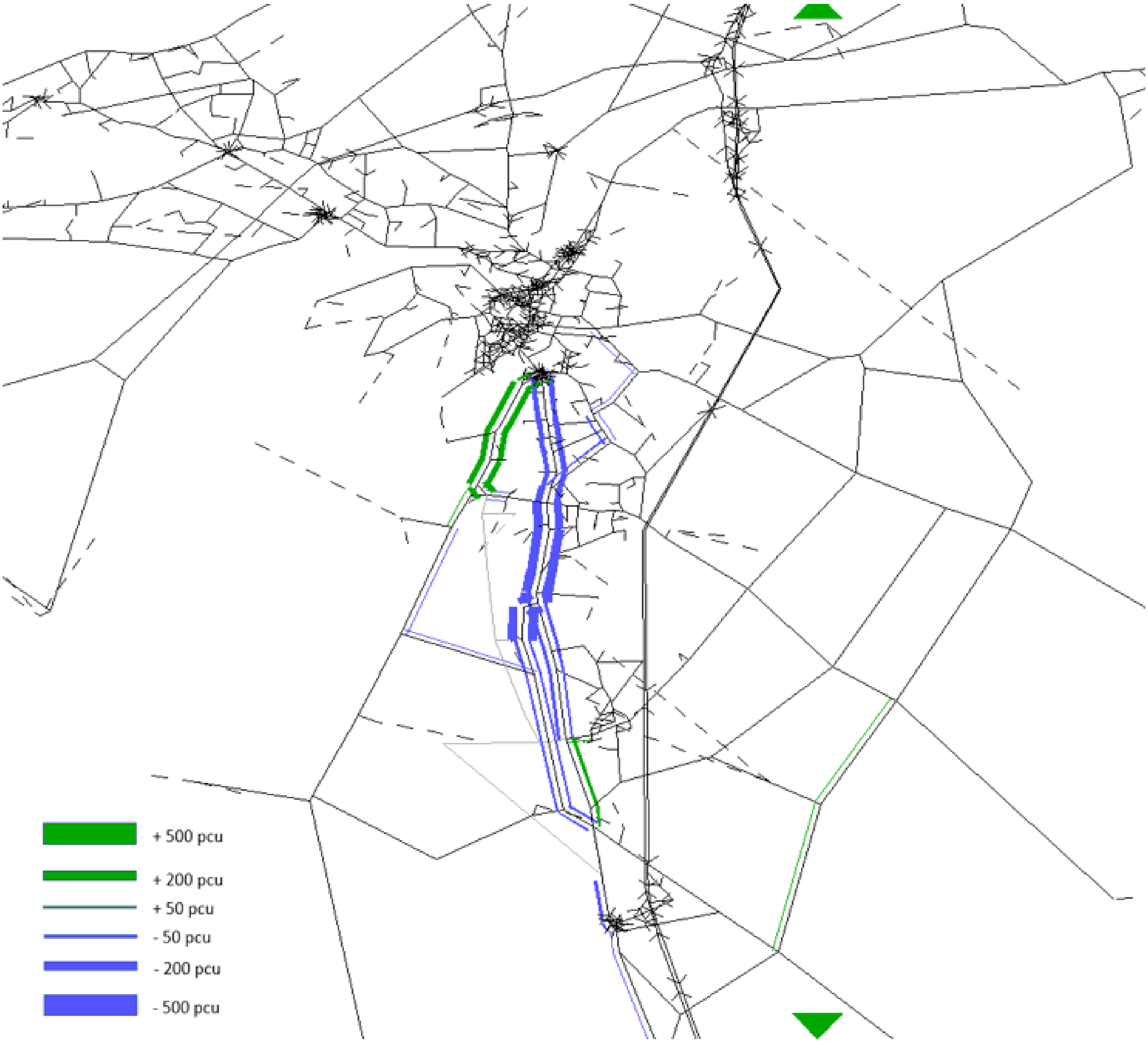


Figure 37: West 2 vs DM, Flow Comparison, 2025, Interpeak (PCU)

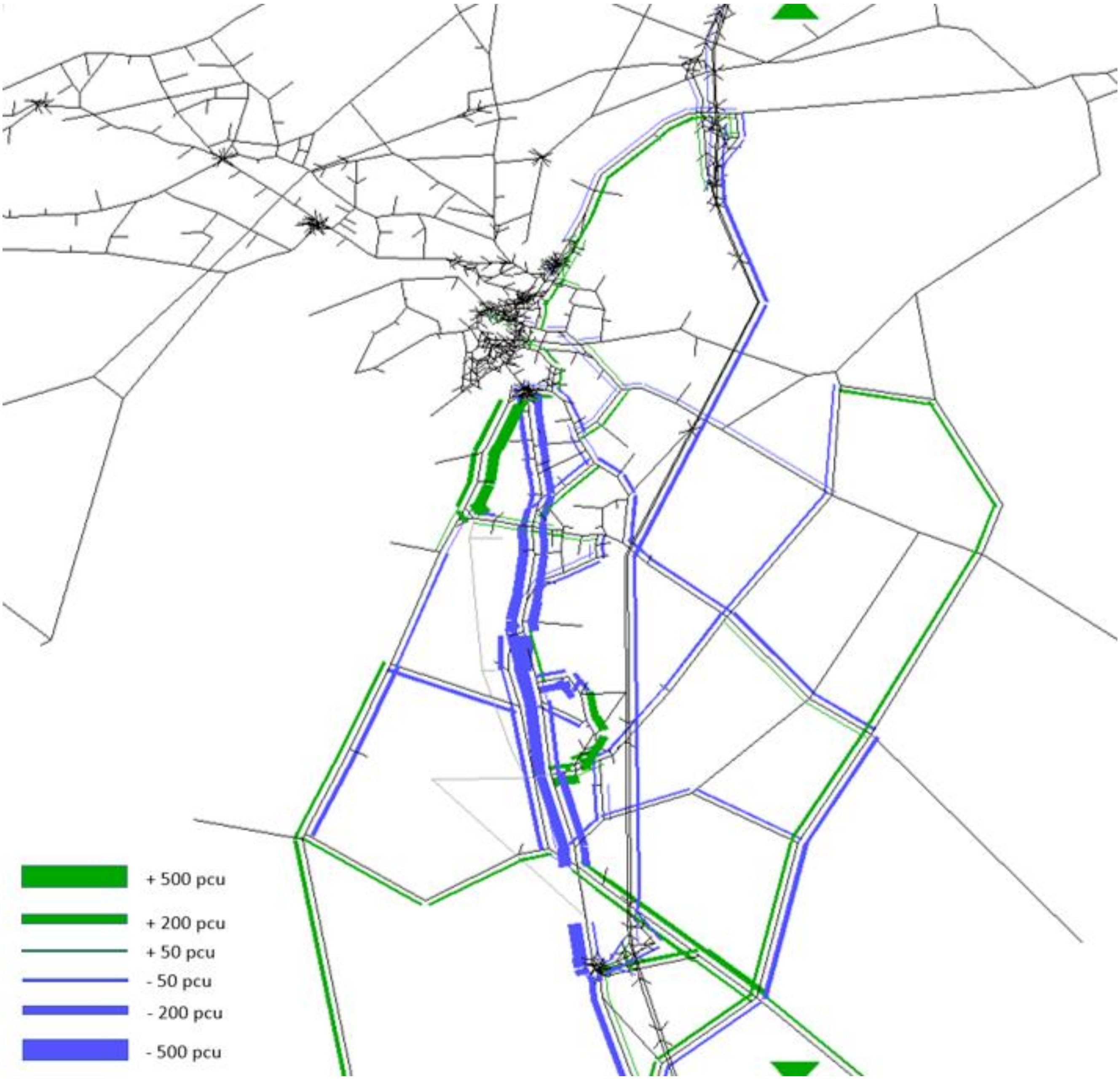


Figure 38: West 2 vs DM, Flow Comparison, 2025, PM peak (PCU)

Table 4.5 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the West 2 route option results in reduction of flows along the A6 with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road. The flow reduction along Galgate varies from 11% and 19% in the AM and PM peaks, to a 3% flow increase in the Interpeak.

With respect to the links located east of the A6, the route option causes flow increases or decreases in different directions and peak periods. In the AM peak, flows increase as vehicle travel along these roads to access the new infrastructure, while in the PM, the increase in concentrated in Bay Horse Rd between Procter Moss Rd and Wyresdale Rd.

To the west of the A6, flow in Birch Avenue and Ashton Rd (both connected to the route option at either end) increase, while flows on the A588 remain at similar levels.

Table 4.5: West 2, 2025, Modelled flows (PCU)

	Road name	Between	Without scheme (2025)			With scheme West 2 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1308	1062	1140	-2%	-2%	-7%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1419	1280	1560	-11%	-3%	-13%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1369	1185	1351	-11%	3%	-19%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1279	1128	1161	-7%	3%	-19%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	858	960	1057	-11%	-6%	-18%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1535	1325	1081	-19%	-16%	-20%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	1244	1274	1199	-15%	-10%	-13%
8	M6	J33 & J34	6548	6559	6286	6501	6568	6243	-1%	0%	-1%
9	Stoney Lane	A6 & Bay Horse Road	214	26	77	256	31	221	20%	20%	186%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	294	64	122	18%	30%	-9%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28	68	12	8	73%	3%	-72%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	394	105	219	4%	-5%	-11%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	322	88	236	6%	-1%	-10%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	242	56	96	20%	13%	-29%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	312	76	87	13%	1%	-32%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1232	781	1170	2%	-4%	-3%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	105	55	85	0%	18%	48%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	76	91	0%	0%	0%
19	Birch Avenue	A588 & Highland Brow	91	86	79	99	82	125	9%	-5%	59%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	404	285	393	-3%	1%	-4%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	411	292	349	-7%	-2%	-10%
22	Ashton Road	Ashford Road & A6	839	501	685	1076	667	935	28%	33%	36%
All values expressed in PCU's. All values are two-way link flows.											
* The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 39, Figure 40 and Figure 41 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, the model predicts some congestion on the A6 at Scotforth. One significant aspect is that there is still some congestion on the A6 at Galgate, visible in both the AM and PM peaks, which shows that the West 2 route option has only a limited effect relieving congestion at Galgate.

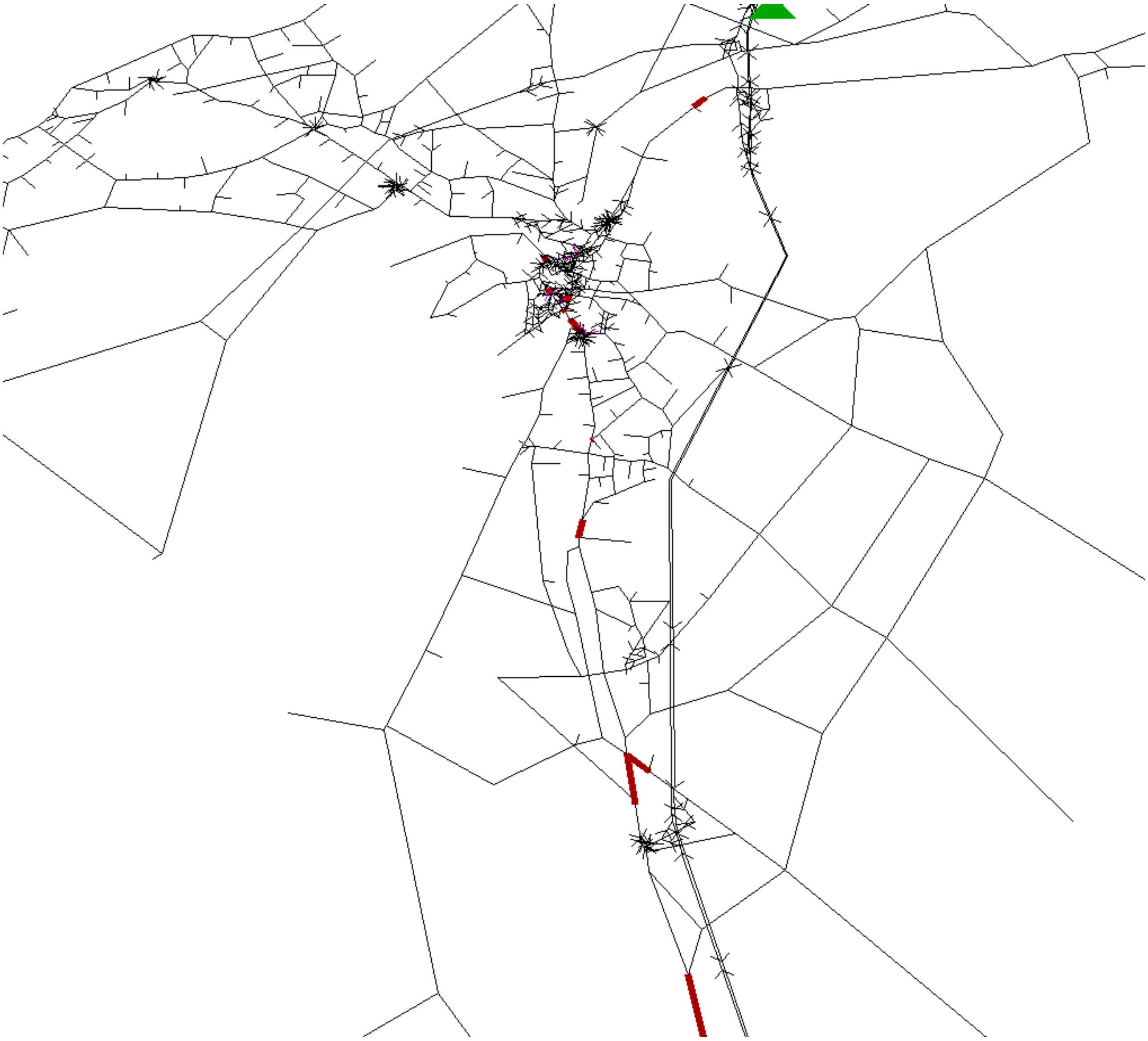


Figure 39: West 2, Volume over Capacity Ratio over 85%, 2025, AM peak

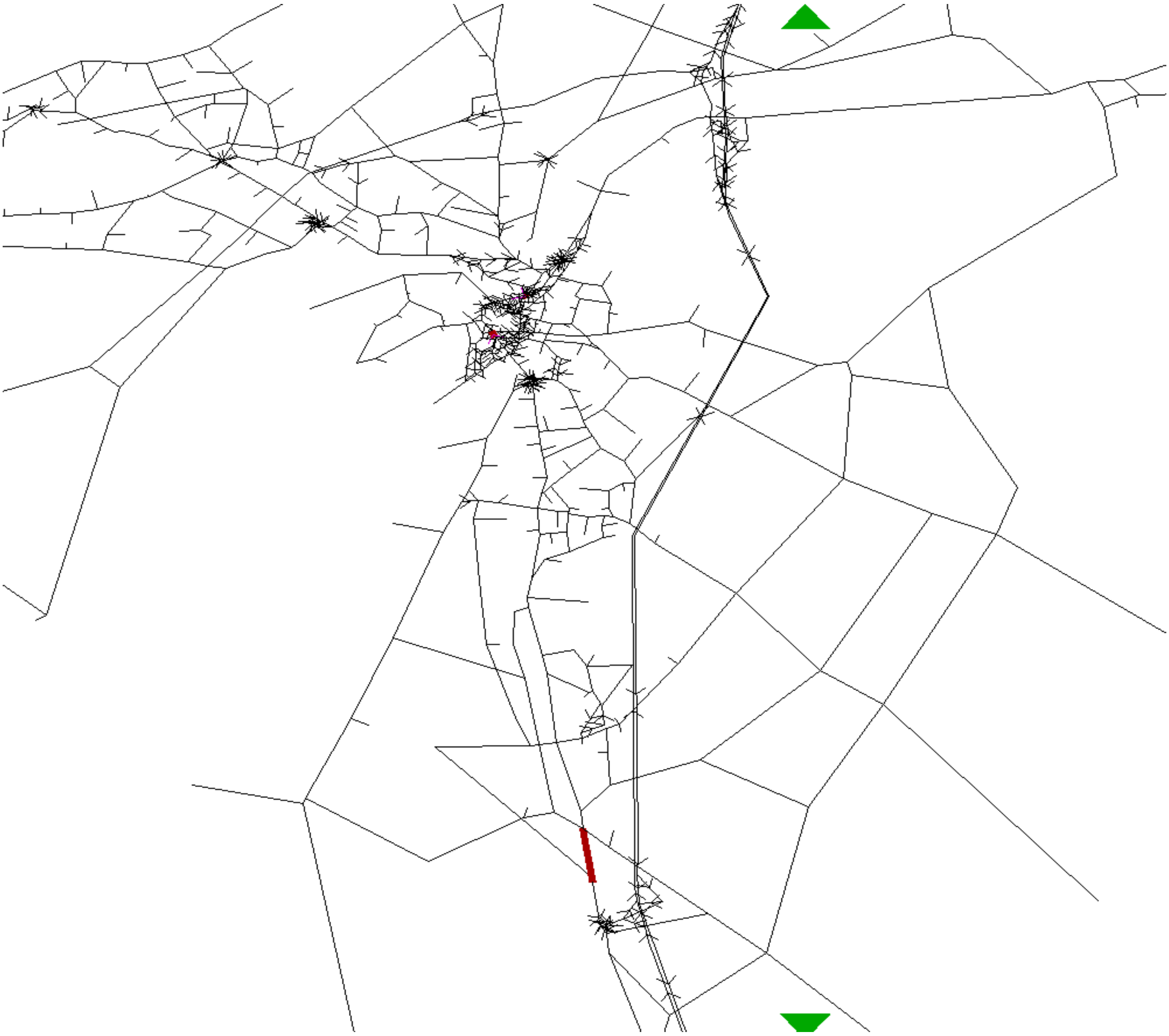


Figure 40: West 2, Volume over Capacity Ratio over 85%, 2025, Interpeak

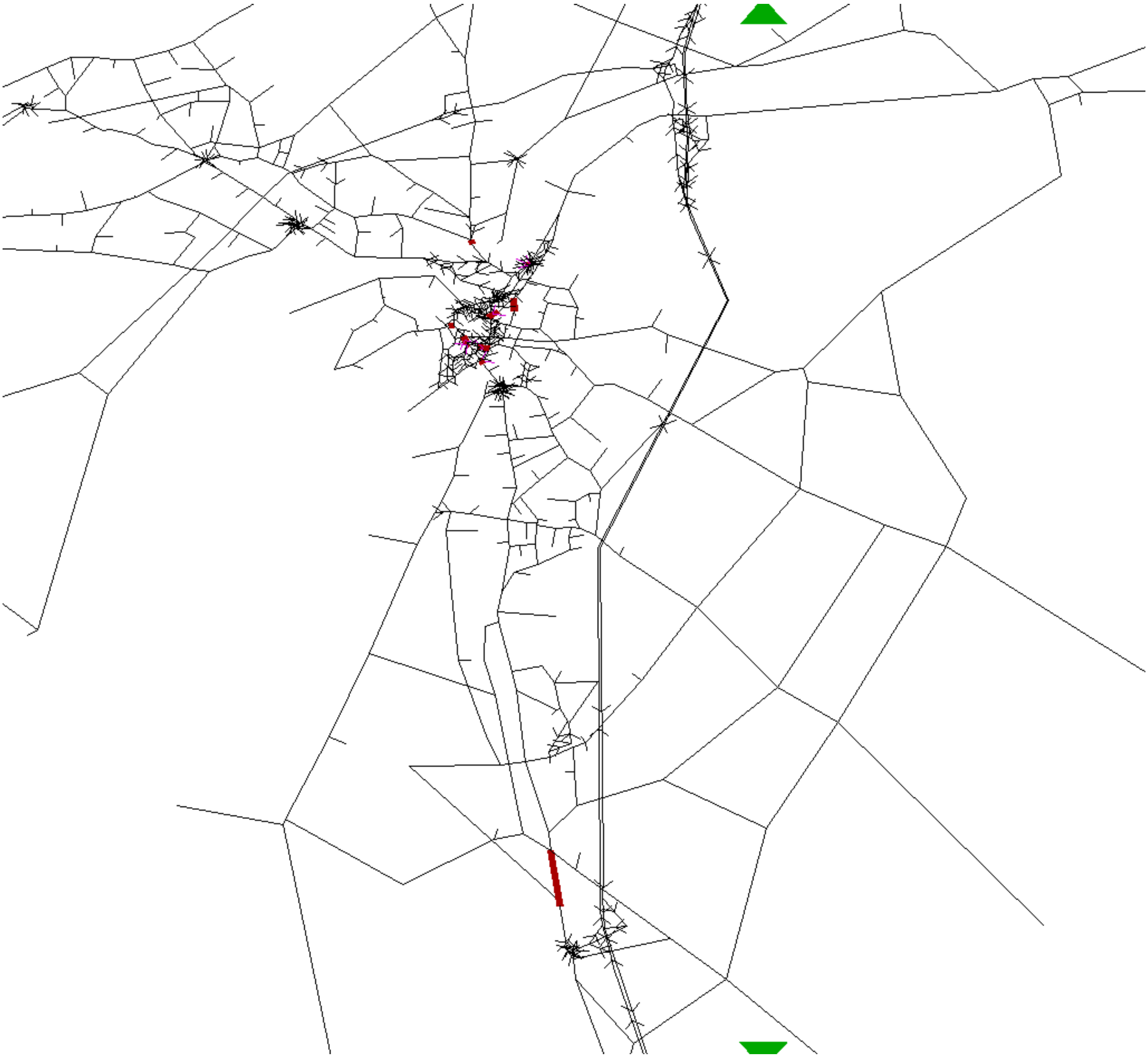


Figure 41: West 2, Volume over Capacity Ratio over 85%, 2025, PM peak

4.2.6 East 1

Figure 42, Figure 43 and Figure 44 show the traffic flow changes that occur on the transport network when the East 1 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the East 1 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

The general pattern of change repeats during the three hours modelled. As drivers travel on the new infrastructure provided by the East 1 route option, which links J33 with Hazelrigg Lane where the Bailrigg Spine Road and the new motorway connection also link, flow decreases in the following routes:

- A6, including sections through Galgate;
- Quernmore Road and Bay Horse Road; and,
- The A588 between Birch Road and Ashford Road.

On the other hand, flow increases on:

- Hazelrigg Lane and Blea Tarn Road which link with the new scheme;
- A6 south of J33 as additional vehicles travel along it to use the new infrastructure; and
- Ashton Road as it becomes a link between the new route and Lancaster.

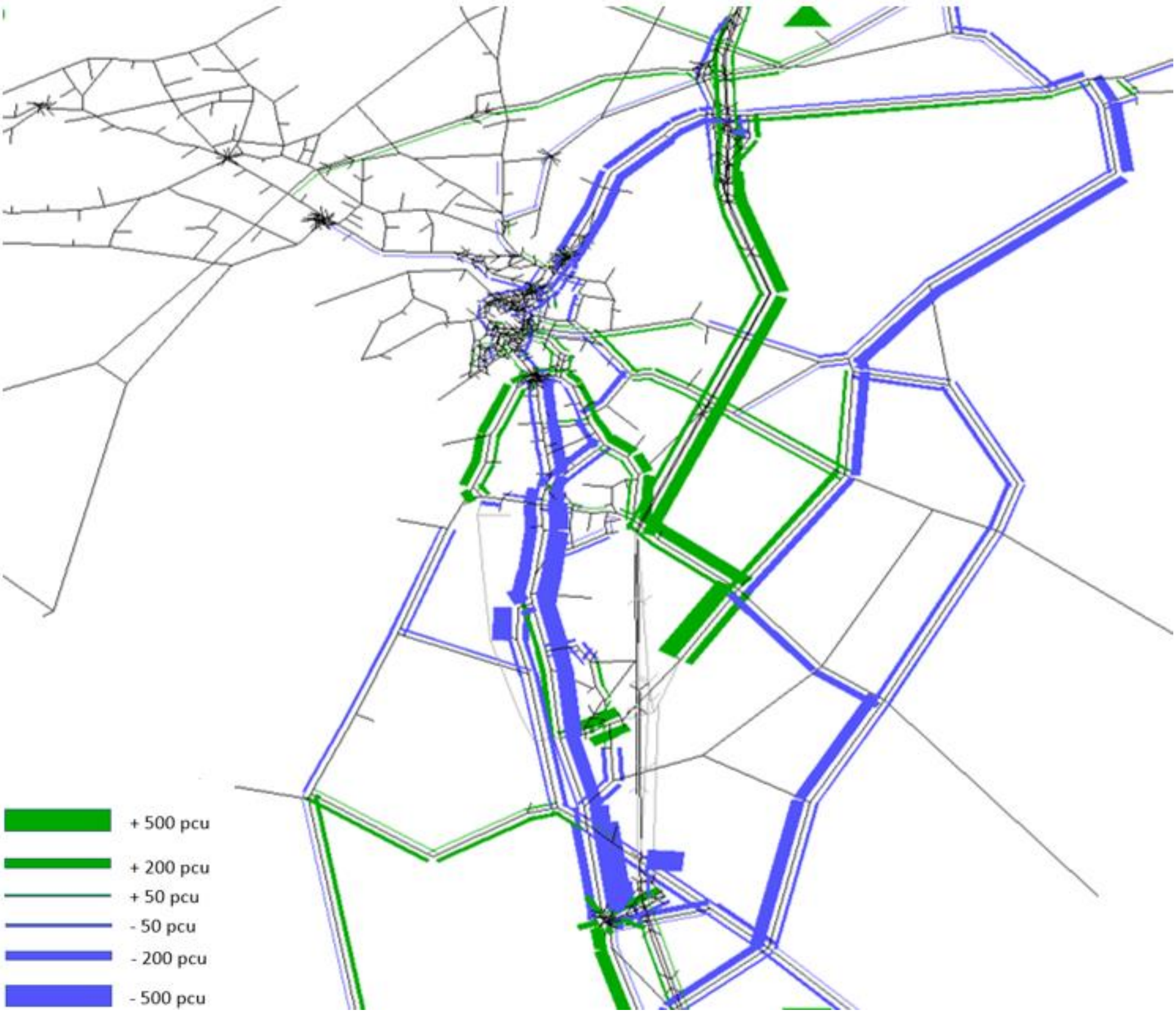


Figure 42: East 1 vs DM, Flow Comparison, 2025, AM Peak (PCU)

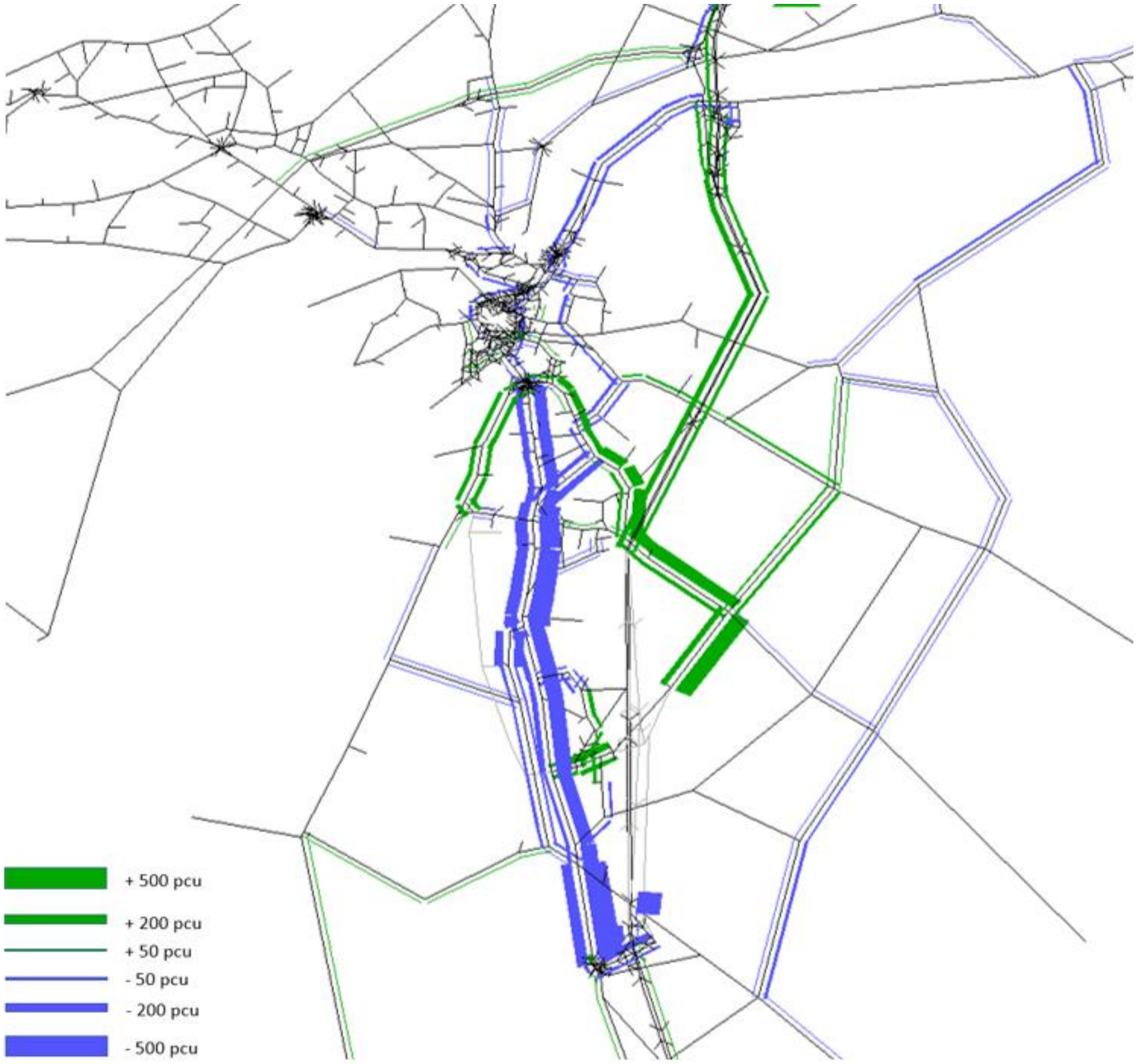


Figure 43: East 1 vs DM, Flow Comparison, 2025, Interpeak (PCU)

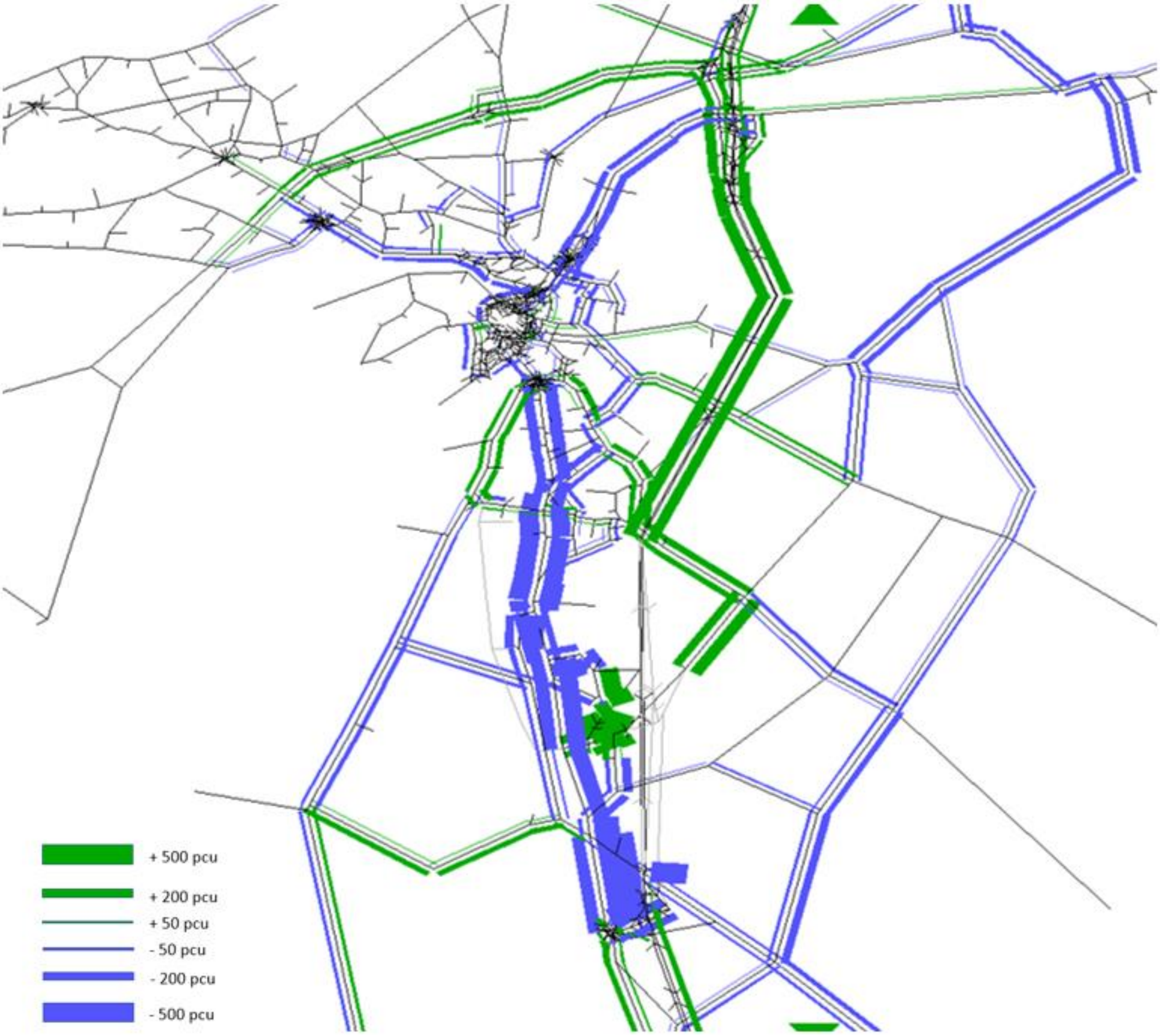


Figure 44: East 1 vs DM, Flow Comparison, 2025, PM Peak (PCU)

Table 4.6 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the East 1 route option results in reduction of flows along the A6 with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road. The flow reduction along Galgate is consistent across the three periods modelled; 24% in the AM peak, 25% in the Interpeak and 26% in the PM peak.

With respect to the links located east of the A6, flow goes up in Hazelrigg Lane and Blea Tarn Road, as vehicles travel along these routes to use the new infrastructure.

To the west of the A6, flow in Birch Avenue and Ashton Road (both connected to the scheme at either end) increase, while flows on the A588 decrease.

Table 4.6: East 1, 2025, Modelled flows (PCU)

	Road name	Between	Without scheme (2025)			With scheme East 1 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1517	1107	1326	13%	3%	9%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1043	794	1018	-34%	-40%	-43%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1182	862	1229	-24%	-25%	-26%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1136	842	1179	-18%	-23%	-18%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	777	714	811	-20%	-30%	-37%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1403	1078	779	-26%	-32%	-43%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	1241	1136	1038	-15%	-20%	-25%
8	M6	J33 & J34	6548	6559	6286	6781	6665	6619	4%	2%	5%
9	Stoney Lane	A6 & Bay Horse Road	39	11	28	42	14	11	7%	25%	-59%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	21	8	10	-92%	-84%	-92%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	201	50	136	56	34	50	-72%	-31%	-63%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	818	479	574	116%	332%	135%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	288	151	245	-6%	69%	-7%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	56	34	50	-72%	-31%	-63%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	572	351	349	107%	365%	173%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1227	864	1160	2%	6%	-4%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	17	18	18	-84%	-62%	-70%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	77	90	0%	1%	-1%
19	Birch Avenue	A588 & Highland Brow	91	86	79	173	106	180	90%	22%	128%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	370	277	319	-11%	-2%	-22%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	382	277	327	-14%	-8%	-16%
22	Ashton Road	Ashford Road & A6	839	501	685	1022	626	819	22%	25%	20%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 45, Figure 46 and Figure 47 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 at Galgate, which shows that the East 1 route option has only a limited effect relieving congestion at Galgate. There are no junctions experiencing V/C over 85% in the Interpeak and the PM peak.

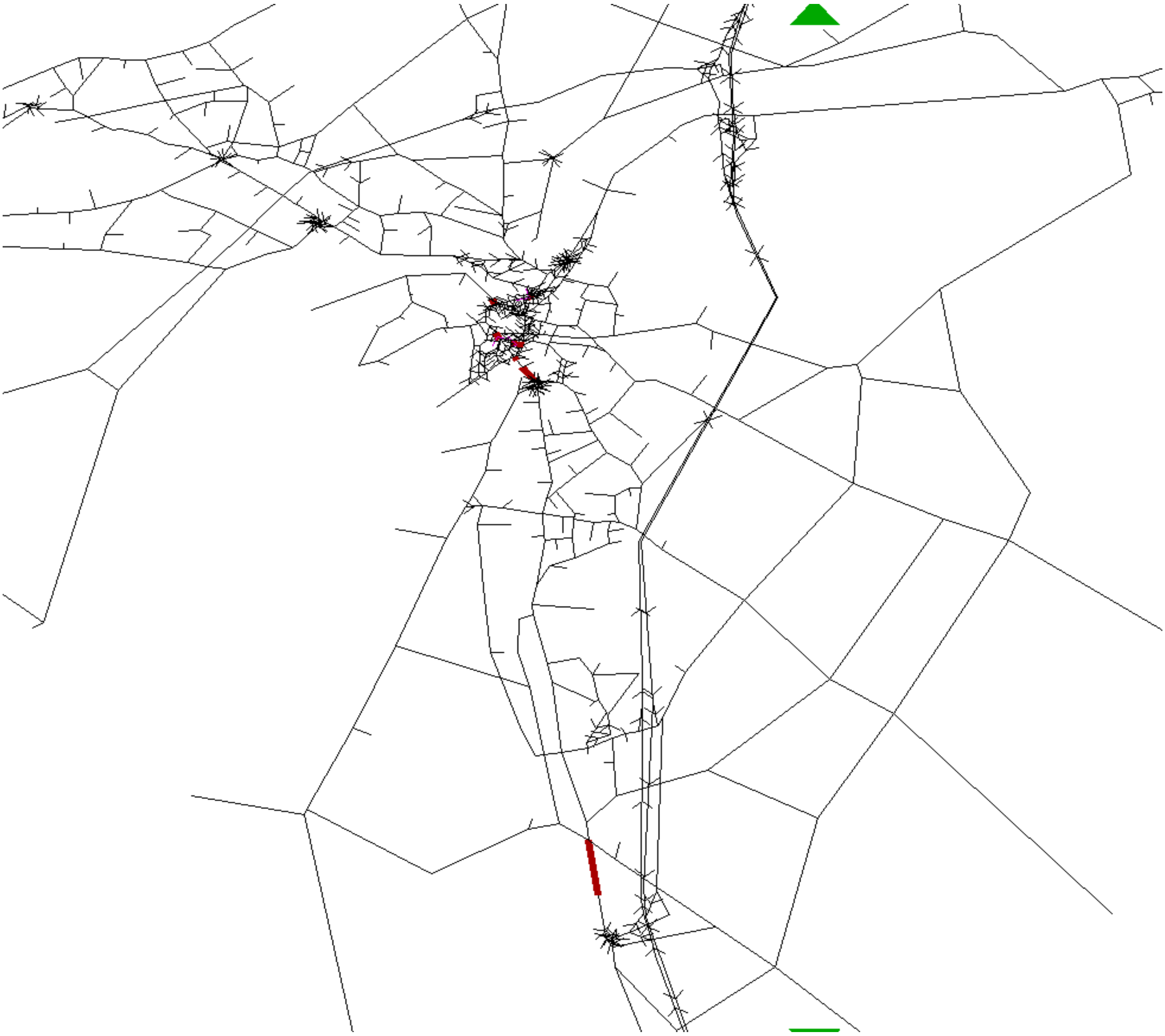


Figure 45: East 1, Volume over Capacity Ratio over 85%, 2025, AM peak

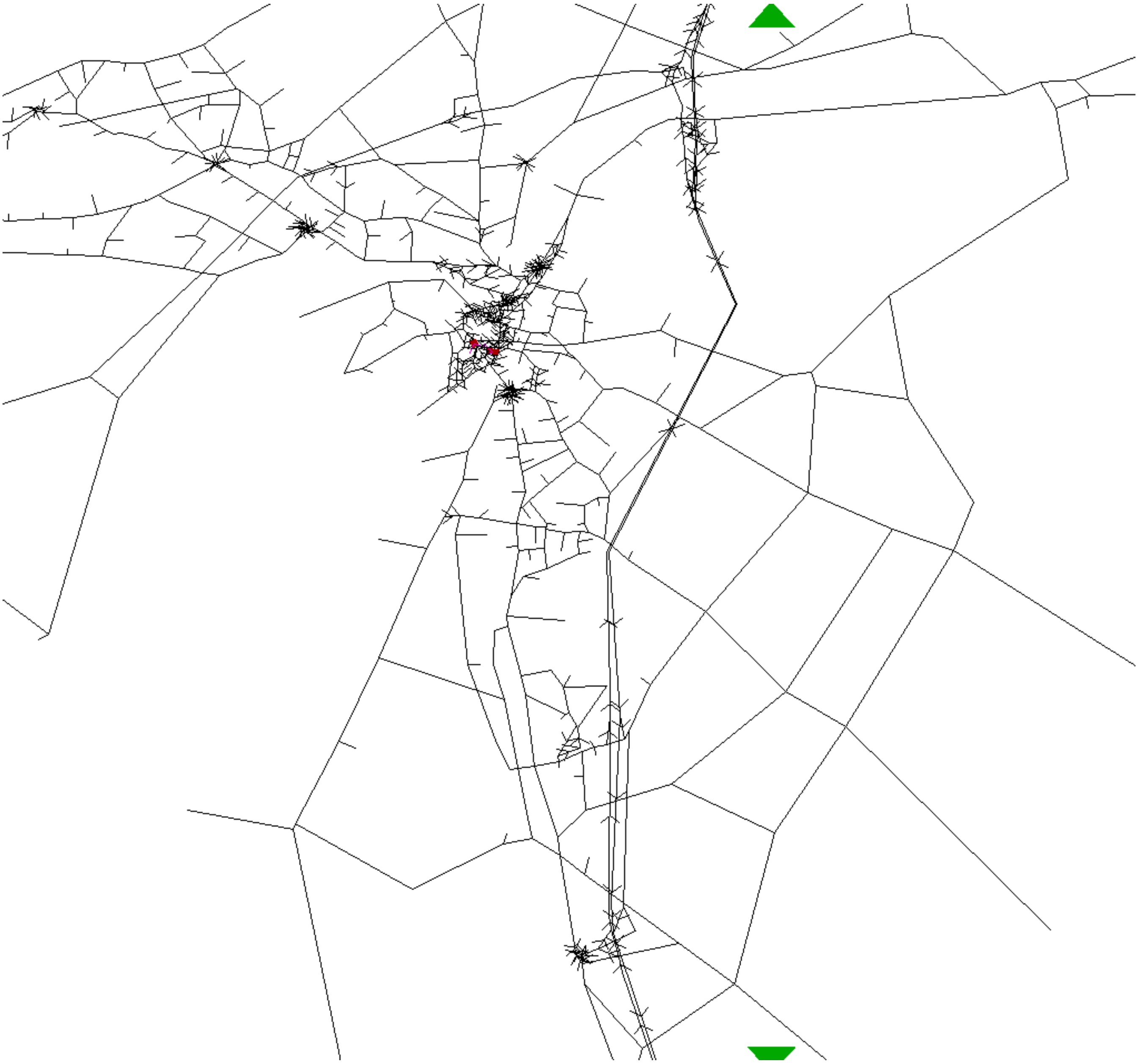


Figure 46: East 1, Volume over Capacity Ratio over 85%, 2025, Interpeak

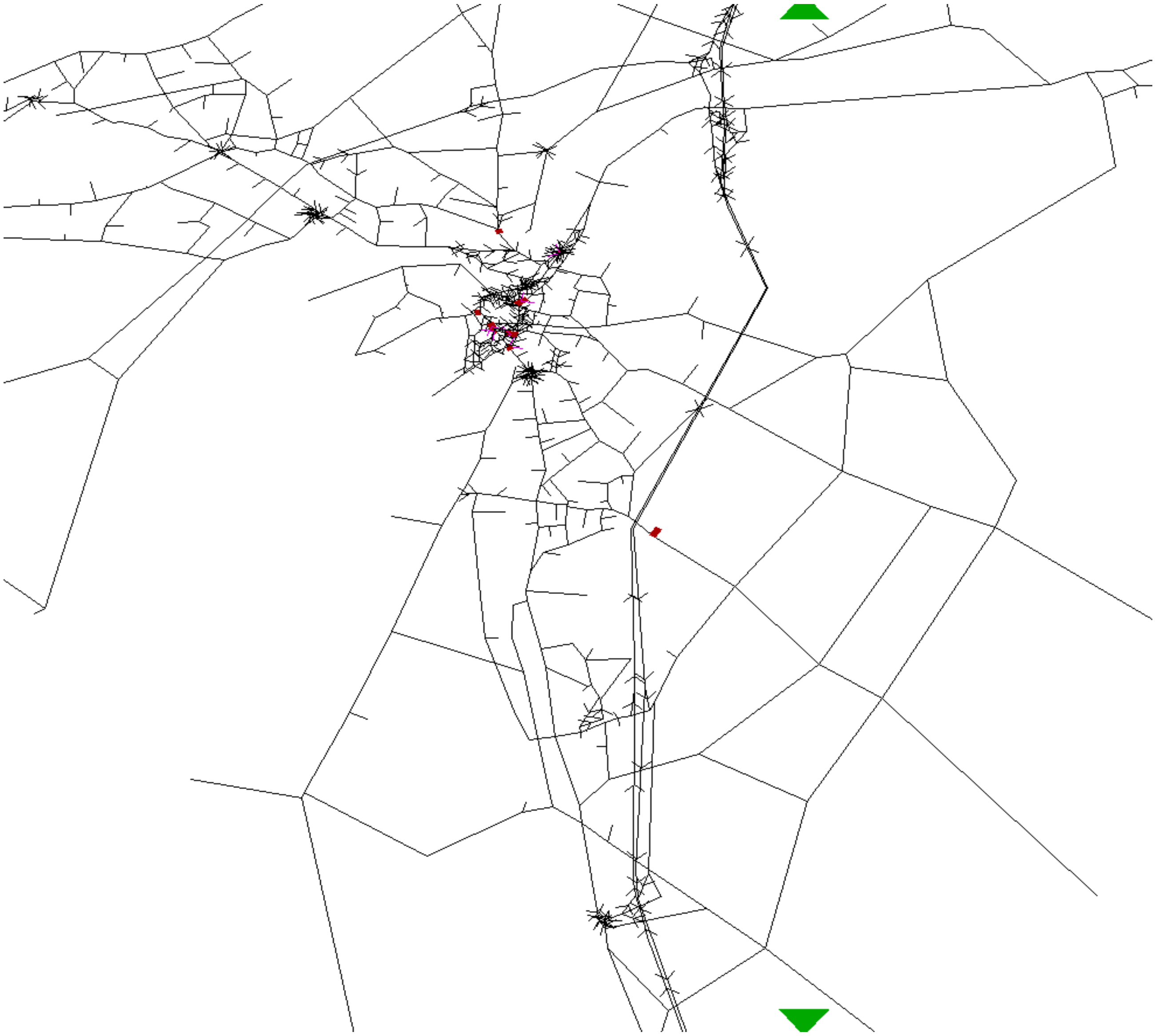


Figure 47: East 1, Volume over Capacity Ratio over 85%, 2025, PM peak

4.2.7 East 2

Figure 48, Figure 49 and Figure 50 show the traffic flow changes that occur on the transport network when the East 2 route option is implemented, in comparison with the Do Minimum scenario. These plots compare the flows with and without the East 2 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

The general pattern of change repeats during the three hours modelled. As drivers travel on the new infrastructure provided by the East 2 route option, which links J33 with Hazelrigg Lane where the Bailrigg Spine Road and the new motorway connection also link, flow decreases in the following routes:

- The A6, although flow reductions are only achieved through Galgate and Bailrigg in the SB direction; Despite this, and due to the flow decreasing on the SB direction, there is still a net reduction of flow in these sections (for more information, flow by direction is presented in Appendix A) and

- Quernmore Road and Bay Horse Road.

On the other hand, flow increases on:

- Hazelrigg Lane, which link to the new route option; M6 south of J33 as additional vehicles travel along it to use the new infrastructure;

- Ashton Road as it becomes a link between the new route and Lancaster; and

- Blea Tarn Road and Bowerham Road.

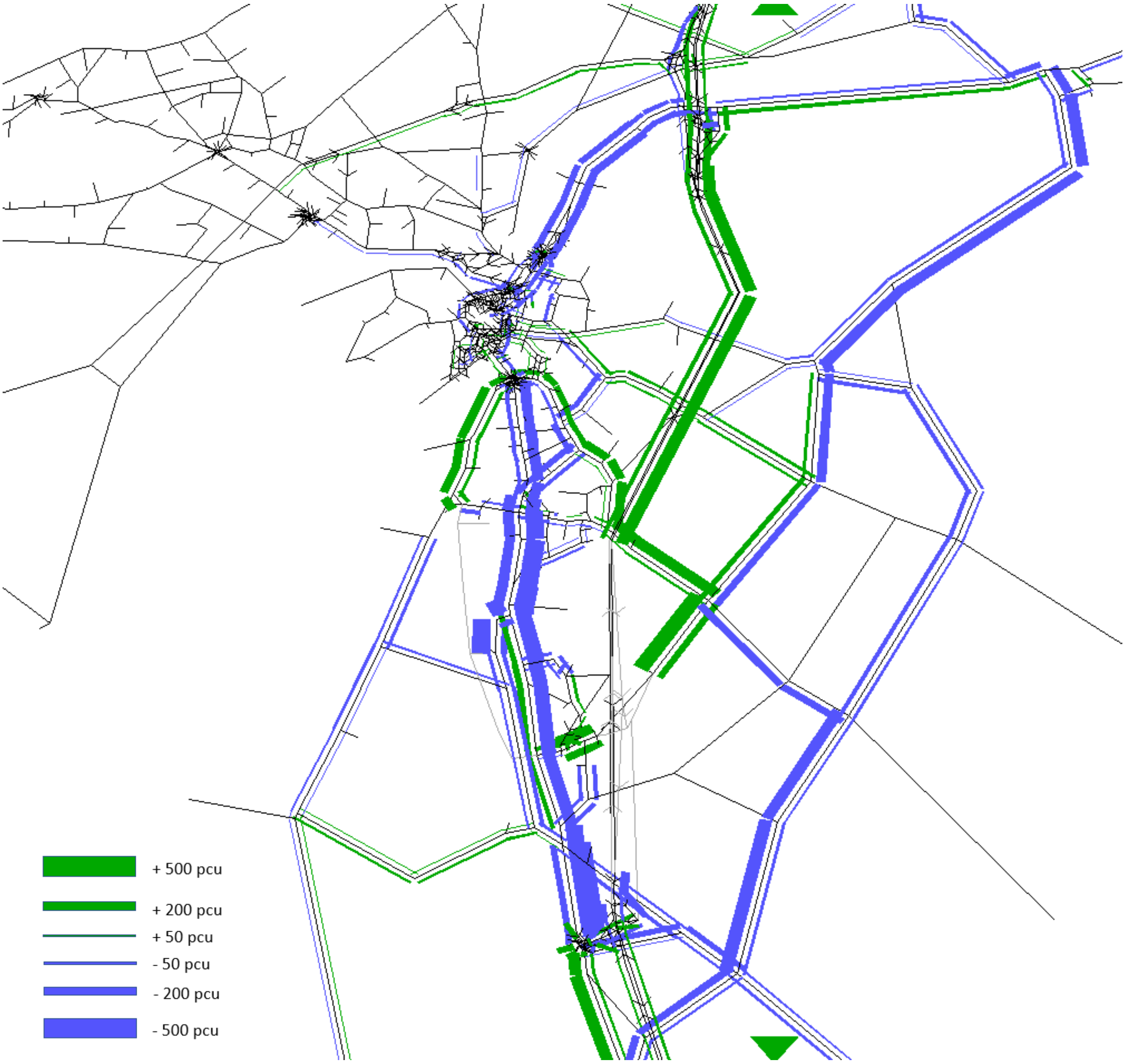


Figure 48: East 2 vs DM, Flow Comparison, 2025, AM Peak (PCU)

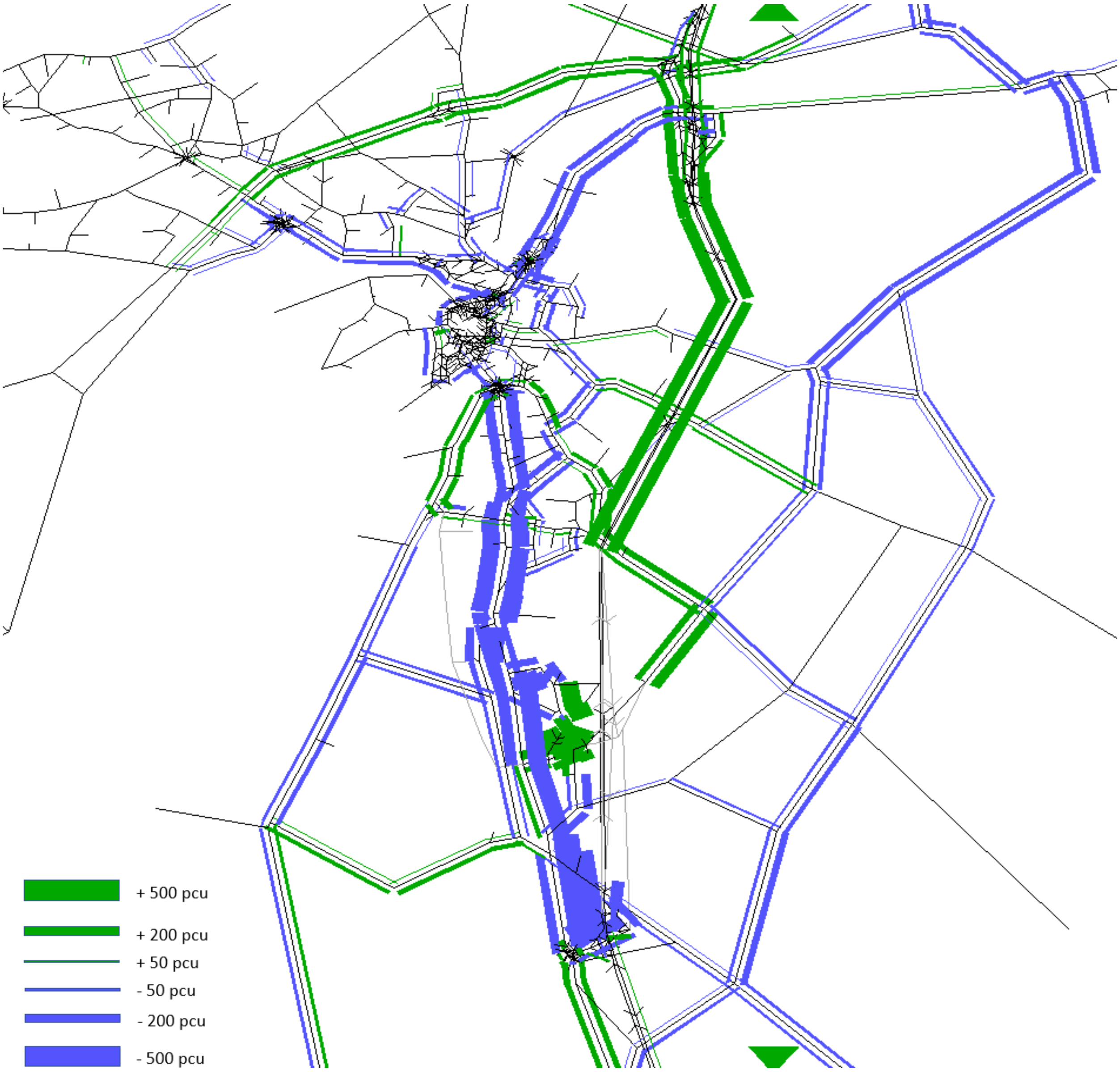


Figure 49: East 2 vs DM, Flow Comparison, 2025 Interpeak (PCU)

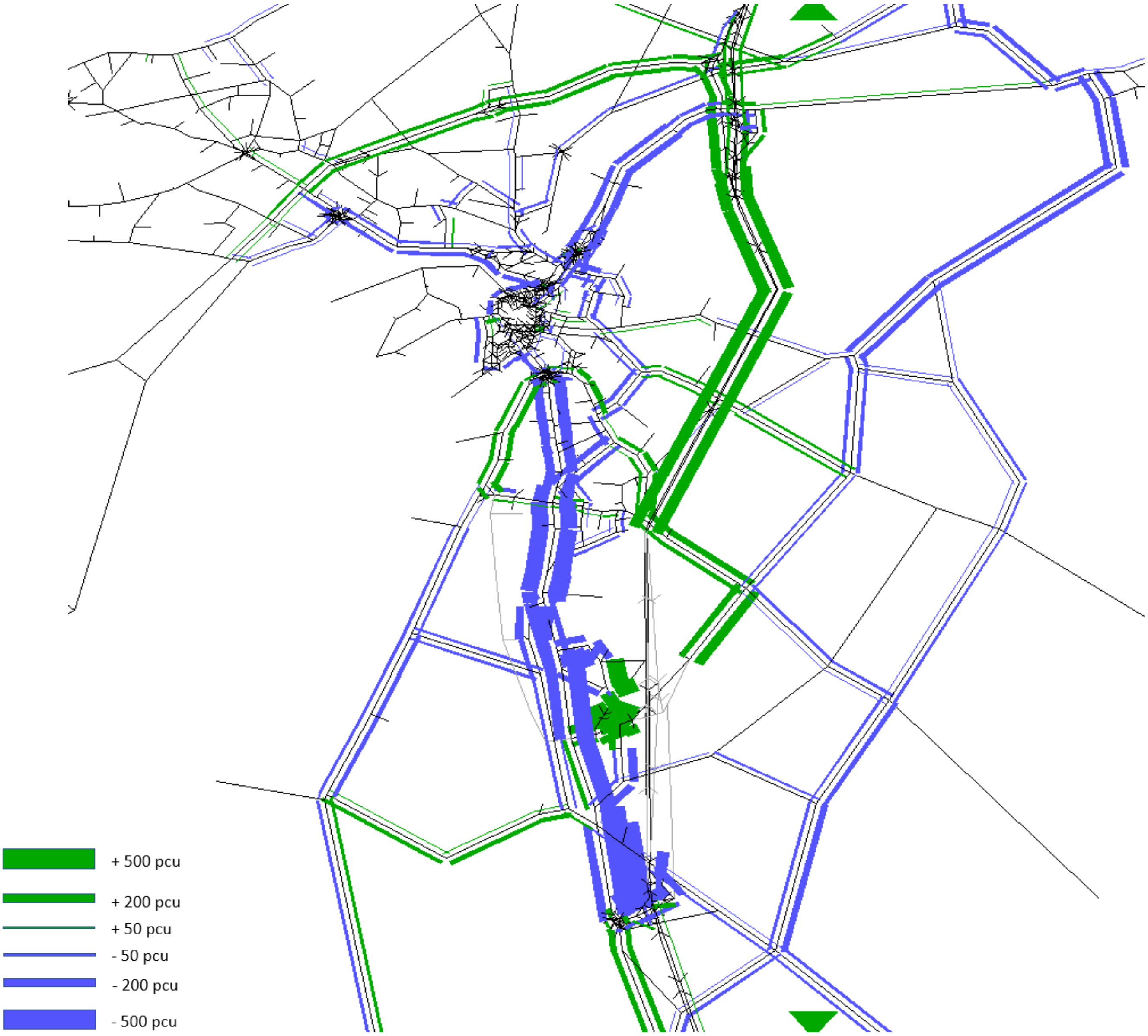


Figure 50: East 2 vs DM, Flow Comparison, 2025, PM Peak (PCU)

Table 4.7 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the East 2 route option results in reduction of flows along the A6 with the only exception of an increase on the section south of J33, which is used by vehicles travelling along the new road.

A net flow reduction along Galgate and Hazelrigg is consistent across the three periods modelled; however, these figures are the average between a flow increase in the NB direction and a flow decrease in the SB direction. The information by direction is presented Appendix A.

With respect to the links located east of the A6, flow goes up in Hazelrigg Lane and Blea Tarn Road, as vehicles travel along these routes to use the new infrastructure.

To the west of the A6, flow in Birch Avenue and Ashton Rd (both connected to the route option at either end) increase, while flows on the A588 decrease.

Table 4.7: East 2, 2025, Modelled flows (PCU)

	Road name	Between	Without scheme (2025)			With scheme East 2 (2025)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1338	1079	1220	1557	1106	1377	16%	2%	13%
2	A6	M6 J33 & Stoney Lane	1590	1321	1794	1113	865	1076	-30%	-35%	-40%
3	A6	Stoney Lane & Chapel Lane	1546	1152	1659	1274	929	1273	-18%	-19%	-23%
4	A6	Chapel Lane & Hazelrigg Lane	1379	1091	1433	1218	906	1214	-12%	-17%	-15%
5	A6	Hazelrigg Lane & Burrow Road	965	1017	1293	827	780	855	-14%	-23%	-34%
6	A6	Burrow Road & Ashford Road	1906	1585	1357	1440	1139	817	-24%	-28%	-40%
7	A6	Ashford Road & Ashton Road	1459	1416	1385	1234	1164	1049	-15%	-18%	-24%
8	M6	J33 & J34	6548	6559	6286	6800	6685	6636	4%	2%	6%
9	Stoney Lane	A6 & Bay Horse Road	214	26	77	103	27	23	-52%	3%	-70%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	250	49	134	24	8	28	-90%	-84%	-79%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	39	11	28	42	14	11	7%	25%	-61%
12	Hazelrigg Lane	A6 & Procter Moss Road	379	111	245	748	394	502	97%	255%	105%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	305	89	263	283	138	220	-7%	55%	-16%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	201	50	136	59	34	66	-71%	-31%	-51%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	277	76	128	509	279	312	84%	270%	144%
16	Bowerham Road	Barnton Road & A6	1208	814	1207	1200	823	1151	-1%	1%	-5%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	105	46	58	17	17	19	-84%	-62%	-66%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	150	76	91	150	77	92	0%	0%	1%
19	Birch Avenue	A588 & Highland Brow	91	86	79	128	106	167	41%	22%	112%
20	A588	Birch Avenue & Tarnwater Lane	416	283	410	371	278	320	-11%	-2%	-22%
21	A588	Tarnwater Lane & Ashford Road	442	299	389	383	281	329	-13%	-6%	-15%
22	Ashton Road	Ashford Road & A6	839	501	685	1021	627	820	22%	25%	20%
All values expressed in PCU's. All values are two-way link flows.											
* The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 51, Figure 52 and Figure 53 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 crossroads at Galgate, which shows that the East 2 route option has only a limited effect relieving congestion on this area.

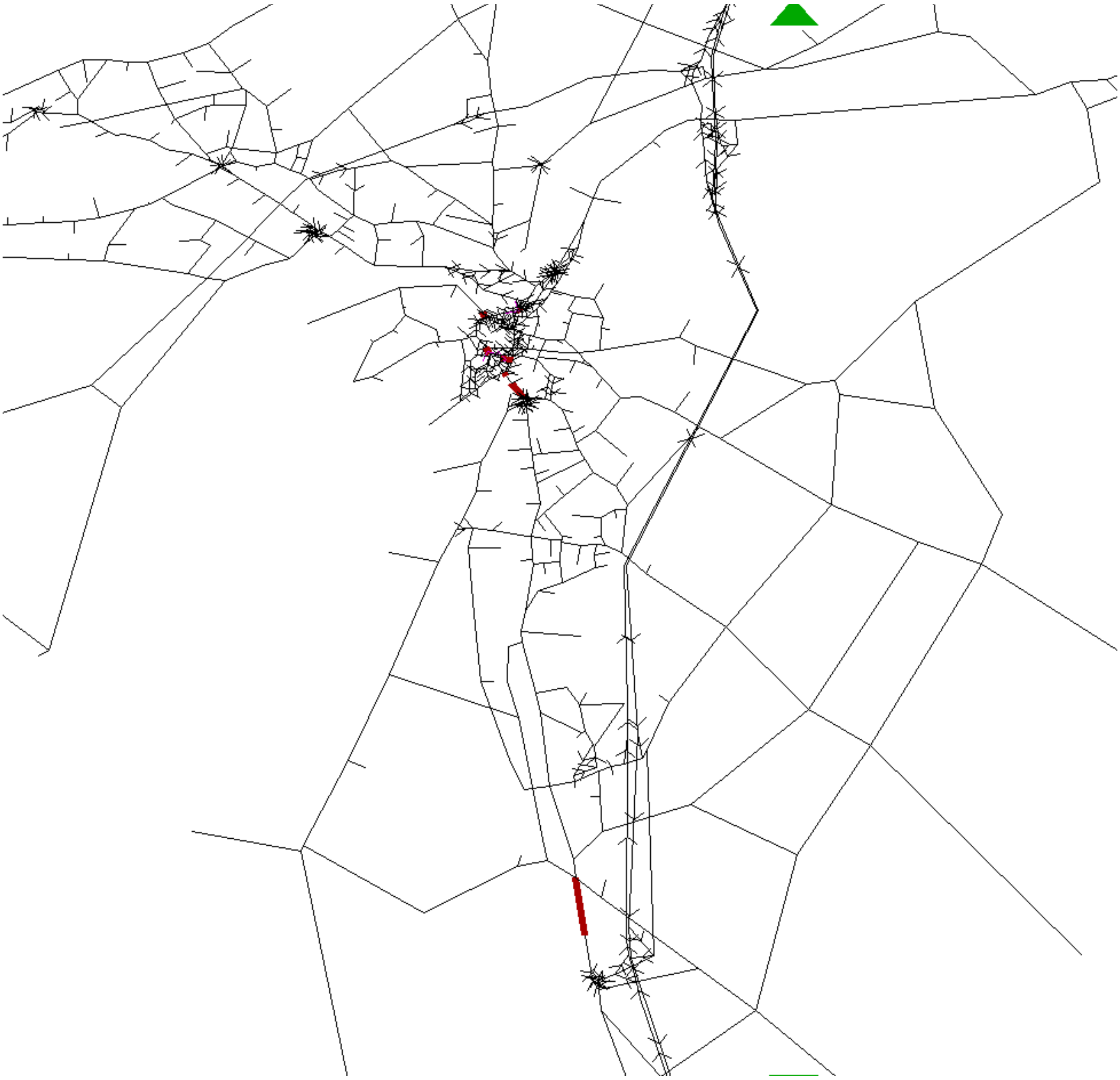


Figure 51: East 2, Volume over Capacity Ratio over 85%, 2025, AM peak

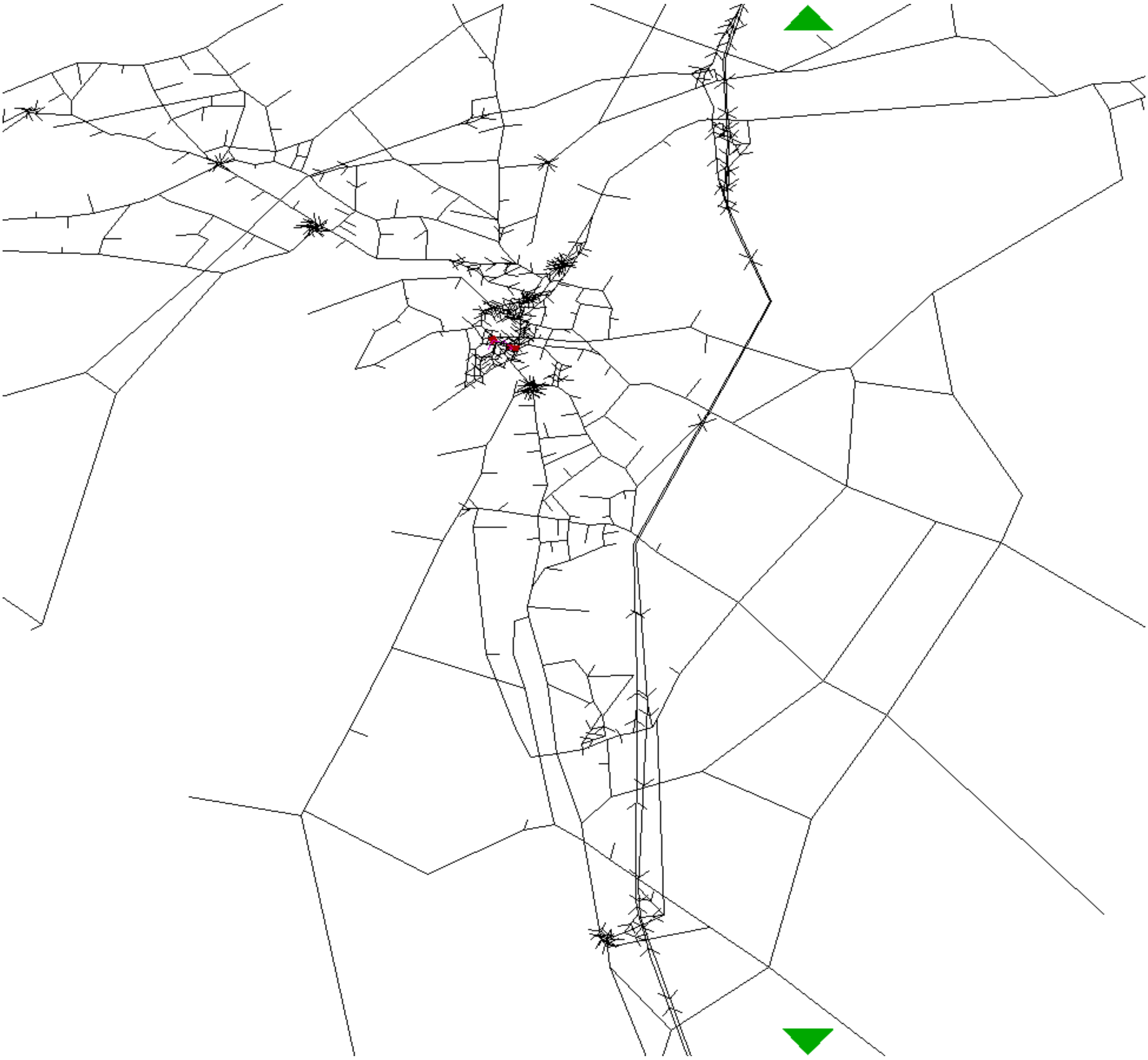


Figure 52: East 2, Volume over Capacity Ratio over 85%, 2025, Interpeak

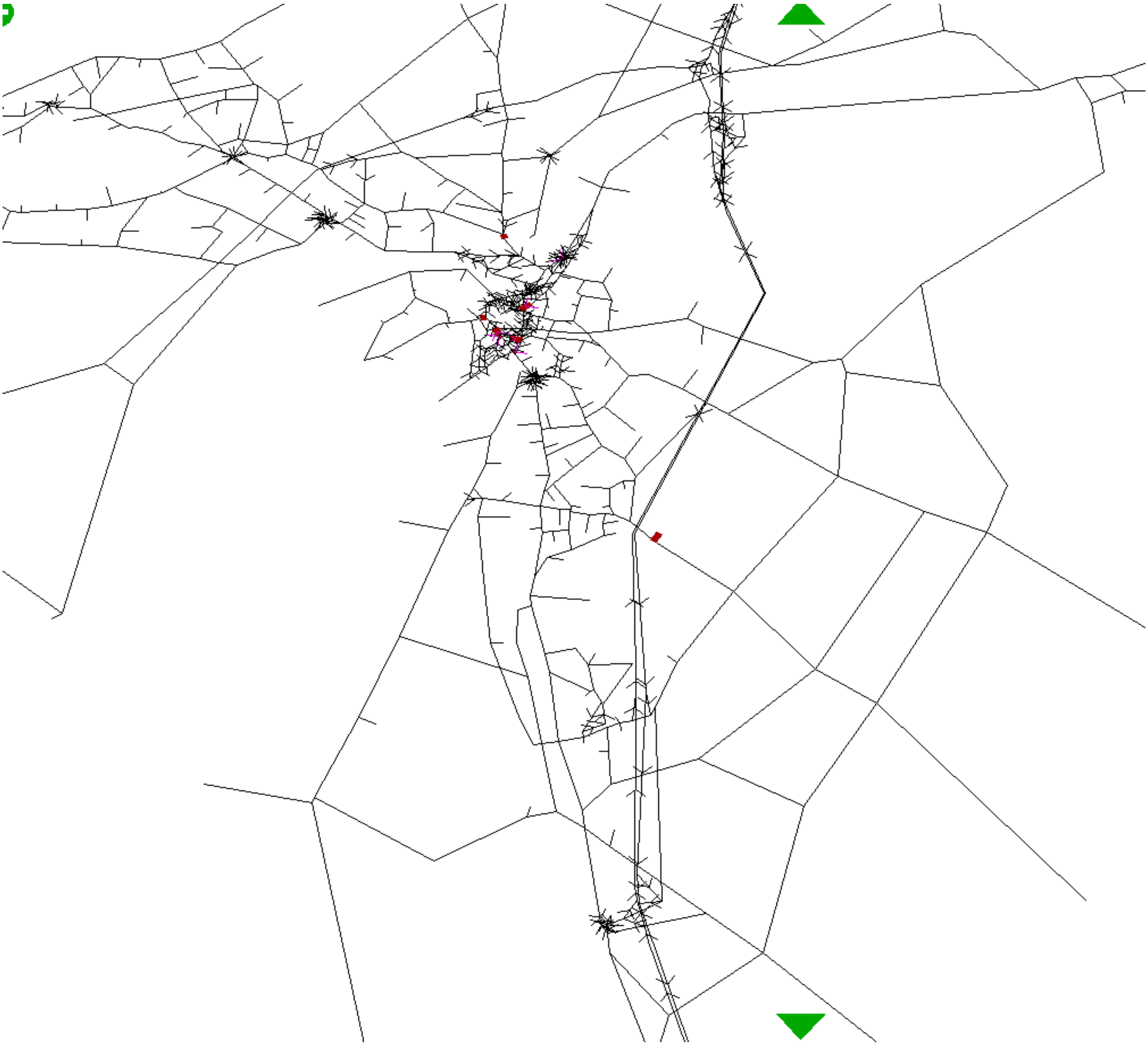


Figure 53: East 2, Volume over Capacity Ratio over 85%, 2025, PM peak

4.3 Forecast flow changes with Route Options – Year 2040

4.3.1 Do Minimum

Figure 54, Figure 55 and Figure 56 show the traffic flows on the transport network without any of the route options but including all the development demand, for AM, IP and the PM peak. Table 4.8 shows the forecast flow in all the key links. This scenario is the starting point to assess the potential of each of the route options to reduce flow and congestion in the A6 through Galgate.

In the DM scenario, flows of over 7000 pcu are experienced in the M6, while the A6 carries flows between 1000 and 1700 pcu in different sections. It is observed that flow in the A6 is at times lower than that observed in 2025, and this is due to congestion in the Galgate and Bailrigg junctions.

Table 4.8 shows that Hazelrigg Lane experiences flows of 859 pcu in the AM and 685 in the PM, more than doubling the flow throughput experienced in 2025.

Links where a volume over capacity ratio exceeds 85%, indicating congested traffic conditions, are presented in Figure 57, Figure 58 and Figure 59, and include the following locations:

- A6 Lancaster Preston Road and Stoney Lane junction;
- A6 and Burrow Lane junction and nearby sections; and
- A558 leading at its junction with Ashford Road.

Figure 54: Do Minimum, Modelled flow, 2040, AM Peak (PCU)

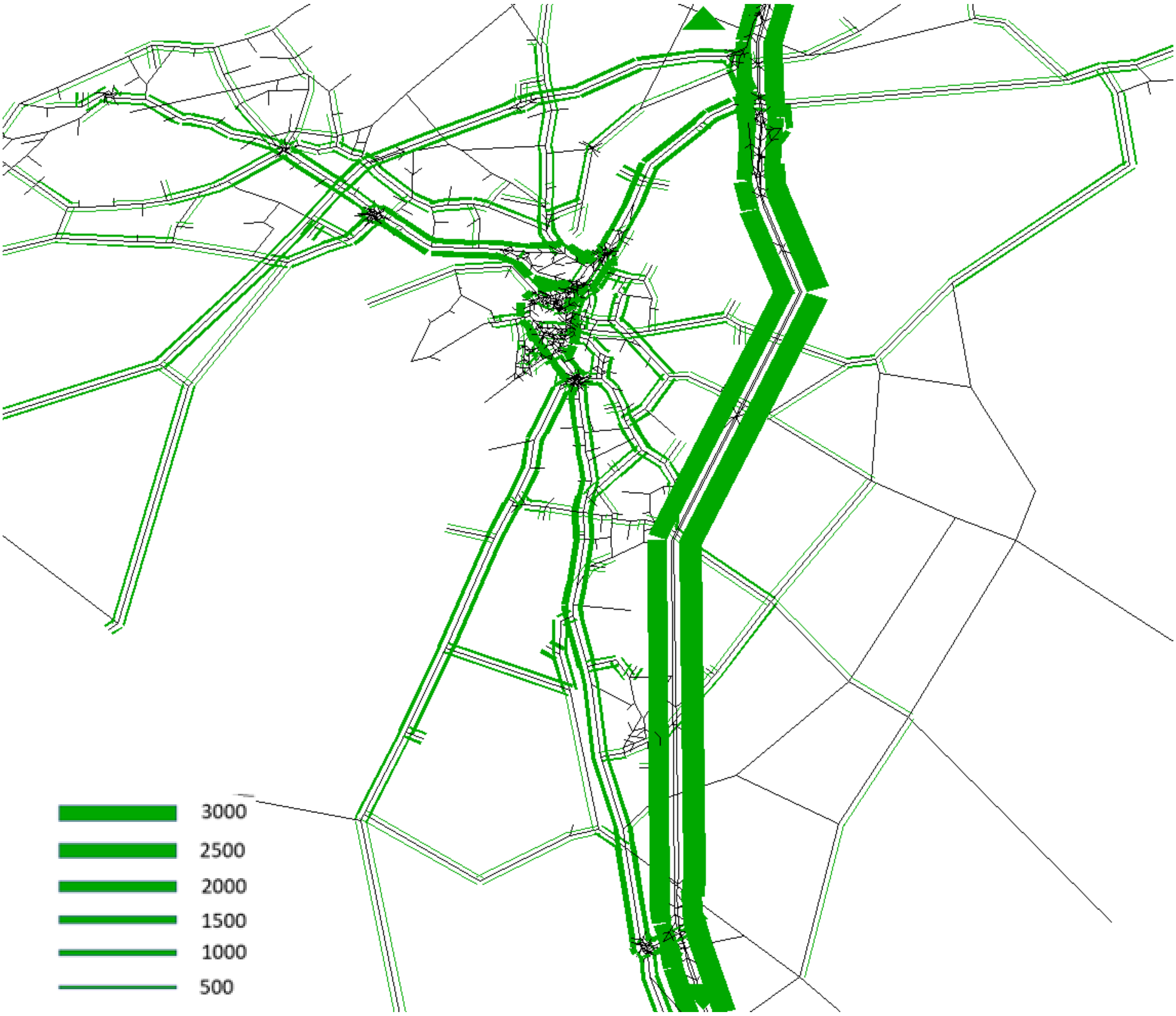


Figure 55: Do Minimum, Modelled flow, 2040, Interpeak (PCU)

Figure 56: Do Minimum, Modelled flow, 2040, PM Peak (PCU)

Table 4.8: Do Minimum, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)		
			AM	IP	PM
1	A6	South of M6 J33	1167	1084	976
2	A6	M6 J33 & Stoney Lane	1666	1707	1678
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137
6	A6	Burrow Road & Ashford Road	1710	1658	1275
7	A6	Ashford Road & Ashton Road	1164	1269	1225
8	M6	J33 & J34	7321	7578	7360
9	Stoney Lane	A6 & Bay Horse Road	271	24	226
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522
16	Bowerham Road	Barnton Road & A6	1557	1229	1613
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95
19	Birch Avenue	A588 & Highland Brow	305	251	336
20	A588	Birch Avenue & Tarnwater Lane	562	480	565
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499
22	Ashton Road	Ashford Road & A6	1576	1357	1448

All values expressed in PCU's. All values are two-way link flows.

* The percentage change is less than 1% and is reported as 0%, as the nearest whole number.

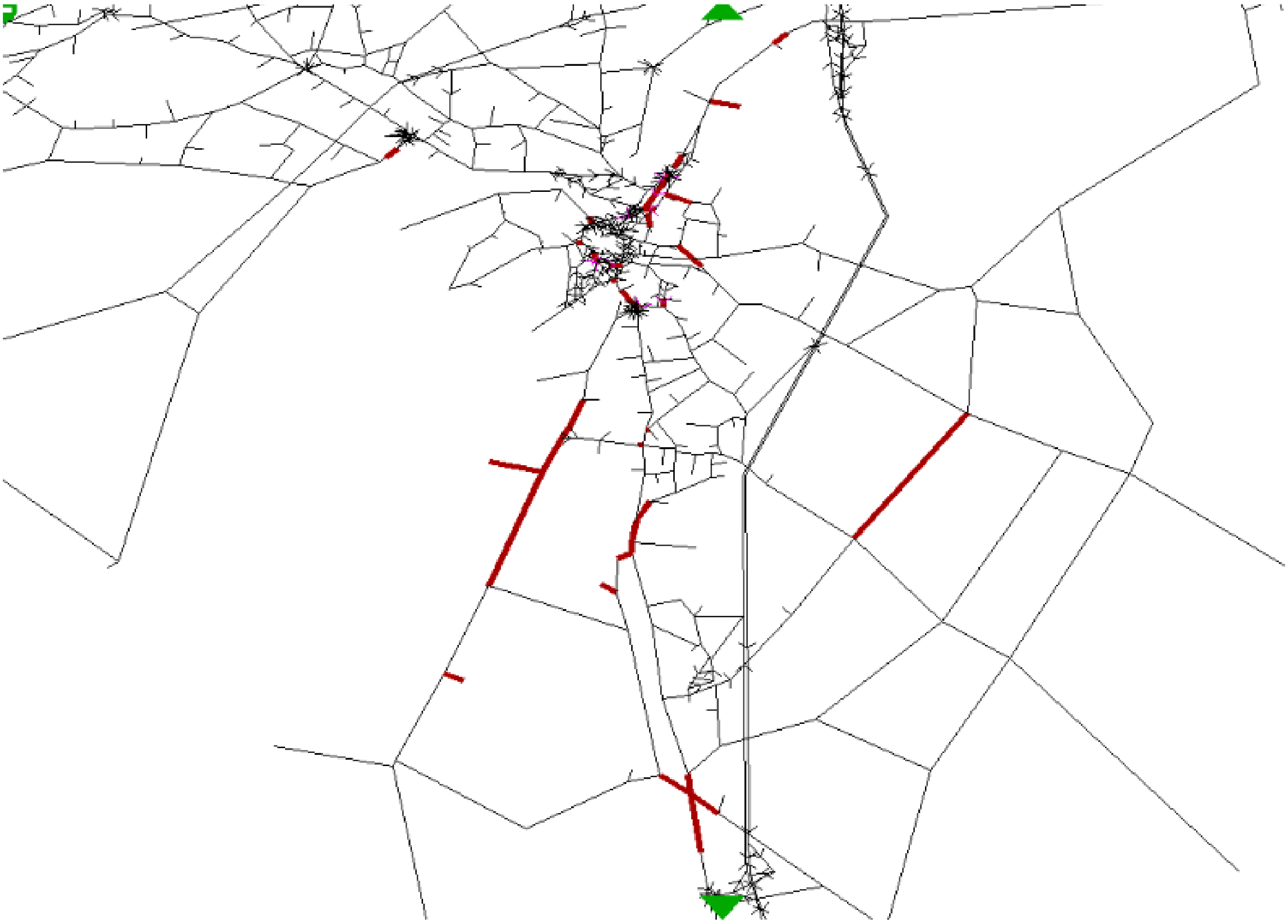


Figure 57: Do Minimum, Volume Over Capacity Ratio (over 85%), 2040, AM Peak

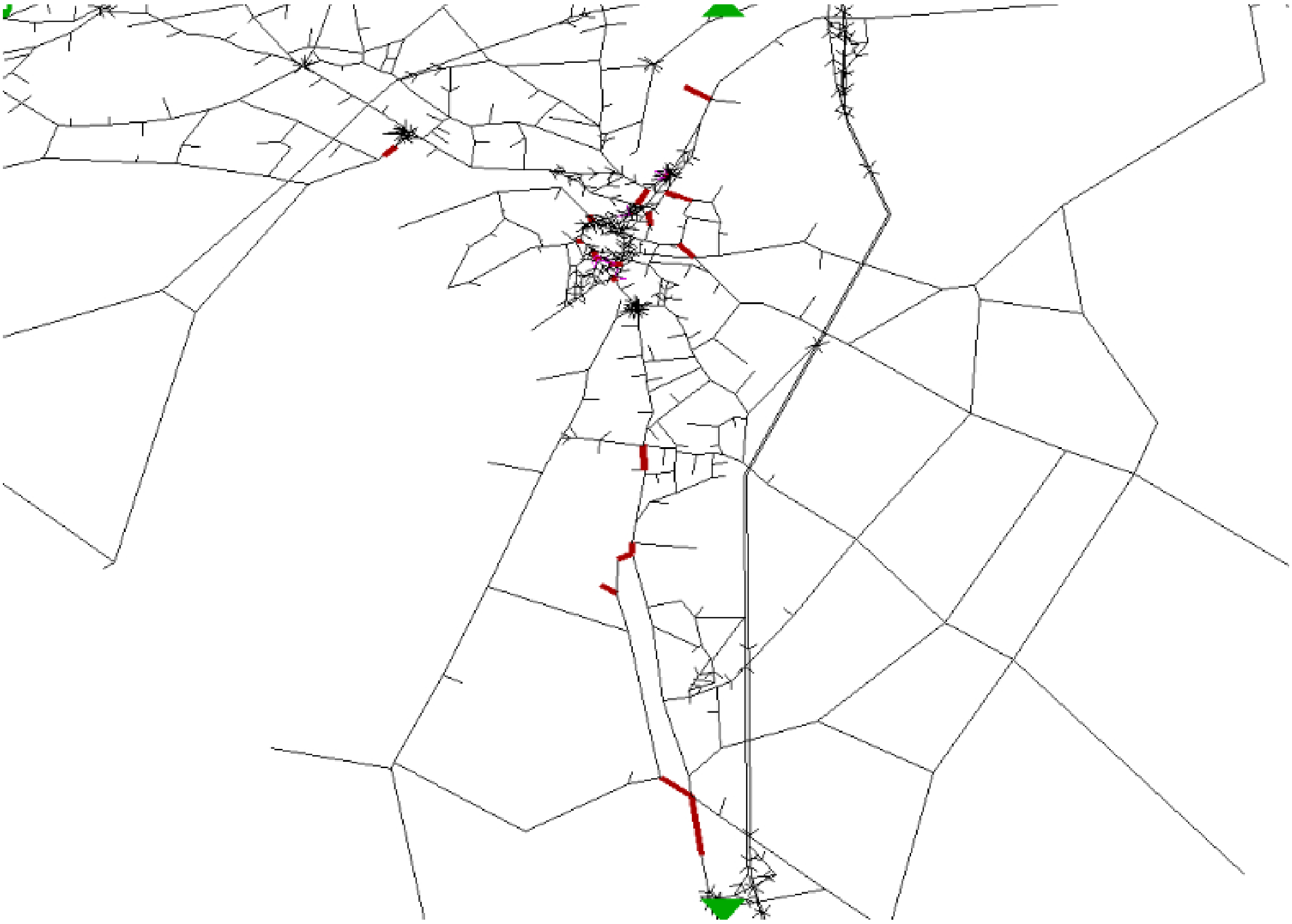


Figure 58: Do Minimum, Volume Over Capacity Ratio (over 85%), 2040, Interpeak

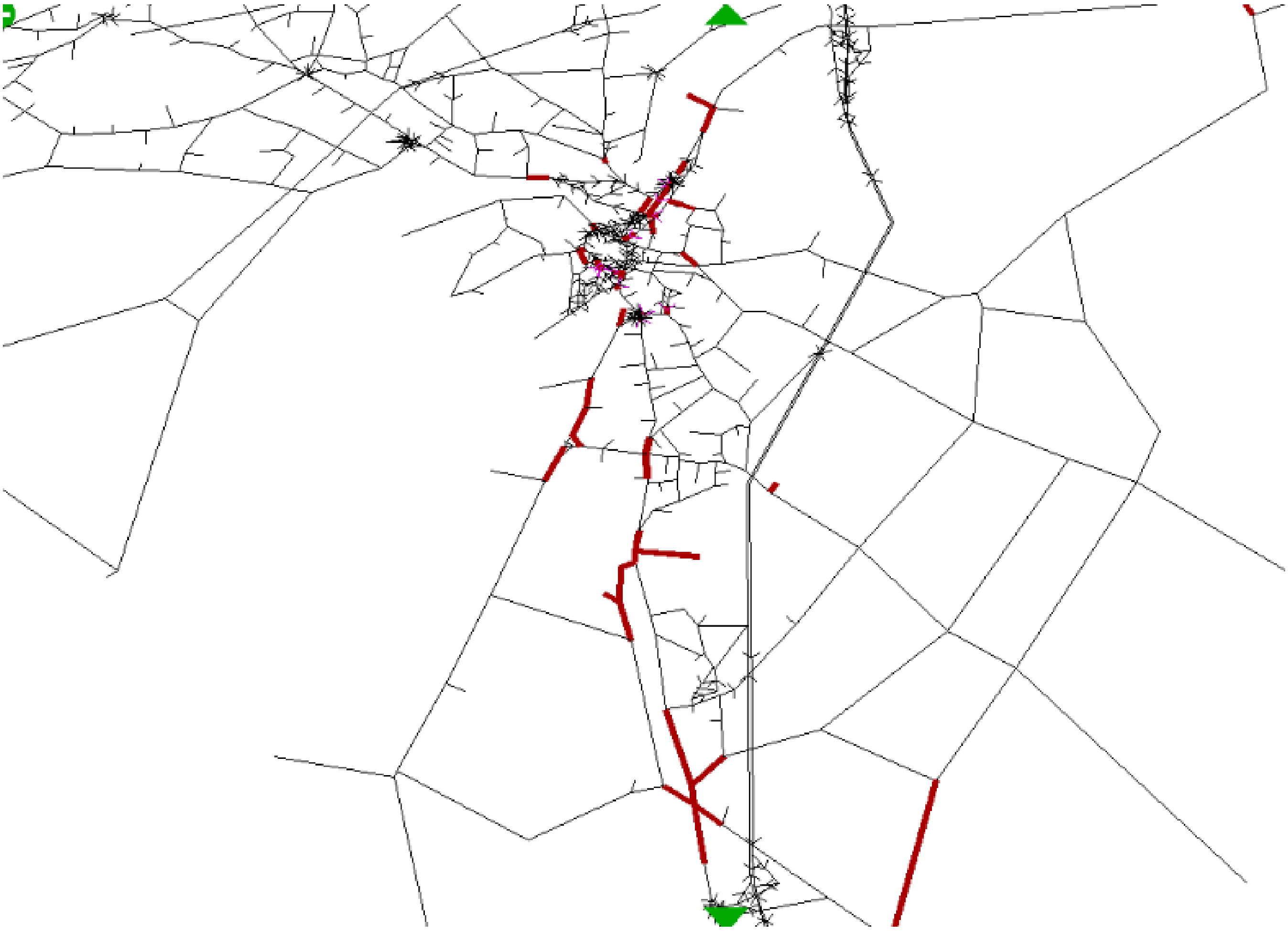


Figure 59: Do Minimum, Volume Over Capacity Ratio (over 85%), 2040, PM Peak

4.3.2 Central 1

Figure 60, Figure 61 and Figure 62 show the traffic flow changes that occur on the transport network when Central 1 route option is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the Central 1 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

The same flow change pattern repeats during the three hours modelled, although the magnitude of change is larger in the evening peak. As drivers use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate, although it should be noted that most of the flow reduction is experienced in the off- peak direction (SB in the AM and NB in the PM) while flows in the peak direction remain very similar to those observed in the DM. For more information, directional flow is presented in Appendix A;
- There is a pattern on flow increases in the northern sections of the A6 sections as development traffic travels along these links on their way to and from Lancaster. This includes the Bailrigg section during the PM peak;
- Flow increases in Hazelrigg Lane, which connects to the new infrastructure; and
- Flow on the A588 and Ashton Road declines as vehicles favour the new scheme and the motorway.

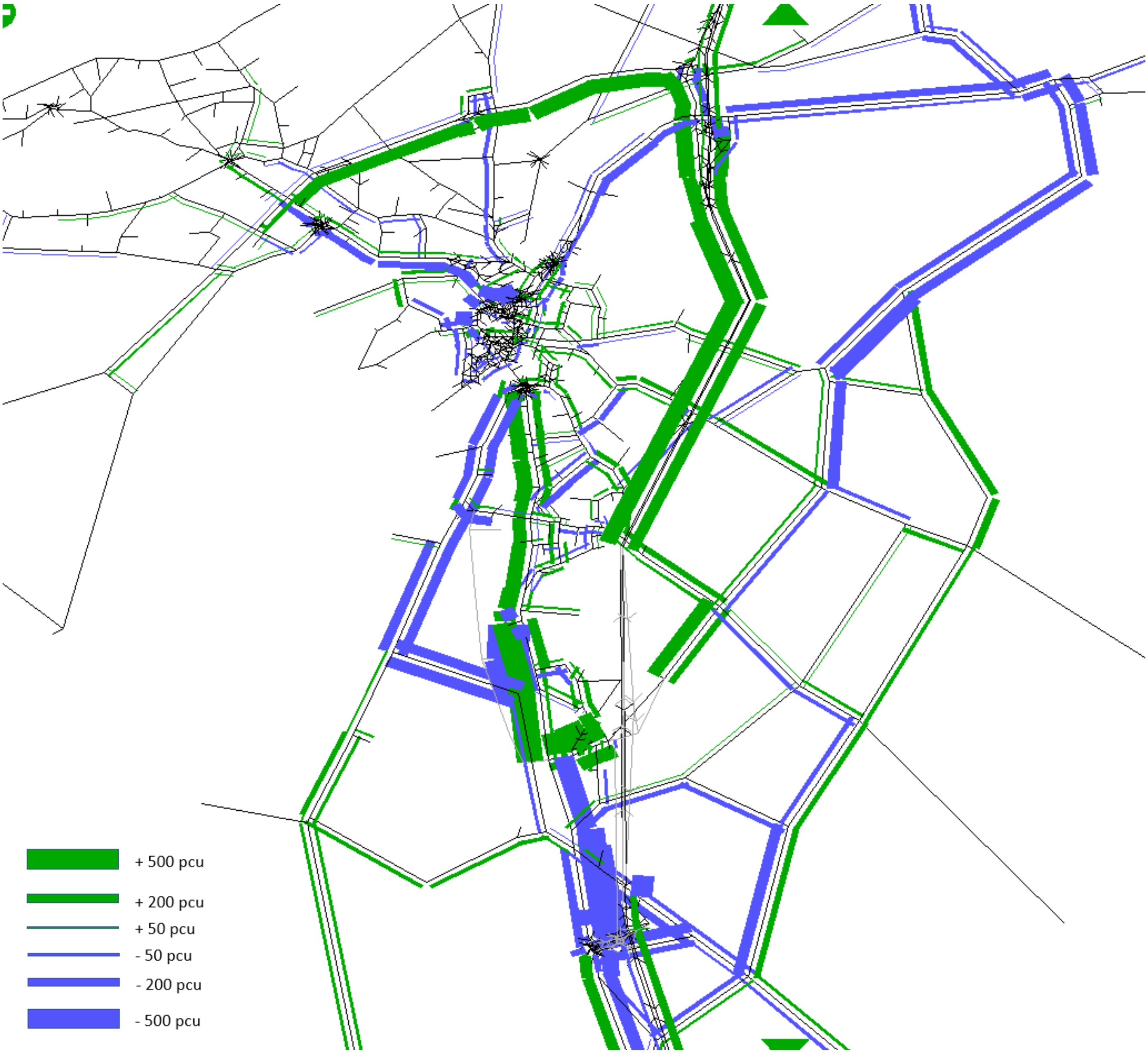


Figure 60: Central 1 vs DM, Flow Comparison, 2040, AM Peak (PCU)

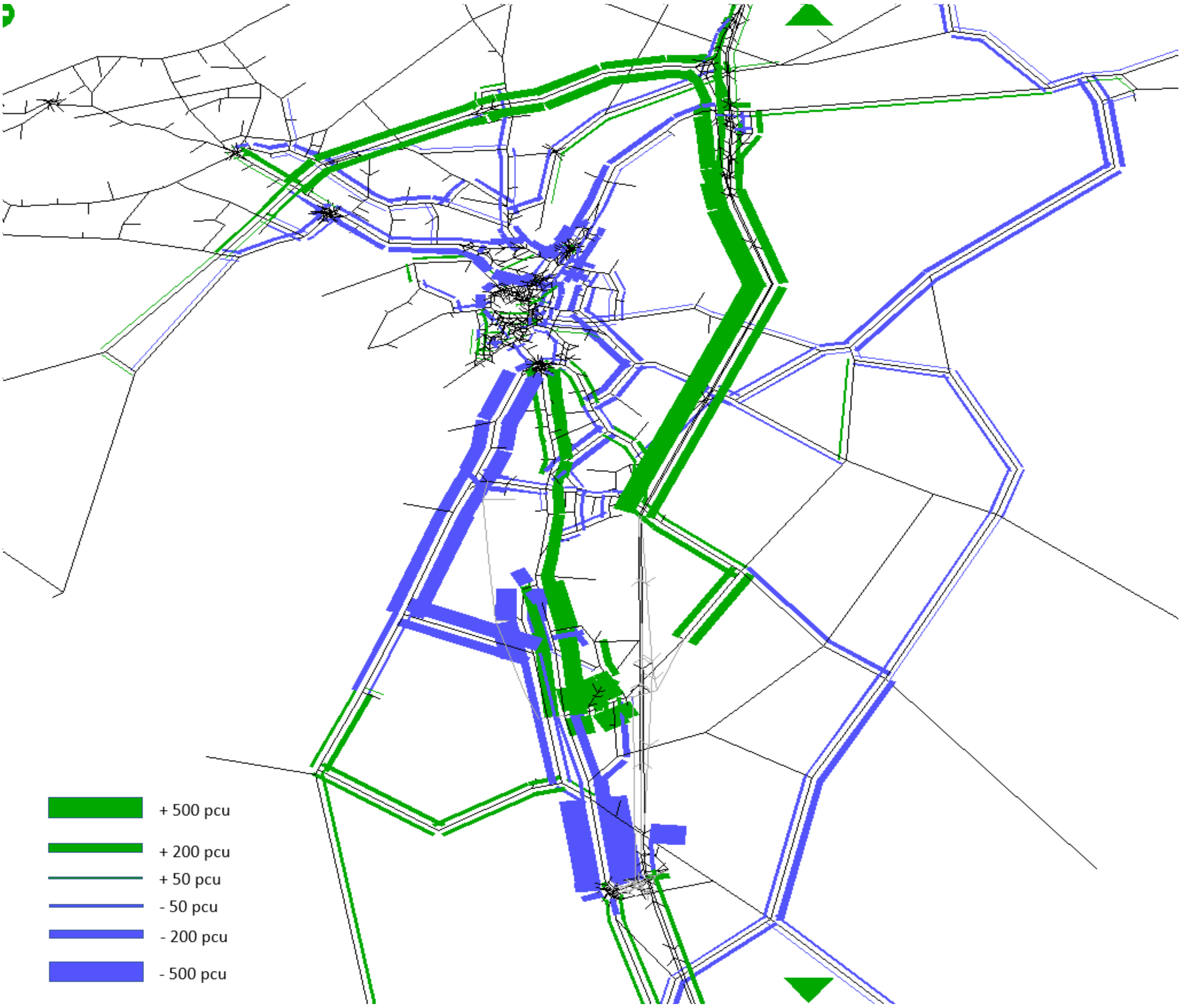


Figure 61: Central 1 vs DM, Flow Comparison, 2040, Interpeak (PCU)

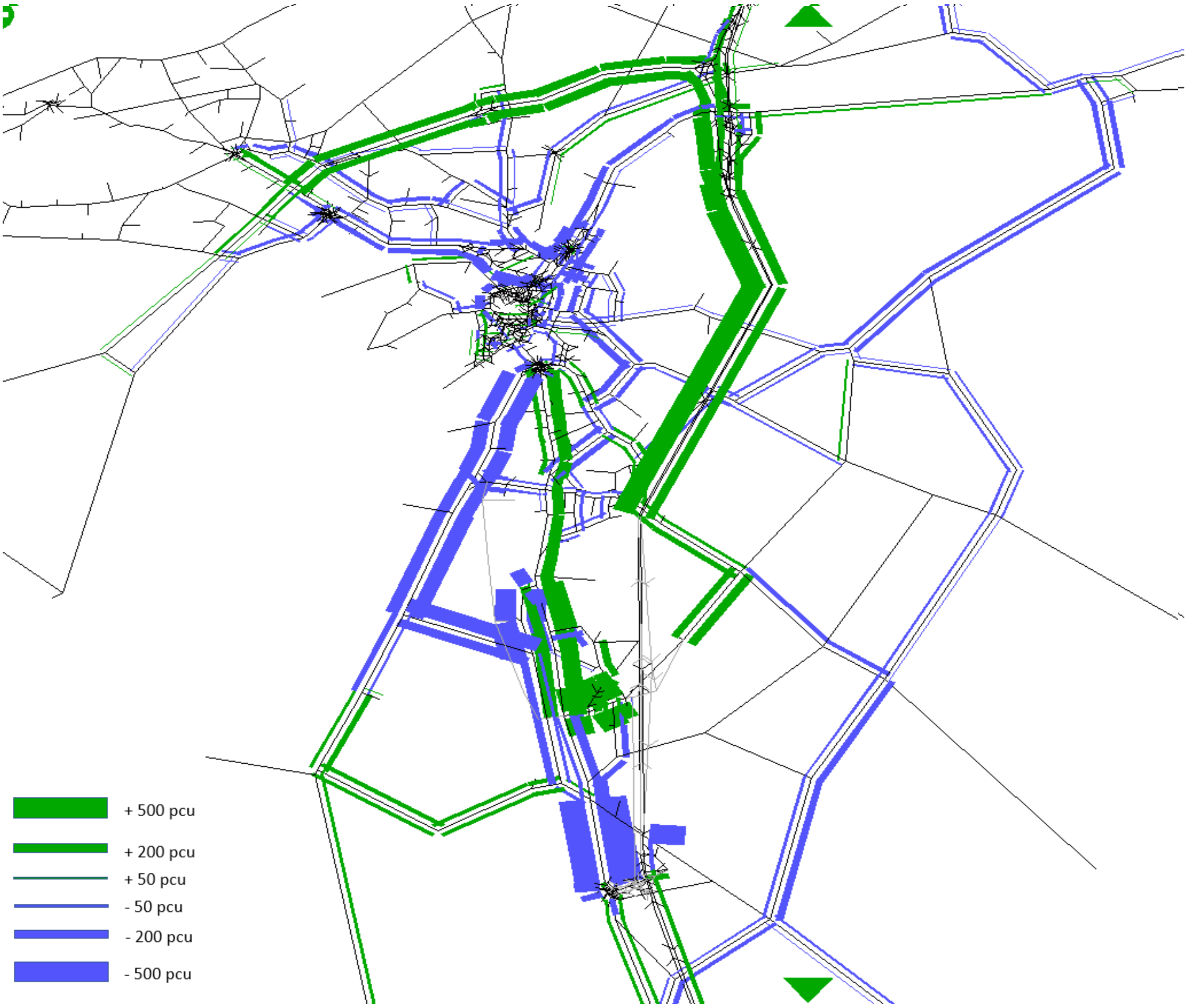


Figure 62: Central 1 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.9 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows, it becomes clear that the implementation of the Central 1 route option results in reduction of flows along the south sections of the A6.

A net flow reduction along Galgate is consistent across the three periods modelled; however, these figures are the average between a flow decrease in the off - peak direction, while flows in the peak direction are only 1% lower than in the DM scenario. A version of Table 4.9 by direction can be found Appendix A.

With respect to the links located east of the A6, flow goes up in Hazelrigg Lane and Blea Tarn Road, as vehicles travel along these routes to use the new infrastructure.

To the west of the A6, flow goes up in Birch Avenue and the south sections of the A588 while decreasing on the north part of the A588 and Ashton Road, as vehicles favour the new route option.

Table 4.9: Central 1, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme Central 1 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1088	1162	1199	-7%	7%	23%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	995	801	960	-40%	-53%	-43%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1068	991	1043	-30%	-22%	-17%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	949	975	1300	-26%	-14%	21%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1465	1484	1184	47%	49%	4%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1923	1830	1613	12%	10%	27%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1518	1538	1498	30%	21%	22%
8	M6	J33 & J34	7321	7578	7360	7788	8068	8011	6%	6%	9%
9	Stoney Lane	A6 & Bay Horse Road	271	24	226	63	22	15	-77%	-9%	-94%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	527	46	125	2%	-74%	-73%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122	203	21	205	-26%	39%	68%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	1198	750	811	39%	52%	18%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	510	256	344	-6%	2%	-39%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	438	76	265	-12%	-54%	-33%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	999	556	719	18%	34%	38%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1519	1167	1498	-2%	-5%	-7%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	209	27	70	34%	-64%	-51%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	162	72	84	-28%	3%	-12%
19	Birch Avenue	A588 & Highland Brow	305	251	336	366	395	471	20%	57%	40%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	690	609	759	23%	27%	34%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1164	798	1152	-21%	-35%	-23%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1269	874	1174	-19%	-36%	-19%
All values expressed in PCU's. All values are two-way link flows. * The percentage change is less than 1% and is reported as 0%, as the nearest whole number.											

Figure 63, Figure 64 and Figure 65 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 at Galgate, although this is only present in the south and west approaches to the A6 Lancaster Road and Stoney Lane. Congestion is equally present in the north sections of the A6. With respect to the new infrastructure, the trend identified in 2025 is exacerbated, with congestion extending from the Hazelrigg junction with the new road. According to the route option drawing, this junction has been coded as a simple roundabout junction. We recommend that the capacity of this junction be considered further as design progresses.

The new infrastructure is also operating at higher volume over capacity ratios during the PM peak, along with some sections of Hazelrigg Lane. Although this route option appears to be the one that achieves a higher overall reduction of flows in Galgate, consideration should be given to the design and capacity of junctions going forward.

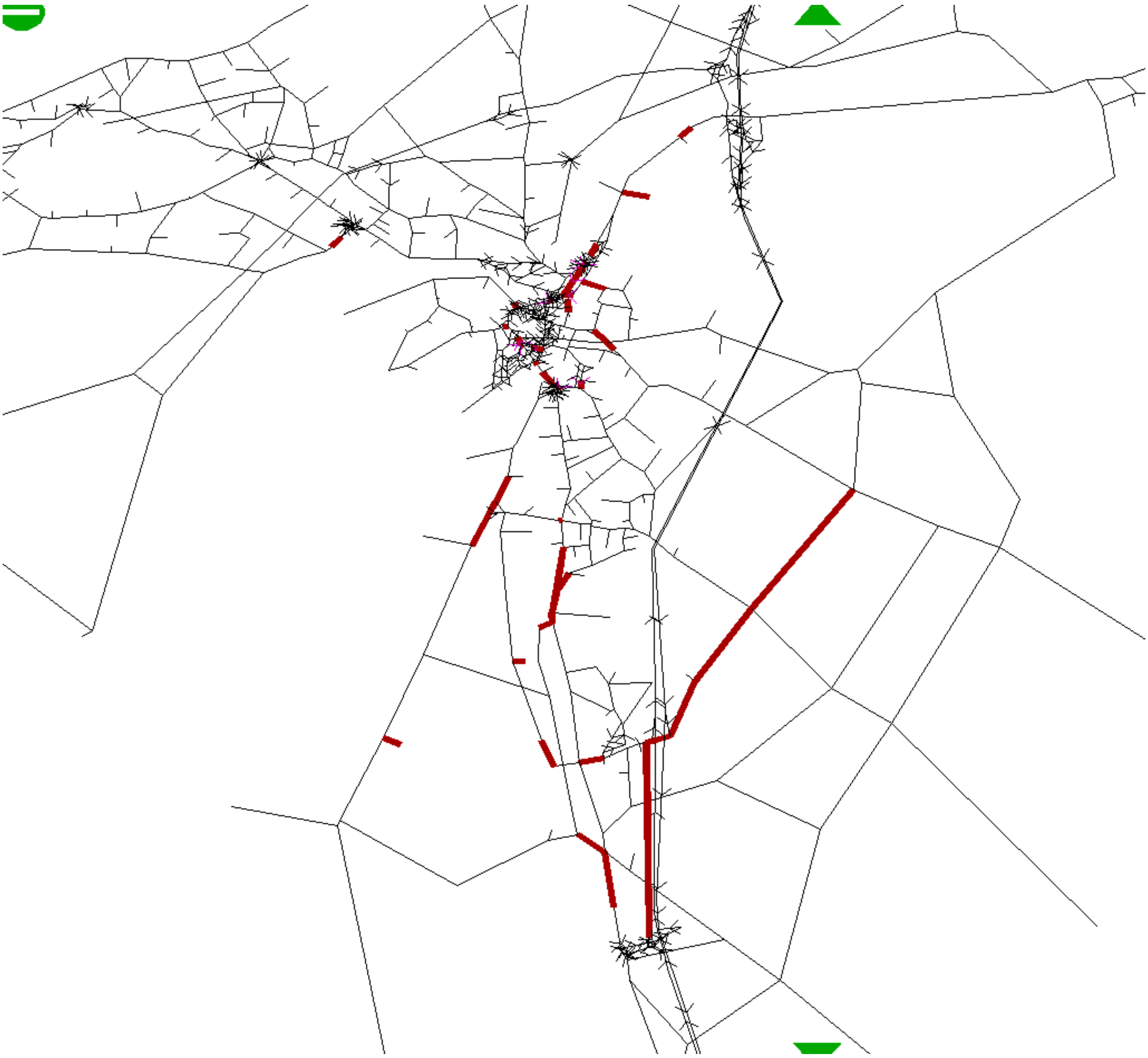


Figure 63: Central 1, Volume over Capacity Ratio over 85%, 2040, AM peak

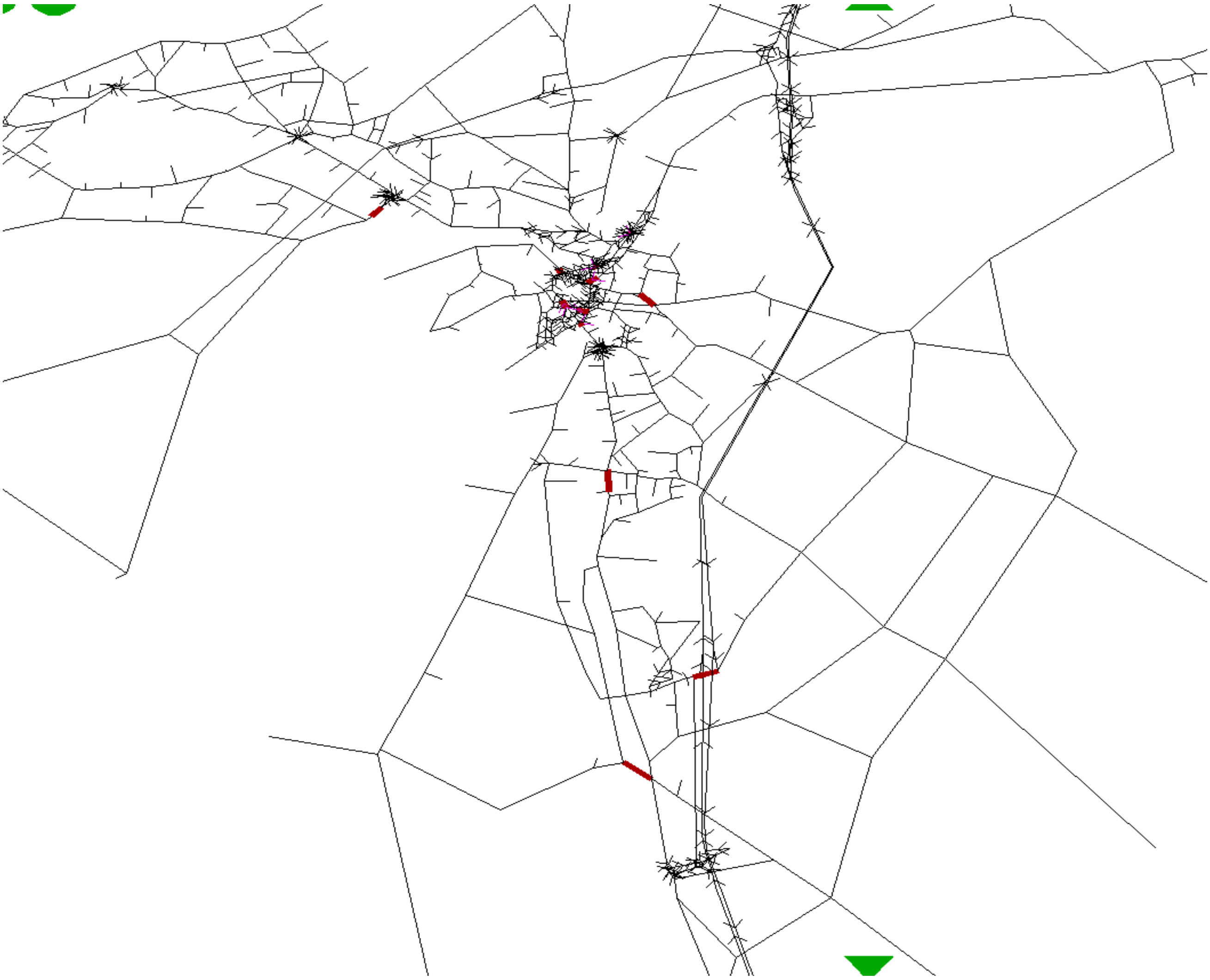


Figure 64: Central 1, Volume over Capacity Ratio over 85%, 2040, Interpeak

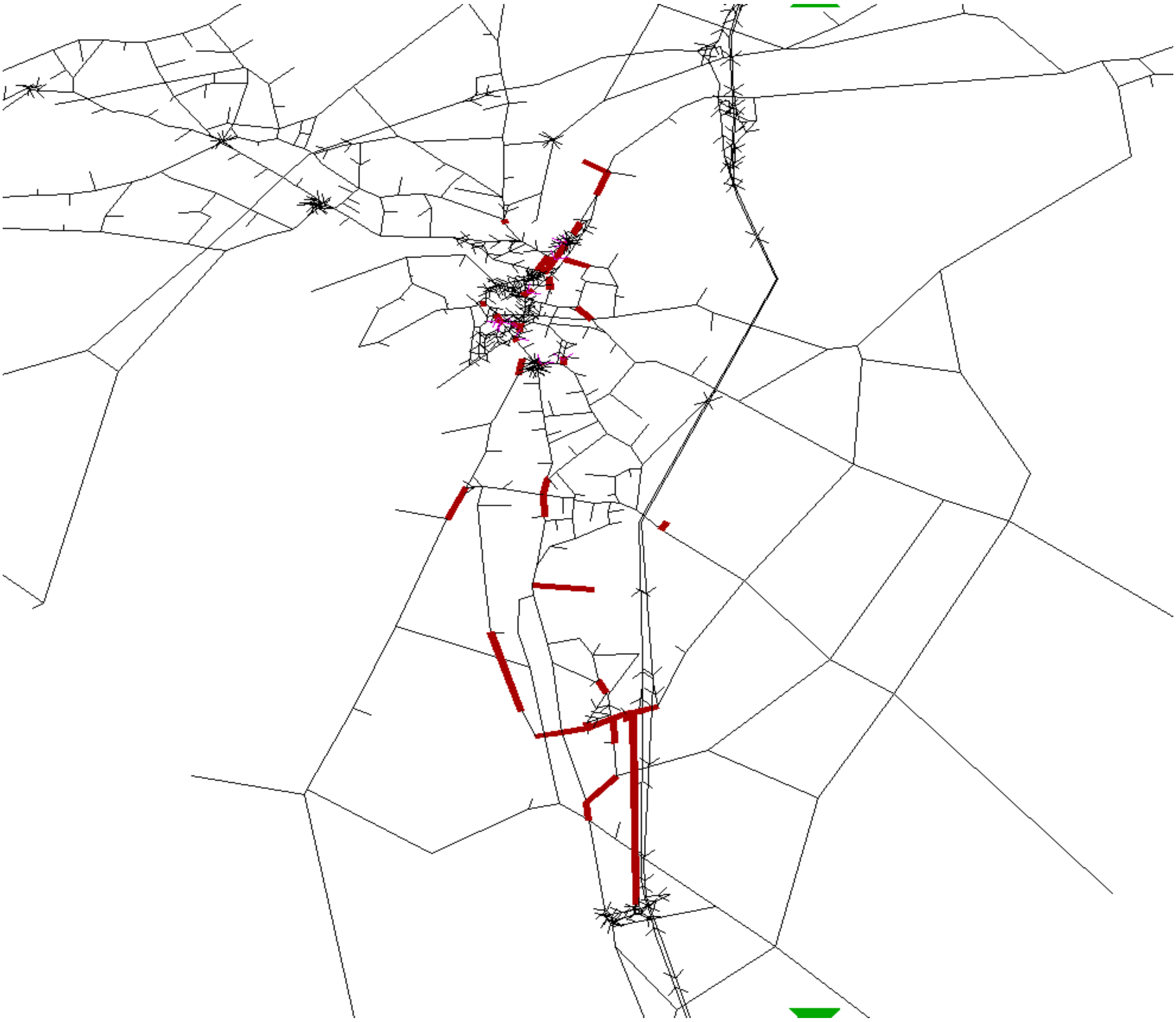


Figure 65: Central 1, Volume over Capacity Ratio over 85%, 2040, PM peak

4.3.3 Central 2

Figure 66, Figure 67 and Figure 68 show the traffic flow changes that occur on the transport network when Central 2 scheme is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the Central 2 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

As vehicles use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate during the AM peak, although this is due to a larger reduction on the off peak direction (SB) while flows on the peak direction (NB) only decline by 1% in comparison with the DM. During the Interpeak, flows decline in both directions;
- Flows increase on the A6 section through Galgate during the PM peak, in both directions;
- There is a pattern on flow increases in the northern sections of the A6 sections as development traffic travels along these links on their way to and from Lancaster. This includes the Bailrigg section during the PM peak;
- Flow increases in Hazelrigg Lane, which connects to the new infrastructure.
- Flow on the A588 and Ashton Road declines as vehicles use the new A588 link to access the new route option and the motorway.

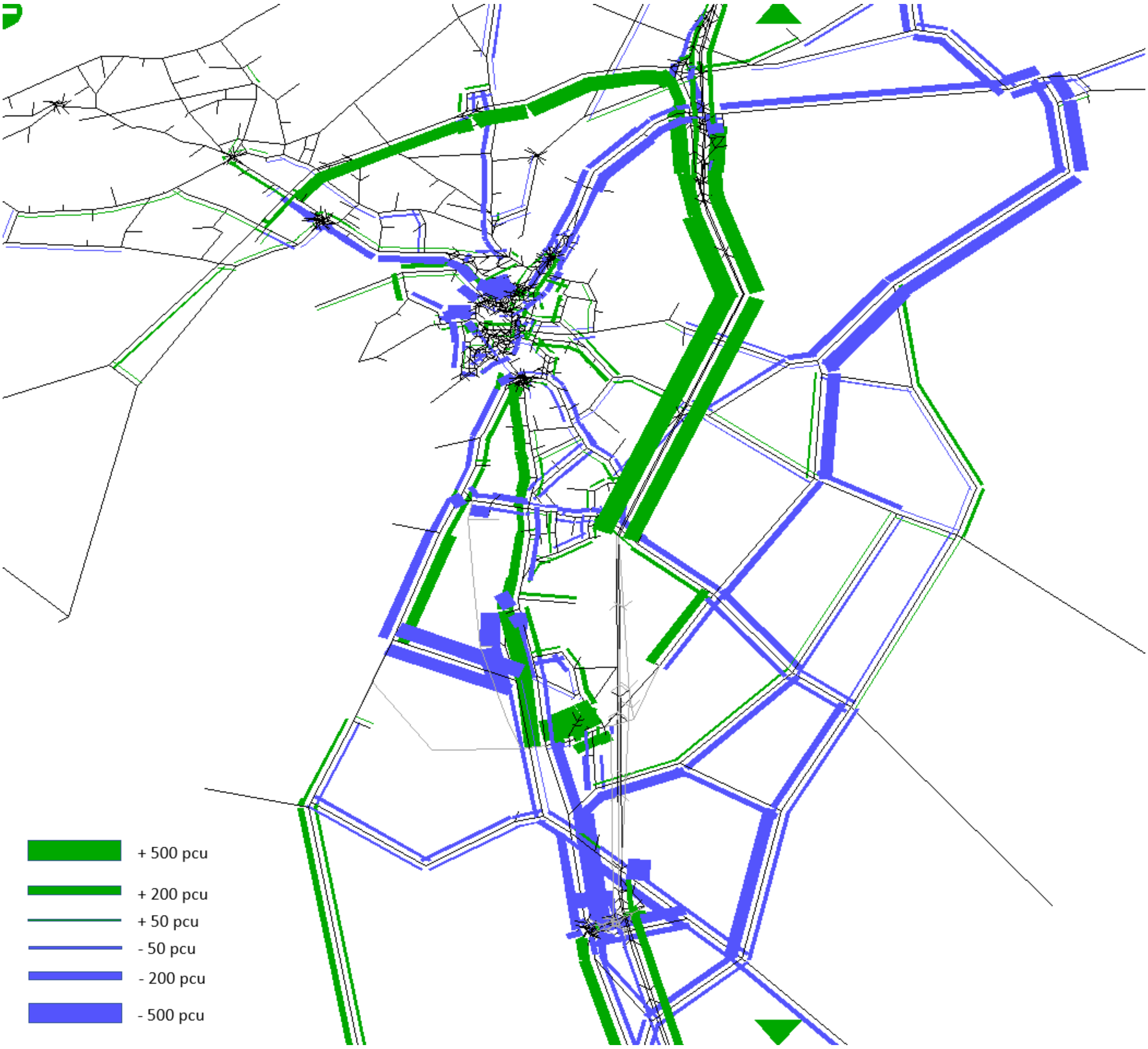


Figure 66: Central 2 vs DM, Flow Comparison, 2040, AM Peak (PCU)

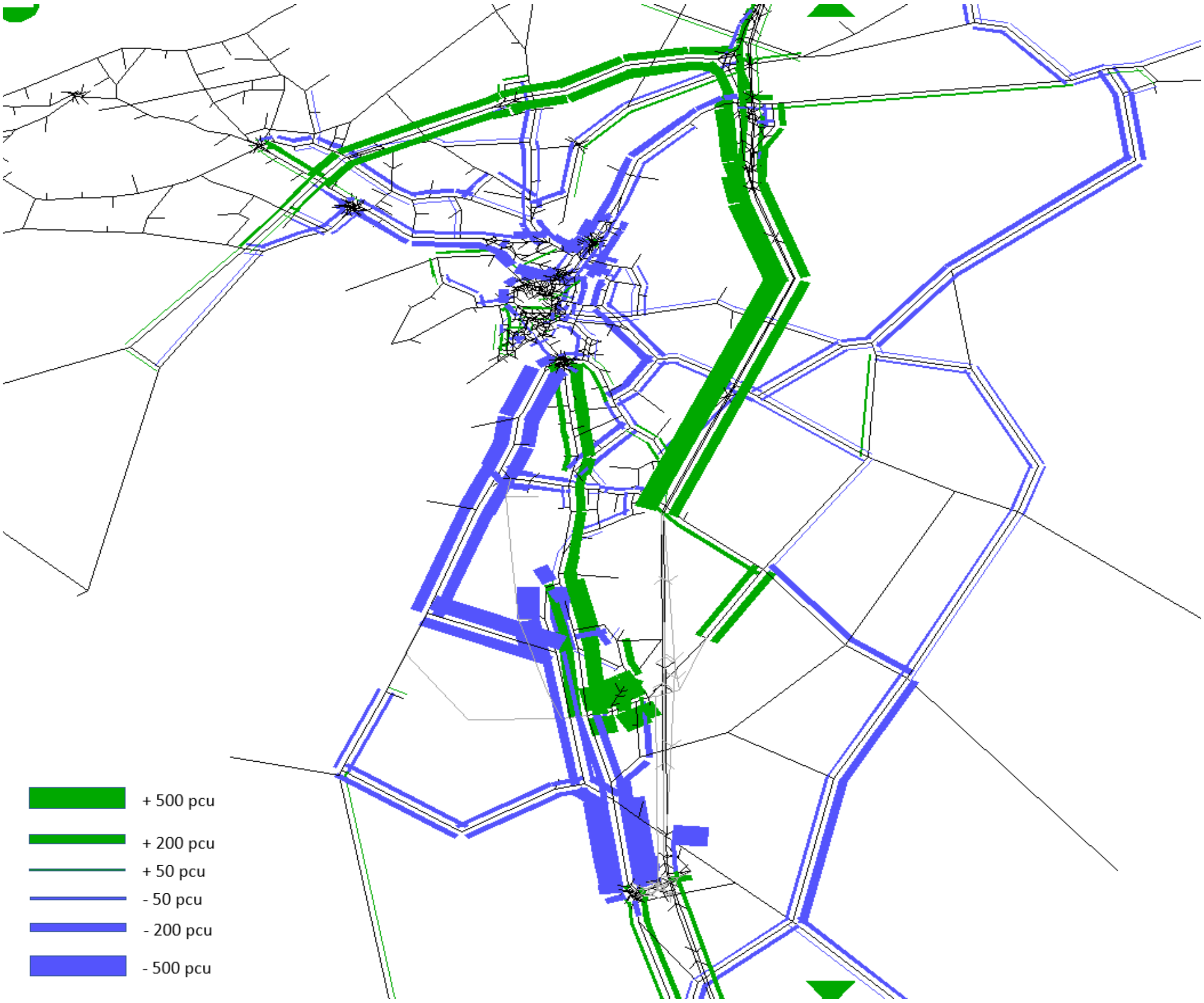


Figure 67: Central 2 vs DM, Flow Comparison, 2040, Interpeak (PCU)

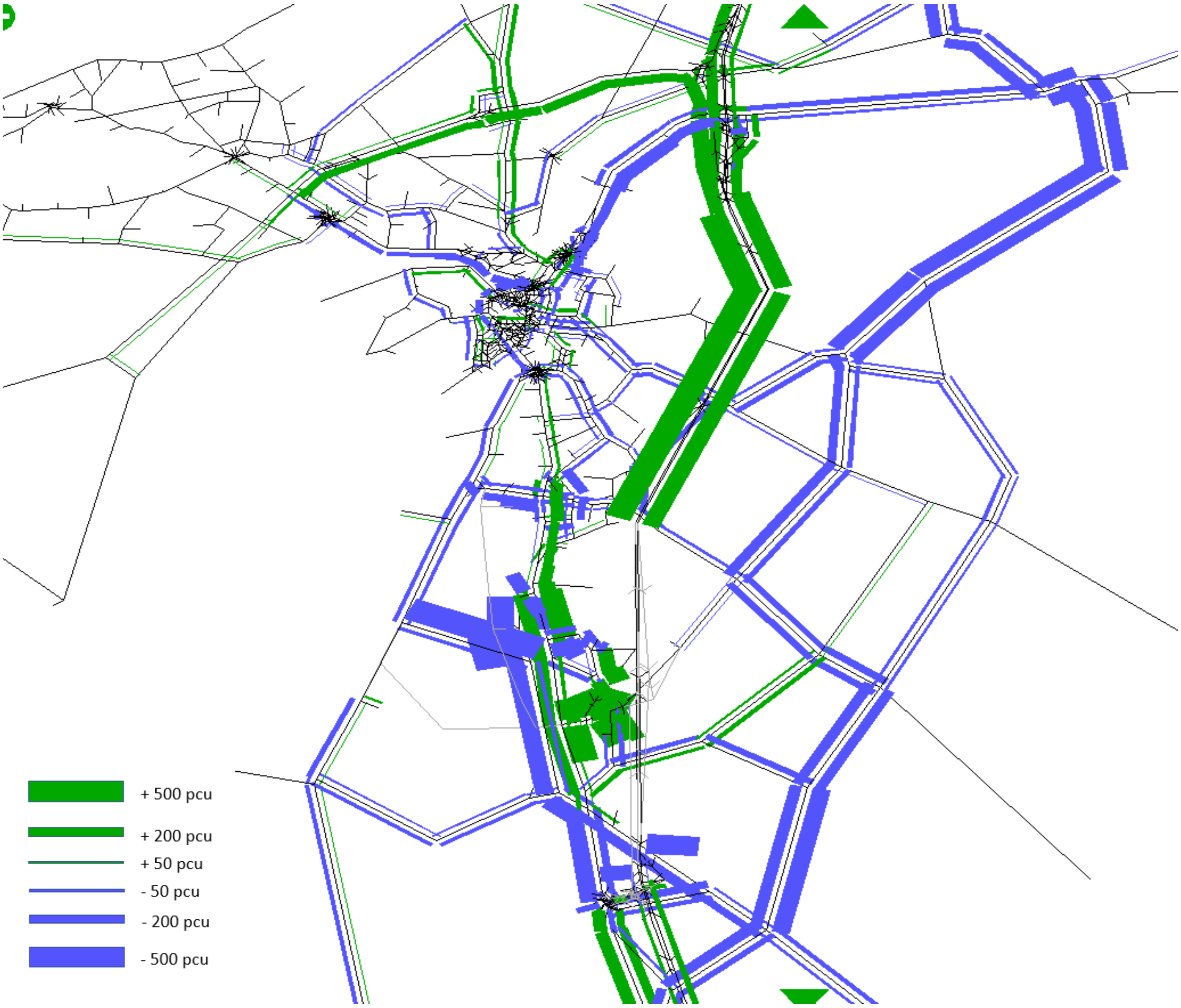


Figure 68: Central 2 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.10 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows.

A net flow reduction along Galgate is consistent in the AM; however, this figure is the average between a flow decrease in the off - peak direction (SB), while flows in the peak direction (NB) are almost identical to those observed in the Do Minimum scenario. A version of Table 4.10 by direction can be found in Appendix A. A flow decrease in both directions is achieved in the Interpeak. But flows increase in Galgate during the PM peak, compromising the objectives of the route option.

Flow goes up on other sections of the A6 to the north of Galgate, including along Bailrigg during the PM peak.

Flows on roads east and west of the A6 tend to decrease, except in Hazelrigg Lane, which connects directly with the new infrastructure.

Table 4.10: Central 2, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme Central 2 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1231	1194	1287	6%	10%	32%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	1187	901	1288	-29%	-47%	-23%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1182	950	1331	-23%	-25%	6%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	1096	941	1279	-14%	-17%	19%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1194	1441	1376	20%	44%	21%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1783	1793	1400	4%	8%	10%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1313	1546	1262	13%	22%	3%
8	M6	J33 & J34	7321	7578	7360	7916	8098	8058	8%	7%	9%
9	Stoney Lane	A6 & Bay Horse Road	271	24	226	42	23	11	-84%	-7%	-95%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	348	17	115	-33%	-90%	-75%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122	120	22	97	-56%	40%	-20%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	947	710	650	10%	44%	-5%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	430	240	307	-21%	-4%	-46%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	285	47	163	-43%	-71%	-59%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	801	501	483	-6%	20%	-7%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1459	1147	1517	-6%	-7%	-6%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	149	27	70	-4%	-64%	-50%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	141	73	82	-38%	3%	-14%
19	Birch Avenue	A588 & Highland Brow	305	251	336	210	82	247	-31%	-67%	-27%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	586	396	493	4%	-17%	-13%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1503	869	1401	2%	-30%	-7%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1547	875	1395	-2%	-36%	-4%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 69, Figure 70 and Figure 71 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 at Galgate, although this is only present in the south and west approaches to the A6 Lancaster Road and Stoney Lane. Congestion is equally present in the north sections of the A6. With respect to the new infrastructure, the trend identified in 2025 is exacerbated, with congestion extending southwards from the Hazelrigg junction with the new road. According to the route option drawing, this junction has been coded as a roundabout. Detailed design is to be considered during subsequent project stages for the preferred option.

The new infrastructure is also operating at higher volume over capacity ratios during the PM peak, along with some sections of Hazelrigg Lane.

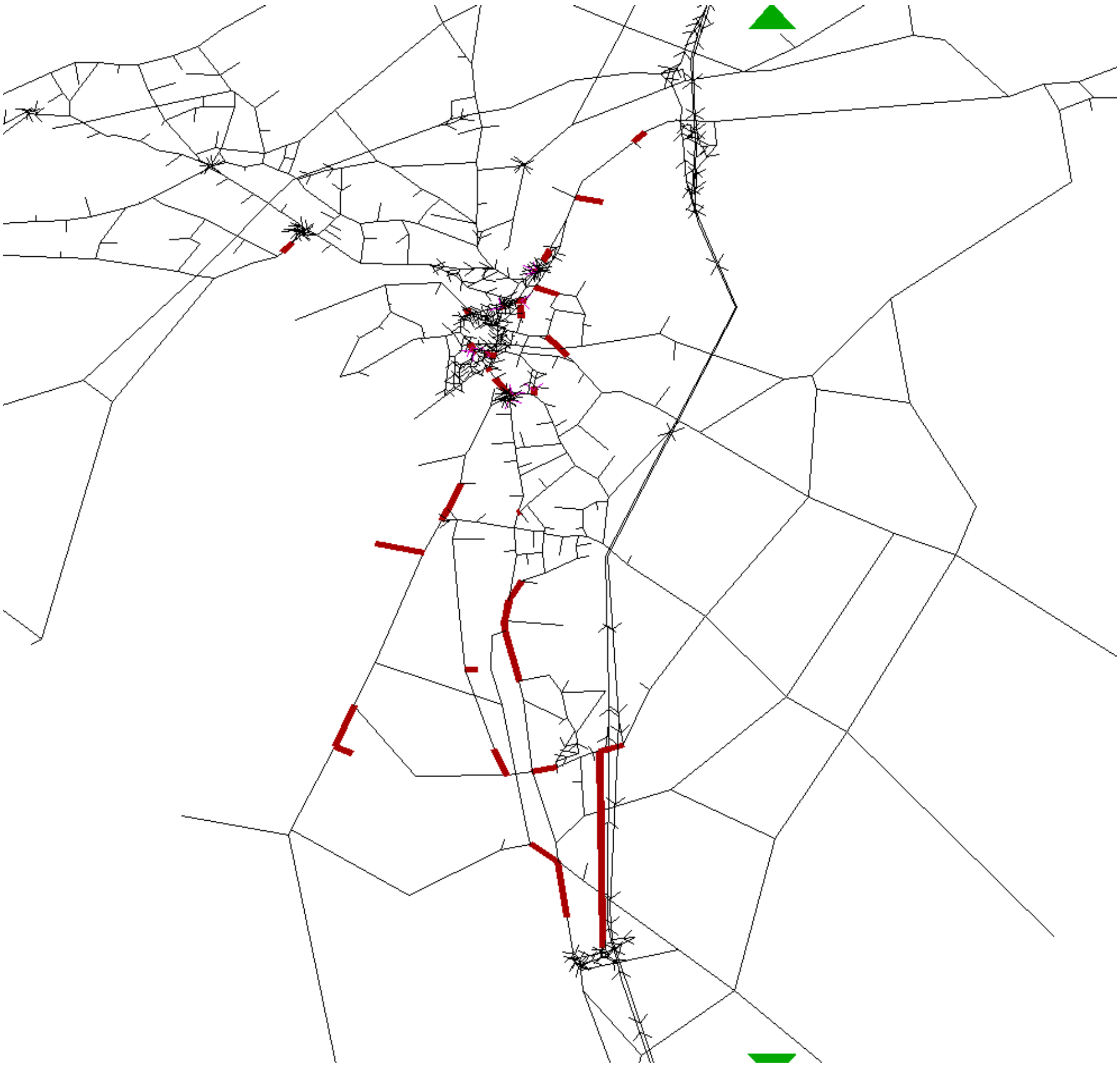


Figure 69: Central 2, Volume over Capacity Ratio over 85%, 2040, AM peak

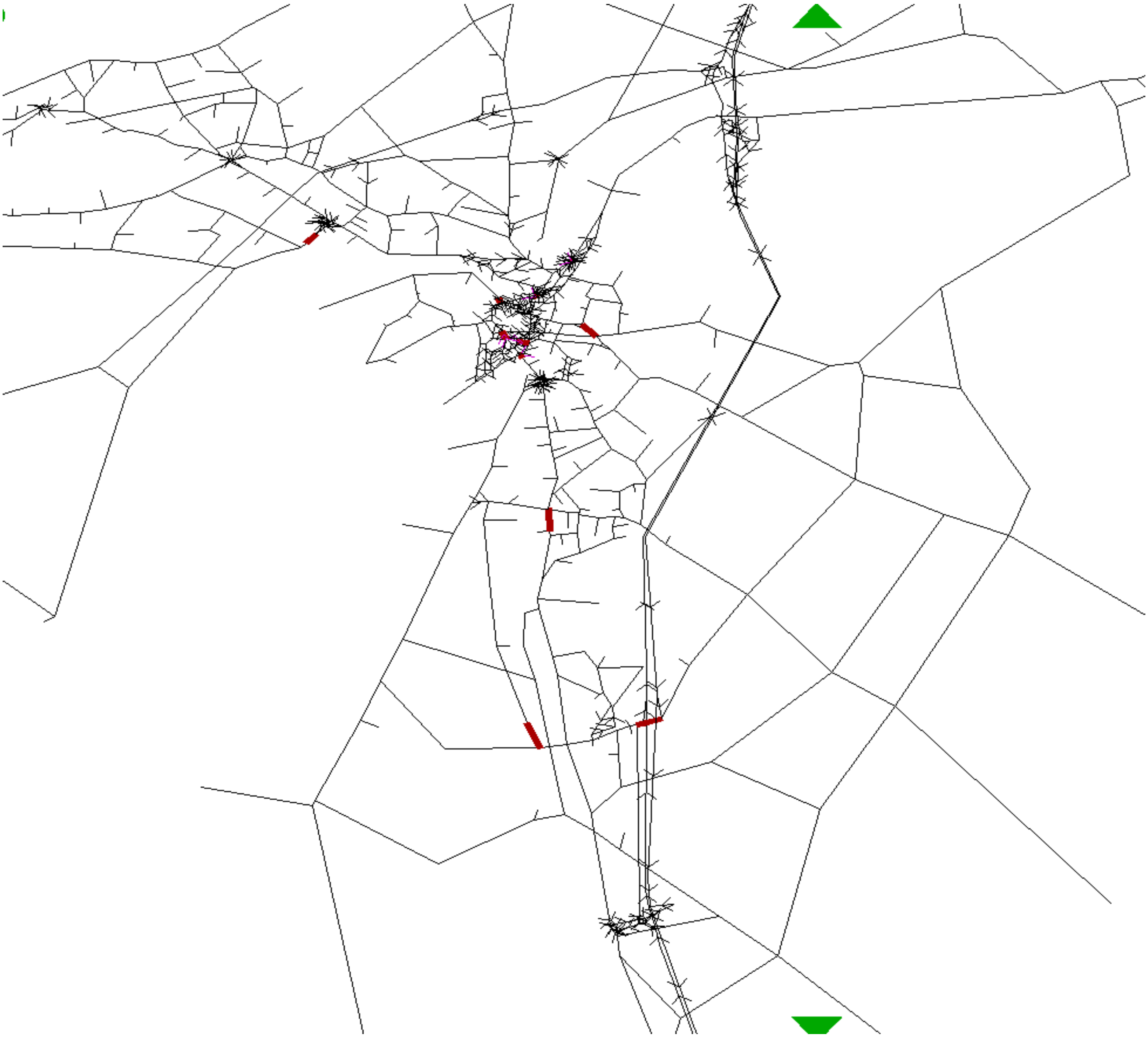


Figure 70: Central 2, Volume over Capacity Ratio over 85%, 2040, Interpeak

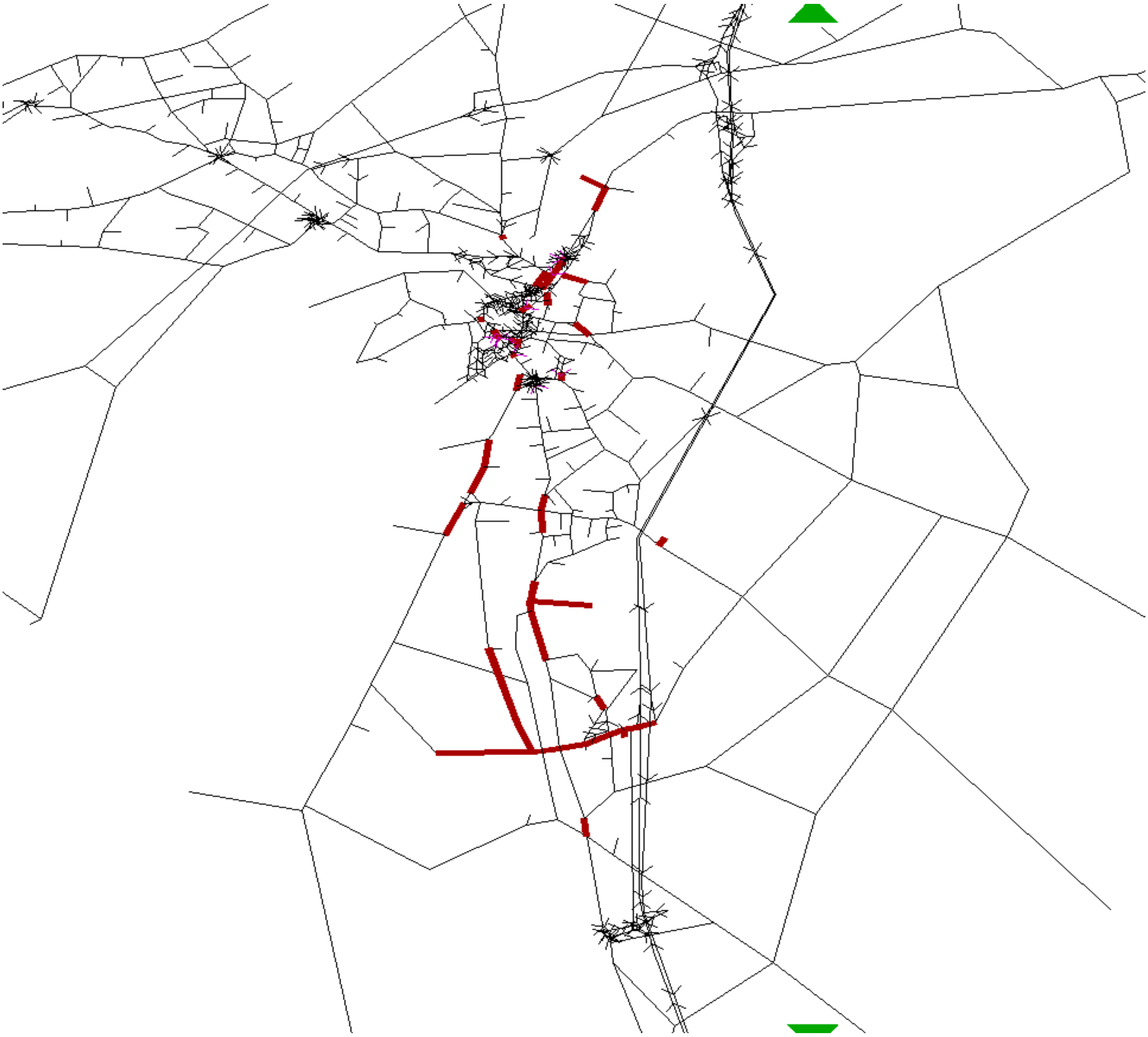


Figure 71: Central 2, Volume over Capacity Ratio over 85%, 2040, PM peak

4.3.4 West 1

Figure 72, Figure 73 and Figure 74 show the traffic flow changes that occur on the transport network when West 1 route option is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the West 1 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

As vehicles use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate during the AM peak, however flows increase during the Interpeak and the PM peak;
- There is a pattern on flow increases in all other sections of the A6;
- Flow increases in Hazelrigg Lane, which connects to the Spine Road; and
- Flow on the A588 and Ashton Road decline.

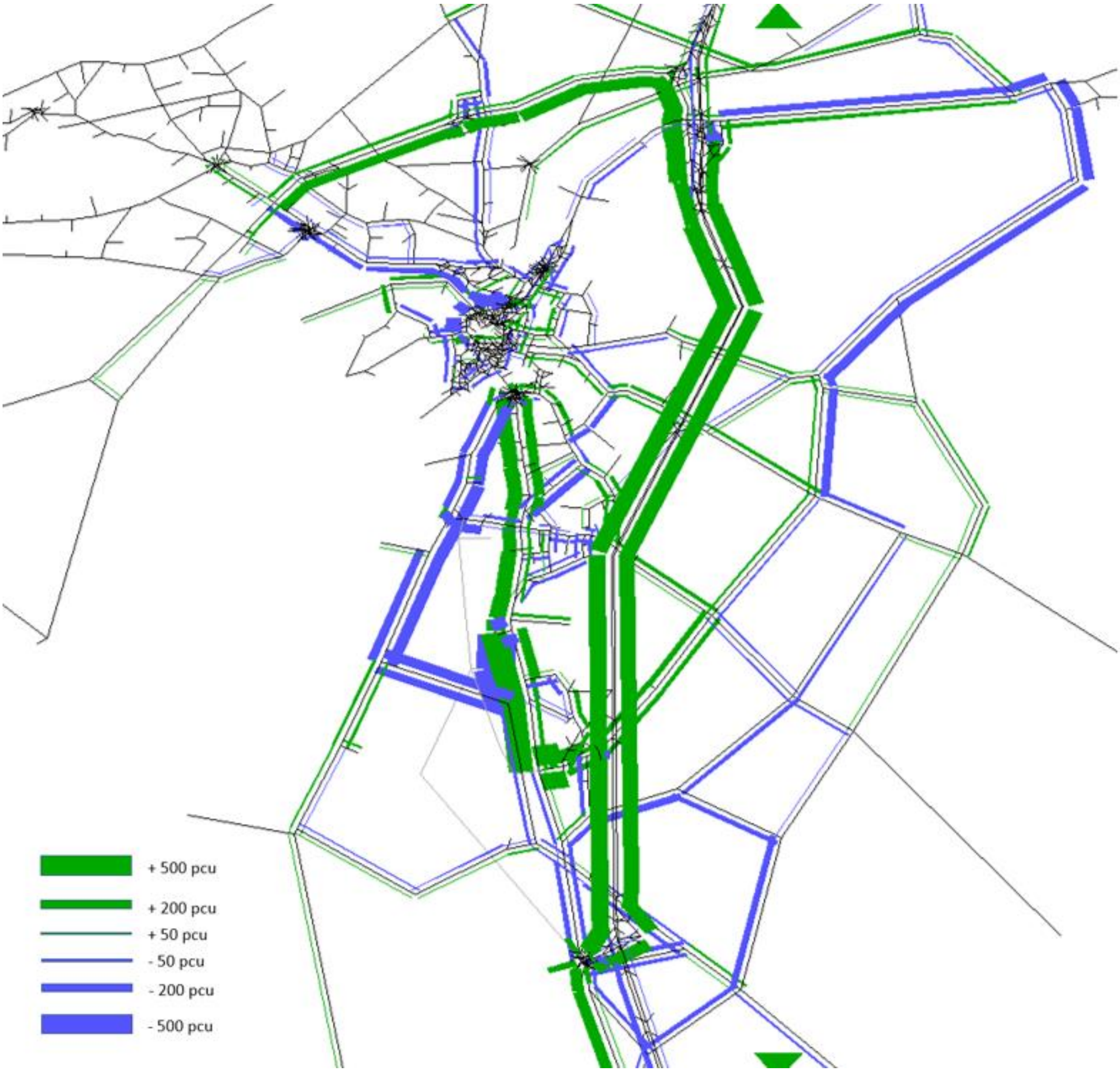


Figure 72: West 1 vs DM, Flow Comparison, 2040, AM Peak (PCU)

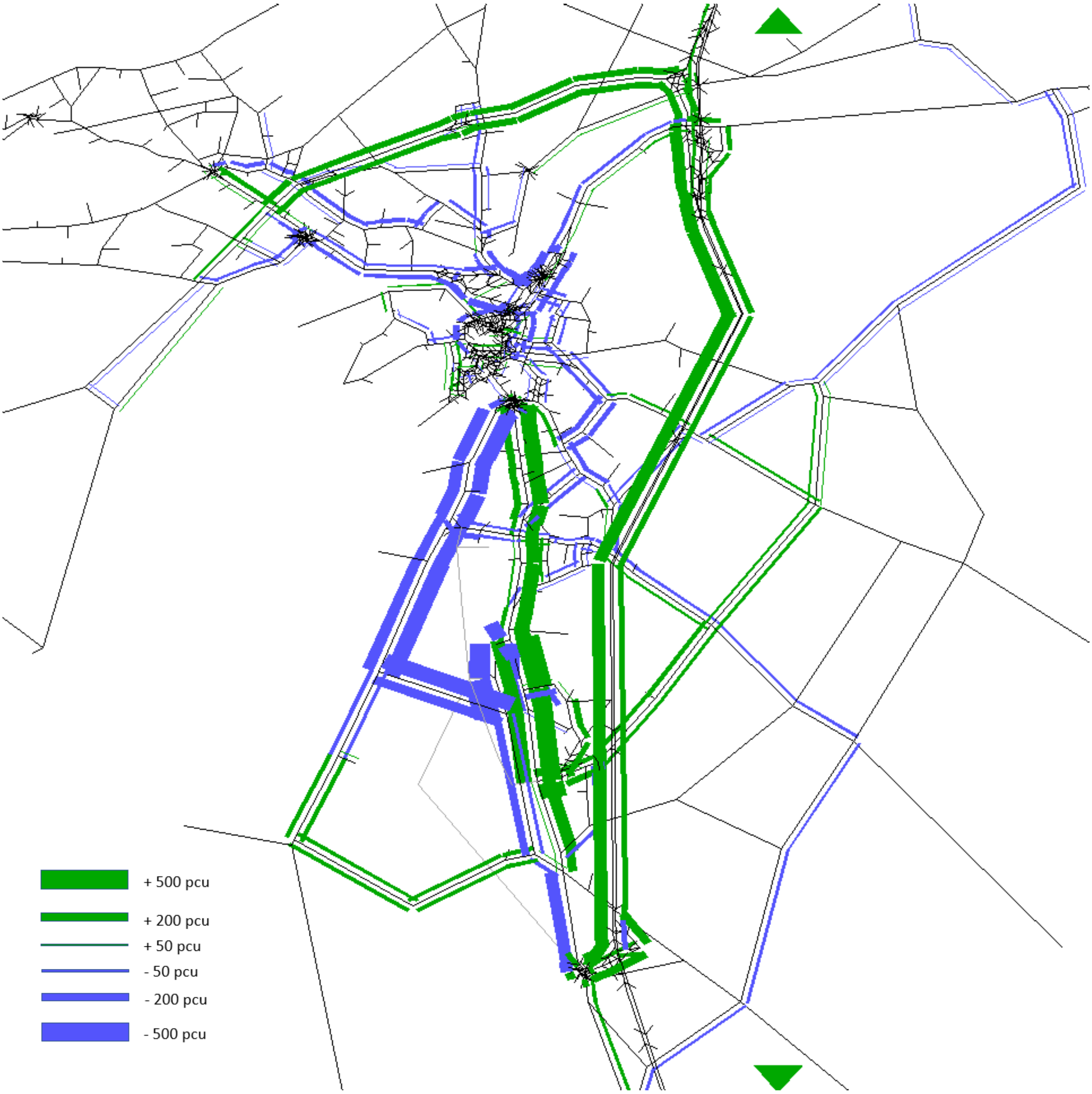


Figure 73: West 1 vs DM, Flow Comparison, 2040, Interpeak (PCU)

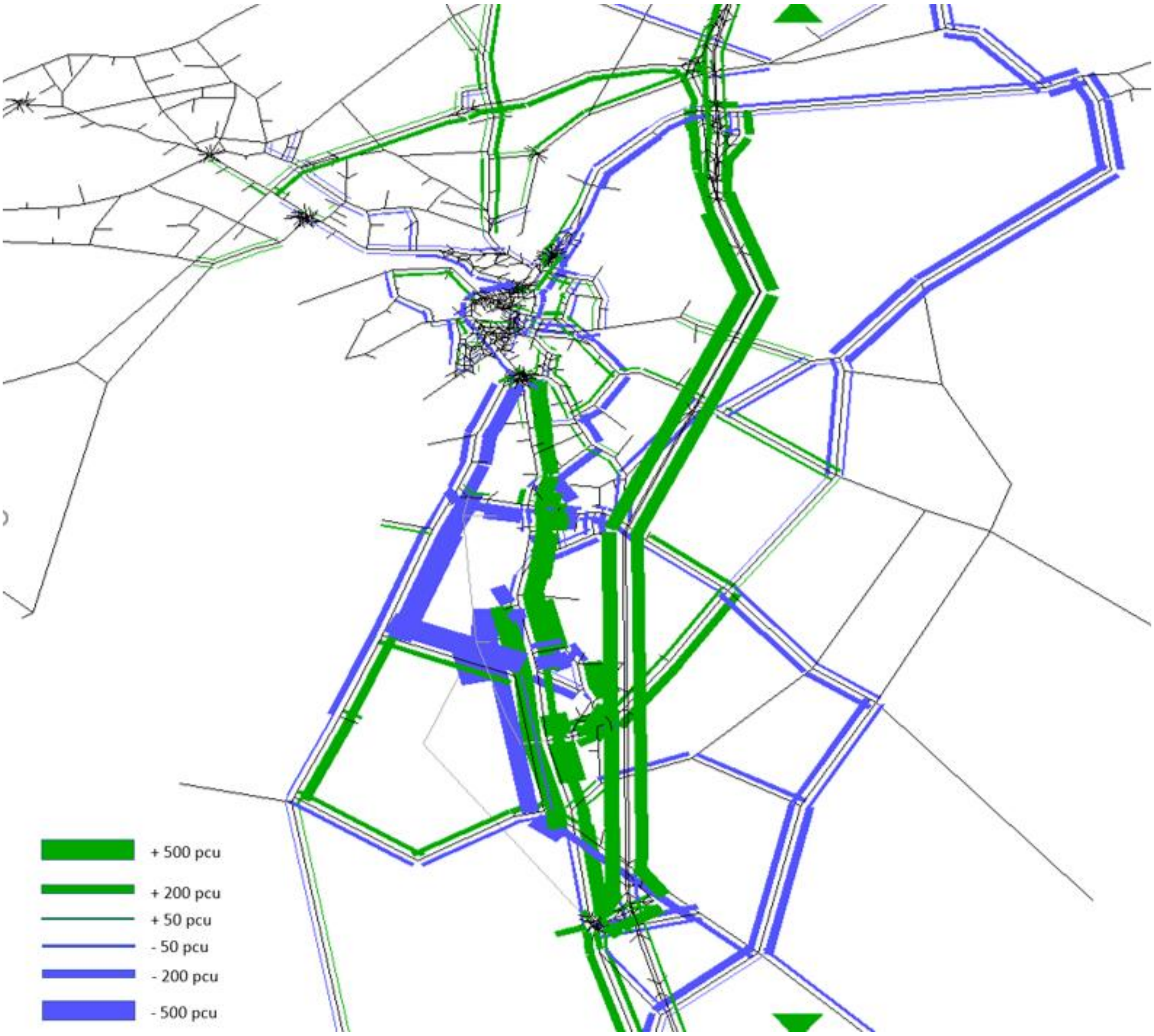


Figure 74: West 1 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.11 shows the flow changes in the key links within the study area. By looking at the right hand columns, which contain the percentage change in modelled flows.

Flow increases in the A6 as vehicles travel along the Bailrigg Spine Road and the A6 on their way to and from Lancaster and the motorway. The new link does not offer an attractive alternative route as distances provided are longer.

Flows on roads east and west of the A6 tend to decrease, except in Hazelrigg Lane, which connects directly with the new infrastructure.

Table 4.11: West 1, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme West 1 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1314	1123	1133	13%	4%	16%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	1547	1518	1879	-7%	-11%	12%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1451	1413	1751	-5%	11%	40%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	1253	1343	1533	-2%	18%	42%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1430	1537	1535	44%	54%	35%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1981	1900	1625	16%	15%	27%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1557	1627	1503	34%	28%	23%
8	M6	J33 & J34	7321	7578	7360	7836	7865	7781	7%	4%	6%
9	Stoney Lane	A6 & Bay Horse Road	271	24	226	147	27	77	-46%	10%	-66%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	502	149	326	-3%	-16%	-30%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122	143	16	51	-48%	2%	-58%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	1017	595	857	18%	21%	25%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	551	328	559	1%	31%	-1%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	441	138	247	-12%	-16%	-37%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	926	411	558	9%	-1%	7%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1520	1143	1528	-2%	-7%	-5%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	179	70	144	15%	-5%	2%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	176	71	99	-23%	2%	5%
19	Birch Avenue	A588 & Highland Brow	305	251	336	297	371	371	-3%	48%	10%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	579	609	708	3%	27%	25%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1149	805	1022	-22%	-35%	-32%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1294	893	1122	-18%	-34%	-23%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 75, Figure 76 and Figure 77 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

There is still some congestion on the A6 at Galgate, present in the north, south and west approaches to the A6 Lancaster Road and Stoney Lane junction. Congestion is equally present in the north sections of the A6. With respect to the new infrastructure, V/C over 85% is also experienced in the west link and the Bailrigg Spine Road, where development trips load. Detailed design will be undertaken as part of subsequent project stages for the preferred option.

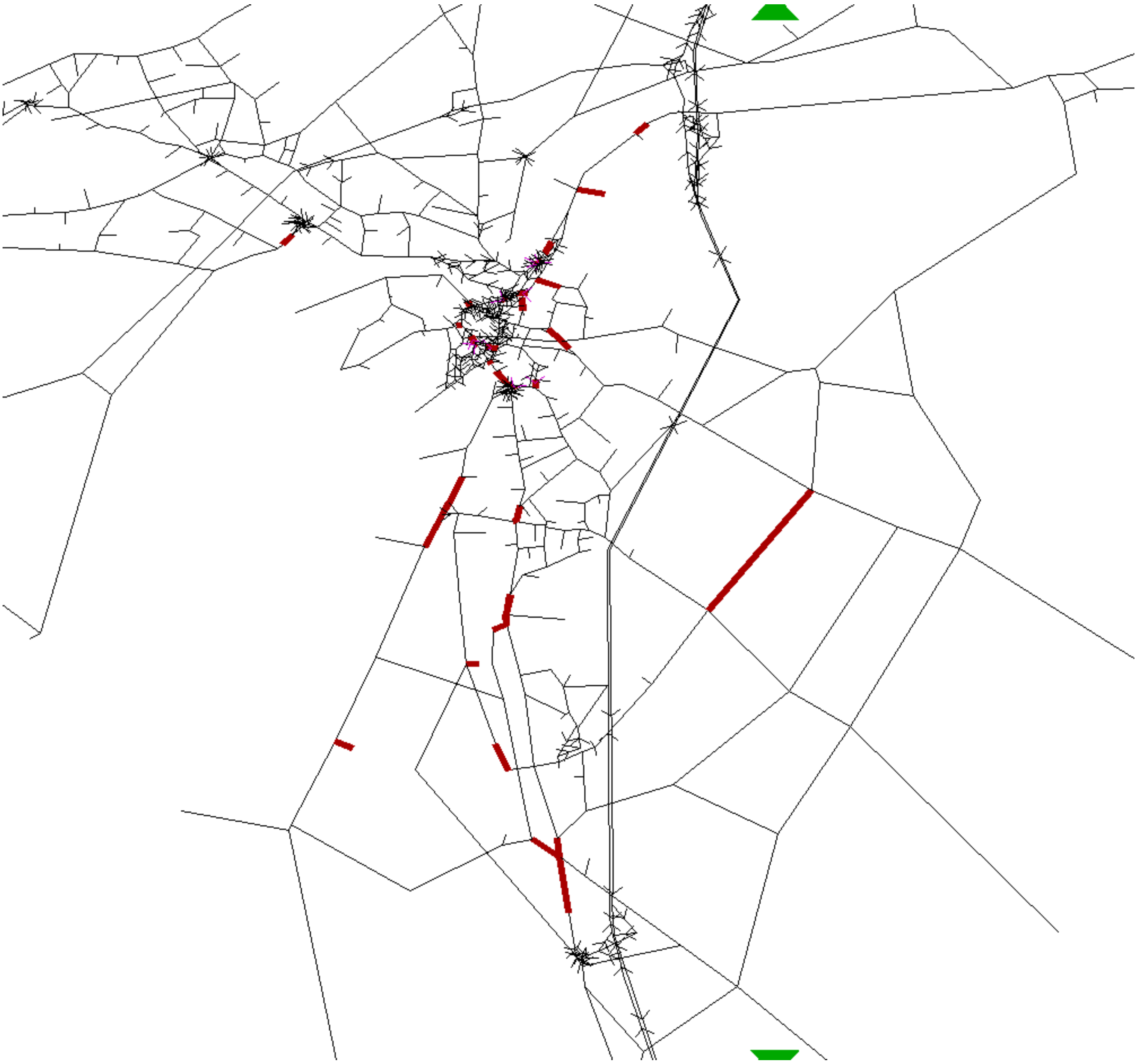


Figure 75: West 1, Volume over Capacity Ratio over 85%, 2040, AM peak

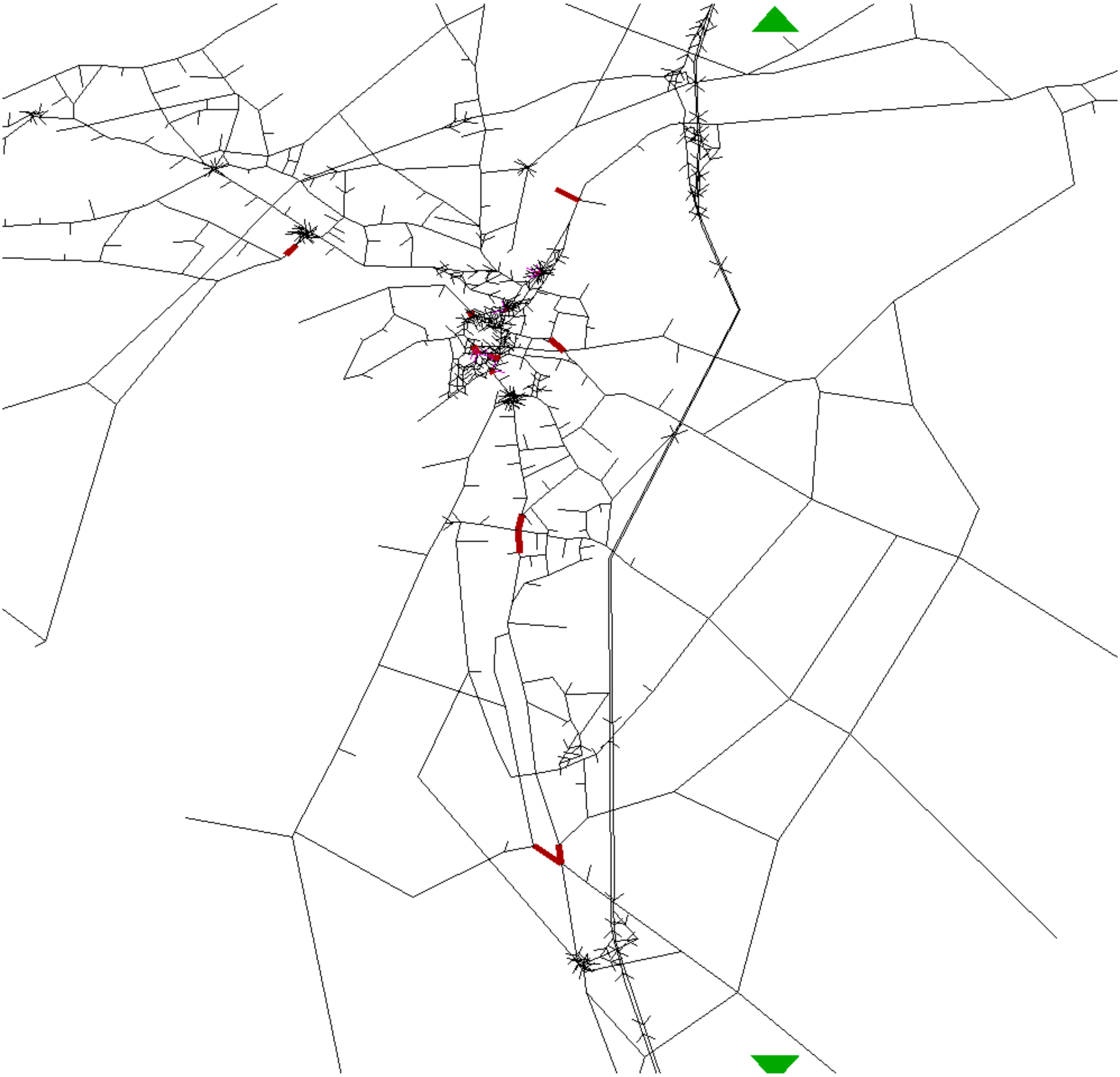


Figure 76: West 1, Volume over Capacity Ratio over 85%, 2040, Interpeak

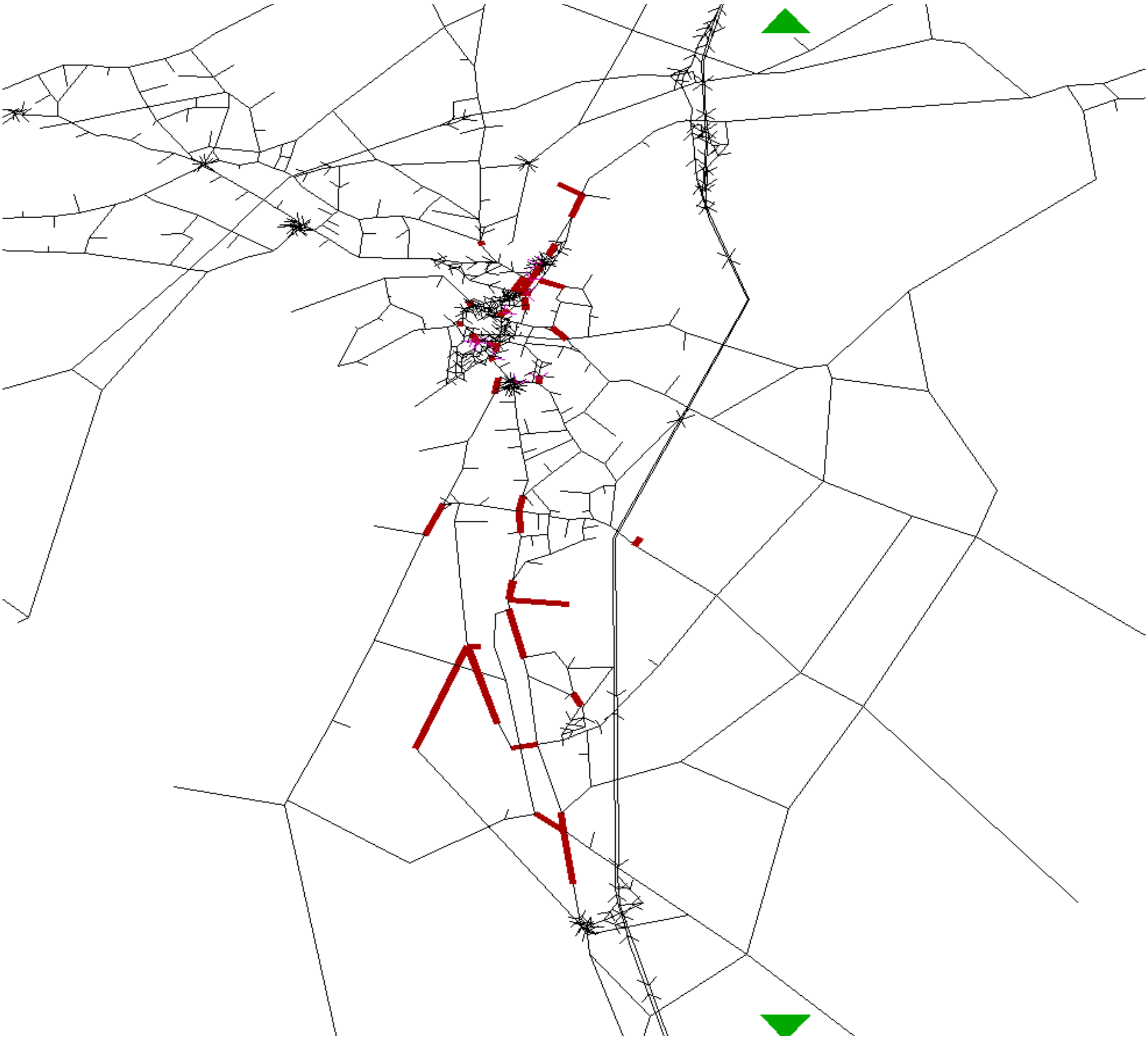


Figure 77: West 1, Volume over Capacity Ratio over 85%, 2040, PM peak

4.3.5 West 2

Figure 78, Figure 79 and Figure 80 show the traffic flow changes that occur on the transport network when West 2 route option is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the West 2 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the scheme implementation, while links with a green bar are those sections where flows go up once the scheme is in place.

As vehicles use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate during the AM peak and the Interpeak, however flows increase during the PM peak;
- There is a pattern on flow increases in all other sections of the A6 as vehicles travel along the Spine Road and the A6 on their way to and from Lancaster and the M6;
- Flow increases on the M6;
- Flow increases in Hazelrigg Lane, which connects to the Spine Road; and
- Flow on the A588 and Ashton Road decline.

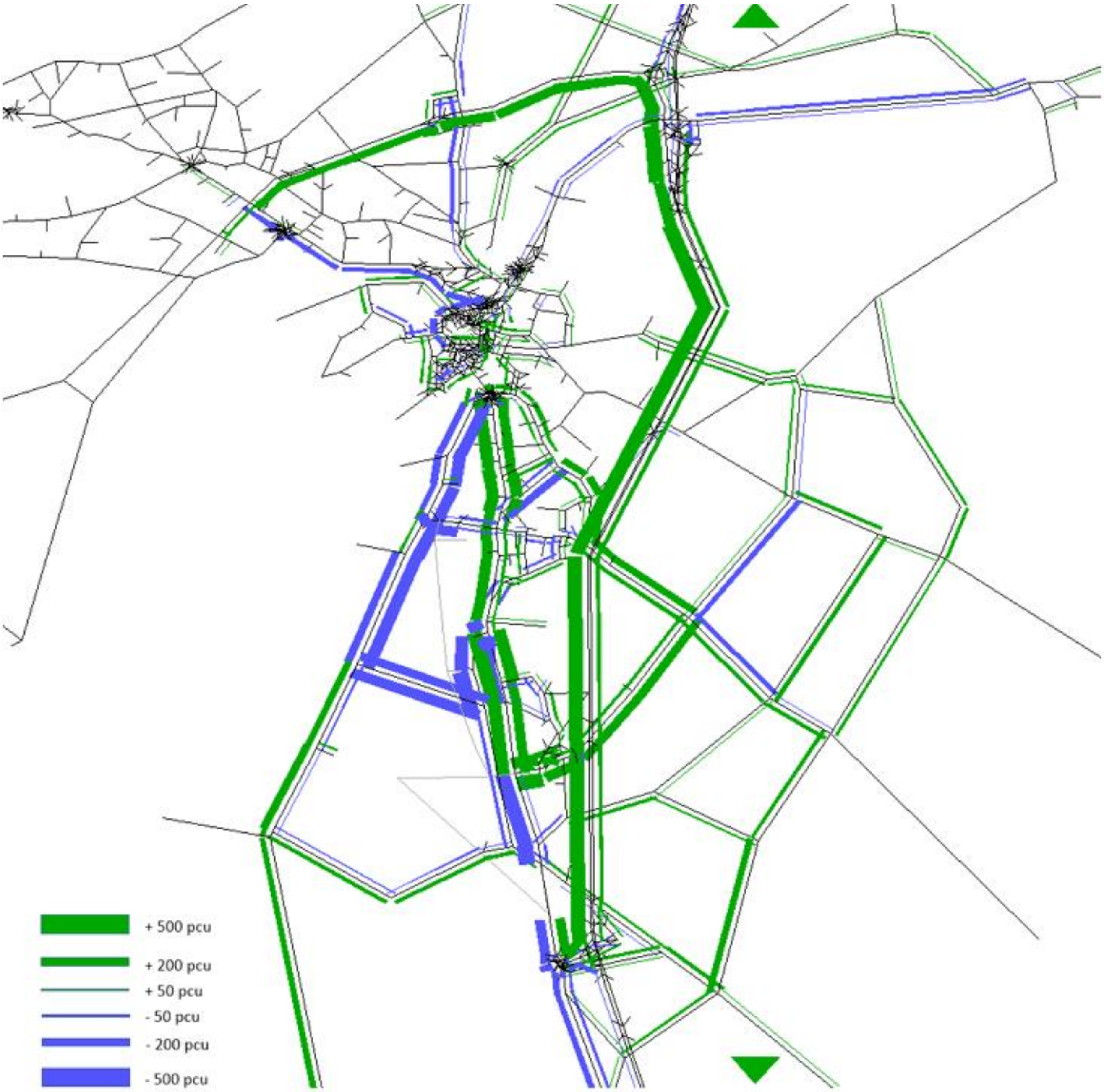


Figure 78: West 2 vs DM, Flow Comparison, 2040, AM Peak (PCU)

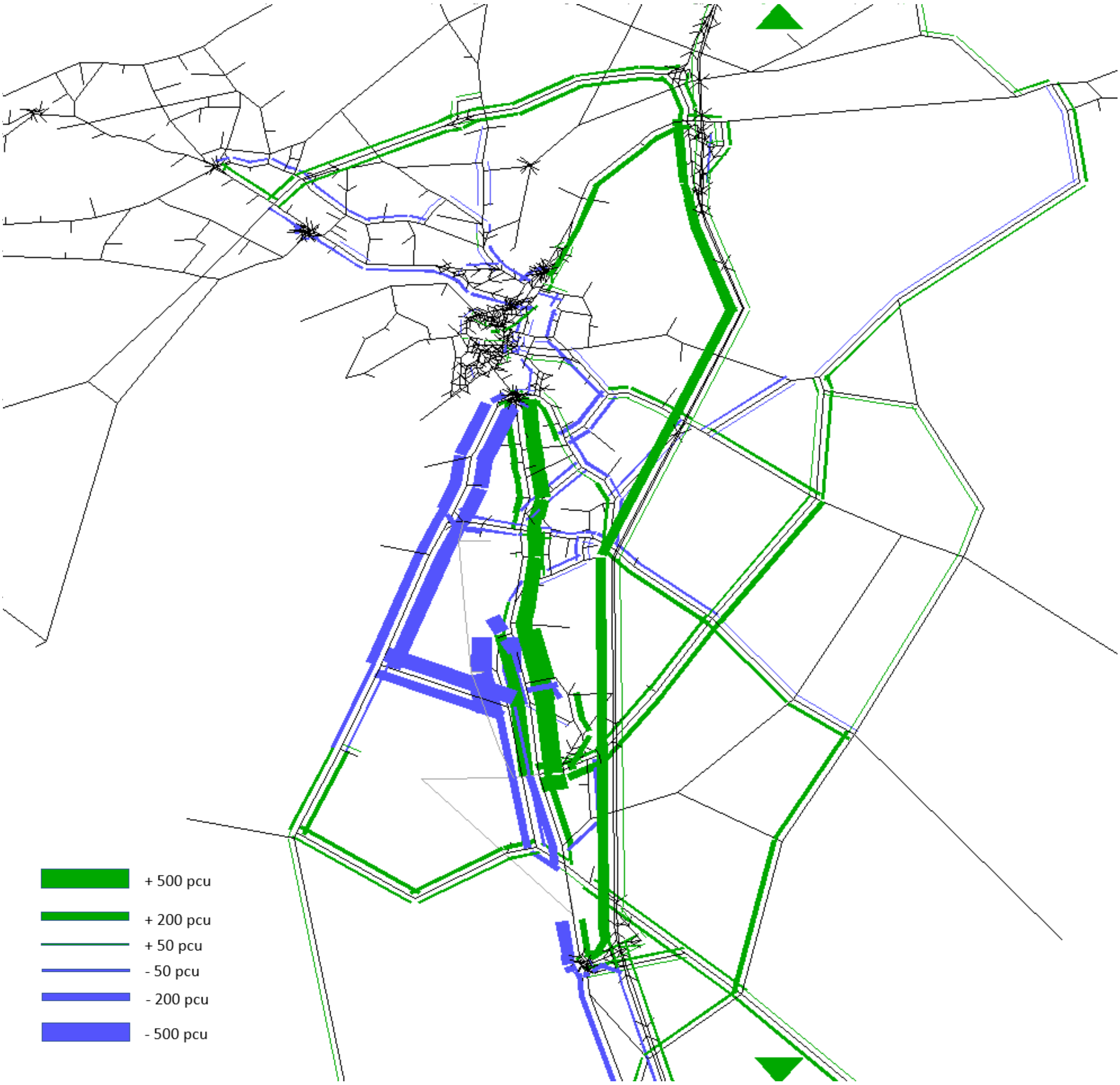


Figure 79: West 2 vs DM, Flow Comparison, 2040, Interpeak (PCU)

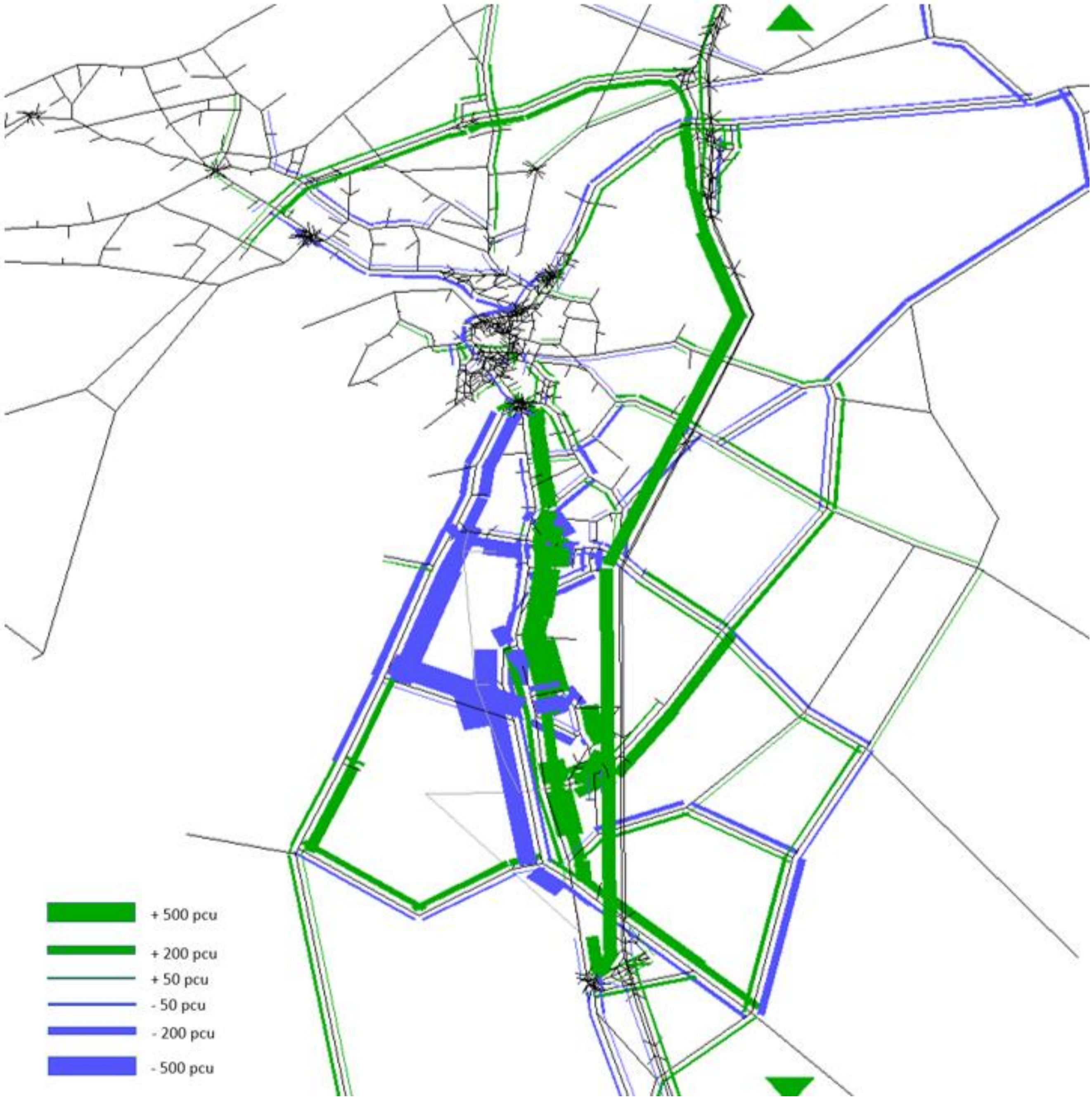


Figure 80: West 2 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.12 shows the flow changes in the key links within the study area. The three columns on the right hand side contain the percentage change in modelled flows.

The West 2 route option achieves a flow reduction in the A6 along Galgate during the AM and the Interpeak; however, flows go up in the PM peak. This is due to the scheme attracting development traffic that would otherwise travel along the A588 to J33 and the A6, rather than acting as an alternative to the A6, which provides a more direct route.

Flow goes up on the norther sections of the A6 as vehicles travel along the Bailrigg Spine Road and the A6 on their way to and from Lancaster.

Flows on roads east and west of the A6 tend to increase, except on the A588, where there is a significant decline.

Table 4.12: West 2, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme West 2 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1053	1007	934	-10%	-7%	-4%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	1666	1605	1845	0%	-6%	10%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1250	1181	1504	-18%	-7%	20%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	1040	1114	1318	-19%	-2%	22%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1345	1512	1369	35%	52%	20%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1916	1892	1624	12%	14%	27%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1513	1604	1467	30%	26%	20%
8	M6	J33 & J34	7321	7578	7360	7599	7752	7573	4%	2%	3%
9	Stoney Lane	A6 & Bay Horse Road	271	24	226	276	114	354	2%	370%	56%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	586	239	465	13%	34%	-1%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122	313	16	88	14%	2%	-28%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	1040	598	859	21%	22%	25%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	483	357	620	-11%	43%	10%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	485	207	371	-3%	26%	-6%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	1045	455	619	23%	9%	19%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1577	1205	1541	1%	-2%	-4%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	188	91	161	20%	23%	13%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	282	71	106	24%	1%	11%
19	Birch Avenue	A588 & Highland Brow	305	251	336	345	353	419	13%	40%	25%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	678	591	799	21%	23%	41%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1159	835	1025	-21%	-32%	-32%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1282	908	1145	-19%	-33%	-21%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 81, Figure 82 and Figure 83 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

The route option does not achieve a noticeable congestion relieve on the A6 at Galgate or other parts. With respect to the new infrastructure, V/C over 85% is also experienced in the west link and the Bailrigg Spine Road, where development trips load. Detailed design for the preferred option will be undertaken during the next project stages.

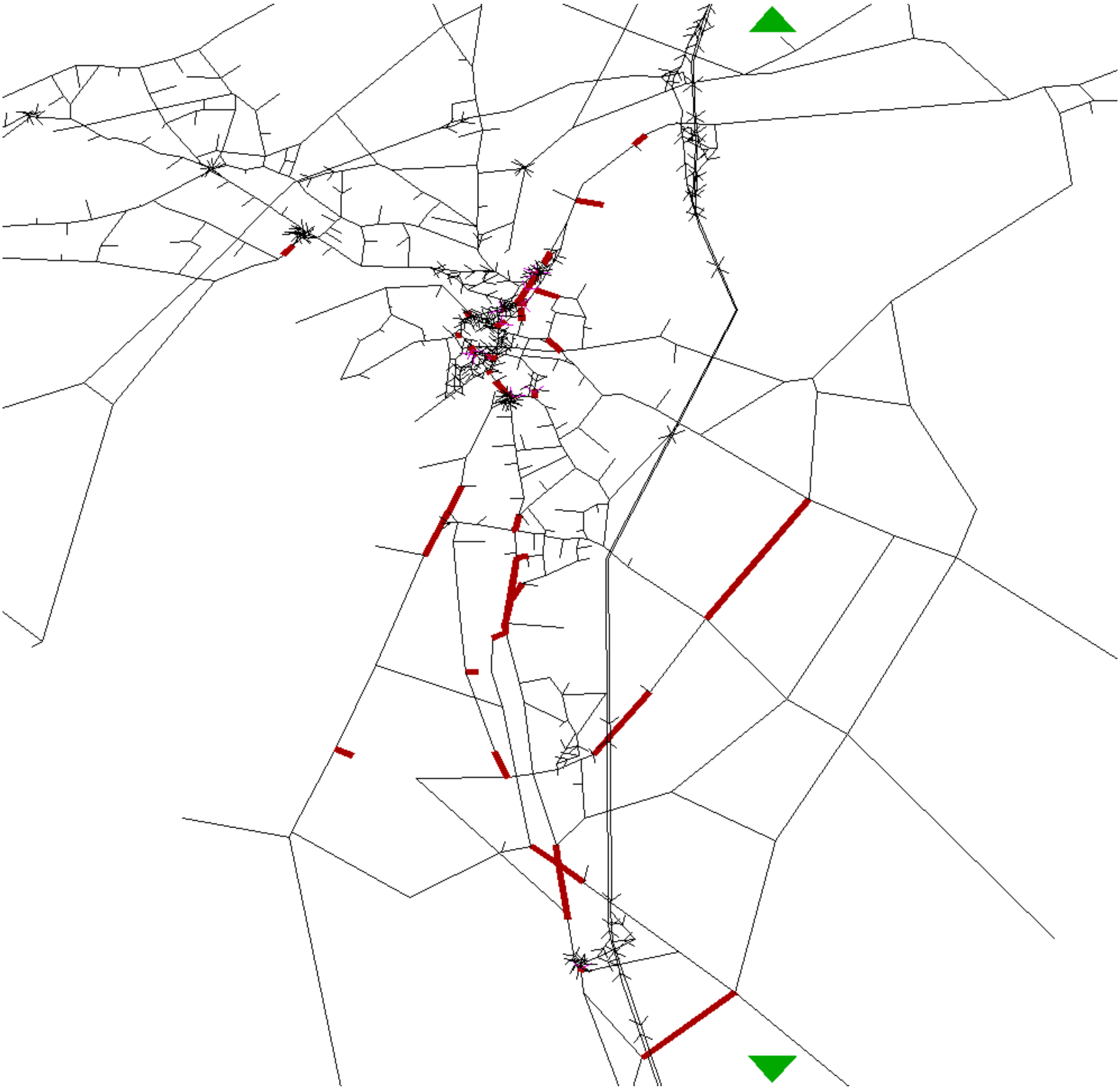


Figure 81: West 2, Volume over Capacity Ratio over 85%, 2040, AM peak

Figure 82: West 2, Volume over Capacity Ratio over 85%, 2040, Interpeak

Figure 83: West 2, Volume over Capacity Ratio over 85%, 2040, PM peak

4.3.6 East 1

Figure 84, Figure 85 and Figure 86 show the traffic flow changes that occur on the transport network when East 1 route option is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the East 1 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

As drivers use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate, although it should be noted that most of the flow reduction is experienced in the SB direction while flows in the NB direction remain very similar to those observed in the DM;
- There is a pattern on flow increases in the northern sections of the A6 sections as development traffic travels along these links on their way to and from Lancaster and the M6. This includes the Bailrigg section during the PM peak;
- Flow increases in Hazelrigg Lane, which connects to the new infrastructure; and
- Flow on the A588 and Ashton Road declines as vehicles favour the new route option and the motorway.

Figure 84: East 1 vs DM, Flow Comparison, 2040, AM Peak (PCU)

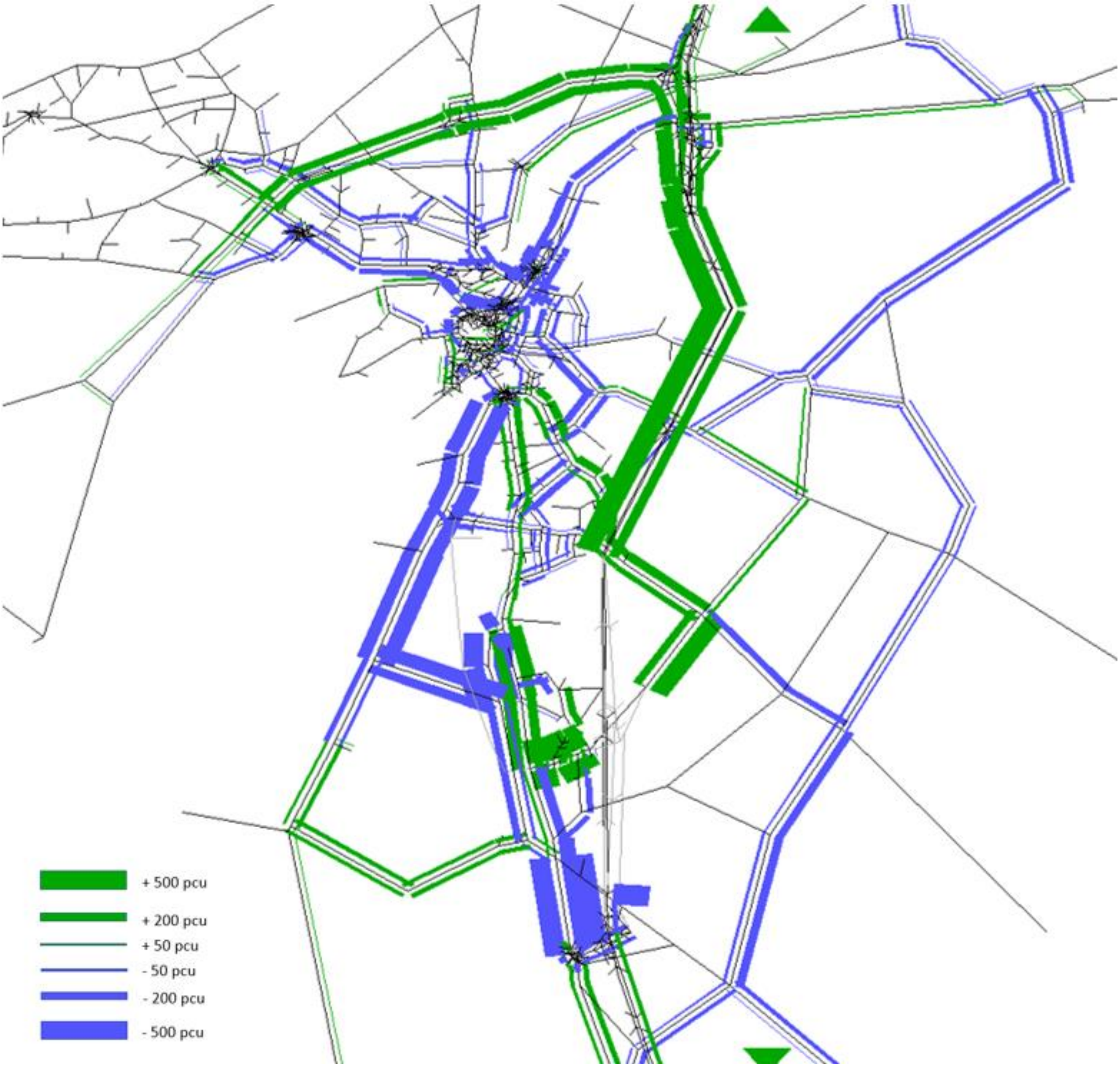


Figure 85: East 1 vs DM, Flow Comparison, 2040, Interpeak (PCU)

Figure 86: East 1 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.13 shows the flow changes in the key links within the study area. The right hand columns contain the percentage change in modelled flows when East 1 is implemented.

A net flow reduction along Galgate is achieved during the AM and the Interpeak; however these figures are the average between a flow decrease in the SB direction while flow on the NB direction goes up by 1% in the AM peak to 5% in the PM peak. A version of Table 4.13 by direction can be found Appendix A.

With respect to the links located east of the A6, flow goes up in Hazelrigg Lane and Blea Tarn Road, as vehicles travel along these routes to use the new infrastructure.

To the west of the A6, flow goes up in Birch Avenue and the south sections of the A588 while decreasing on the north part of the A588 and Ashton Road, as vehicles favour the new route option.

Table 4.13: East 1, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme East 1 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1569	1208	1359	35%	11%	39%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	1041	840	1023	-38%	-51%	-39%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1104	1033	1173	-28%	-19%	-6%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	1022	1010	1406	-20%	-11%	31%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1452	1348	1083	46%	35%	-5%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1913	1711	1349	12%	3%	6%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1500	1438	1312	29%	13%	7%
8	M6	J33 & J34	7321	7578	7360	8121	8078	8208	11%	7%	12%
9	Stoney Lane	A6 & Bay Horse Road	274	15	122	110	20	174	-60%	31%	42%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	158	10	26	-69%	-94%	-94%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	499	164	394	190	46	176	-62%	-72%	-55%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	1306	939	1116	52%	91%	63%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	498	299	390	-8%	19%	-31%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	190	46	176	-62%	-72%	-55%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	991	672	888	17%	61%	70%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1511	1242	1561	-3%	1%	-3%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	75	21	38	-52%	-72%	-73%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	148	73	88	-35%	4%	-7%
19	Birch Avenue	A588 & Highland Brow	305	251	336	404	396	508	32%	57%	51%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	680	588	787	21%	23%	39%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1105	776	1035	-25%	-37%	-31%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1225	858	1111	-22%	-37%	-23%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 87, Figure 88 and Figure 89 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 at Galgate, present in the north, south and west approaches to the A6 Lancaster Road and Stoney Lane. Congestion is equally present in the north sections of the A6. With respect to the new infrastructure, there is some congestion on Hazelrigg Lane and East link junction. Consideration should be given to the design and capacity of junctions going forward.

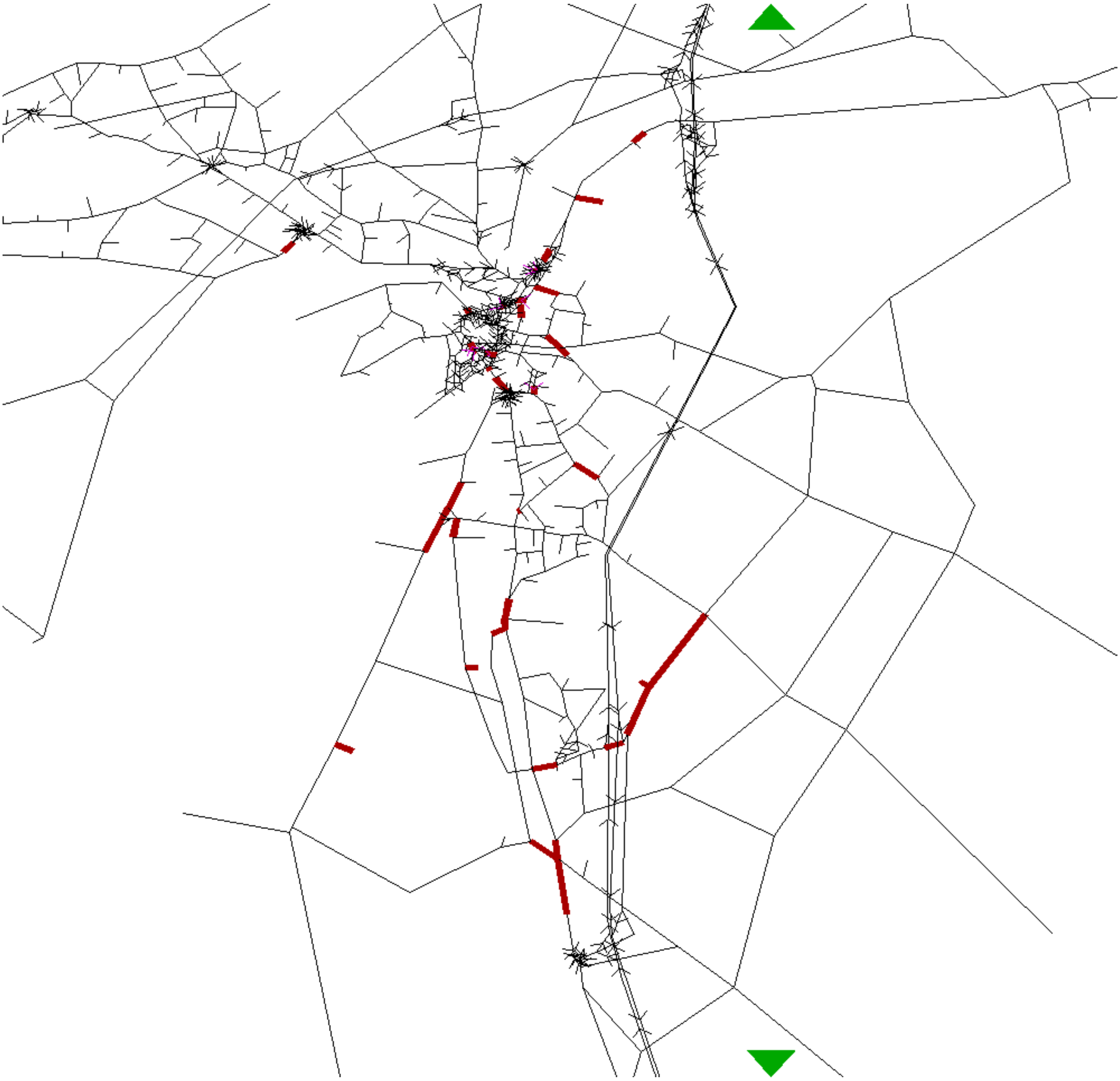


Figure 87: East 1, Volume over Capacity Ratio over 85%, 2040, AM peak

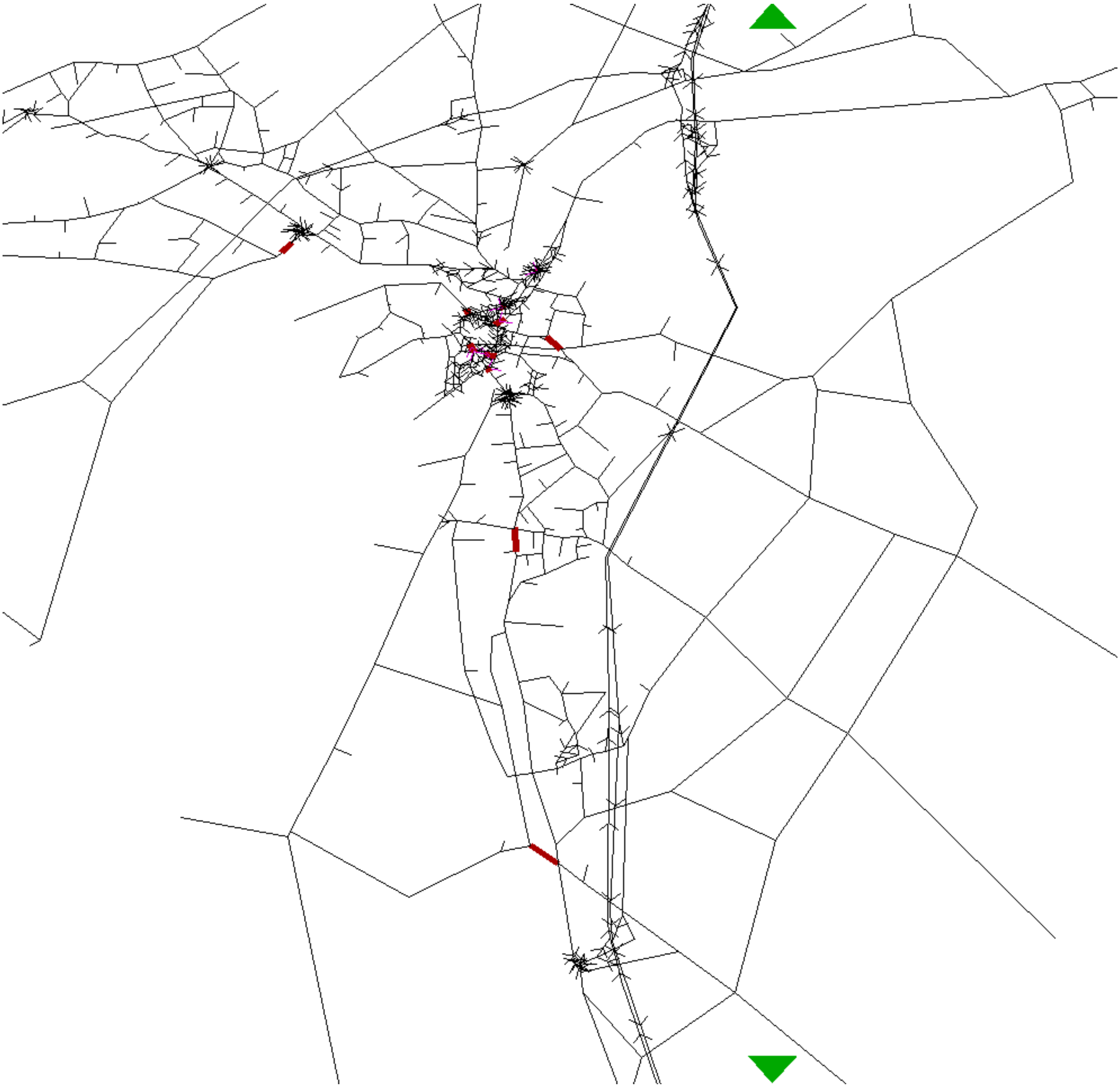


Figure 88: East 1, Volume over Capacity Ratio over 85%, 2040, Interpeak

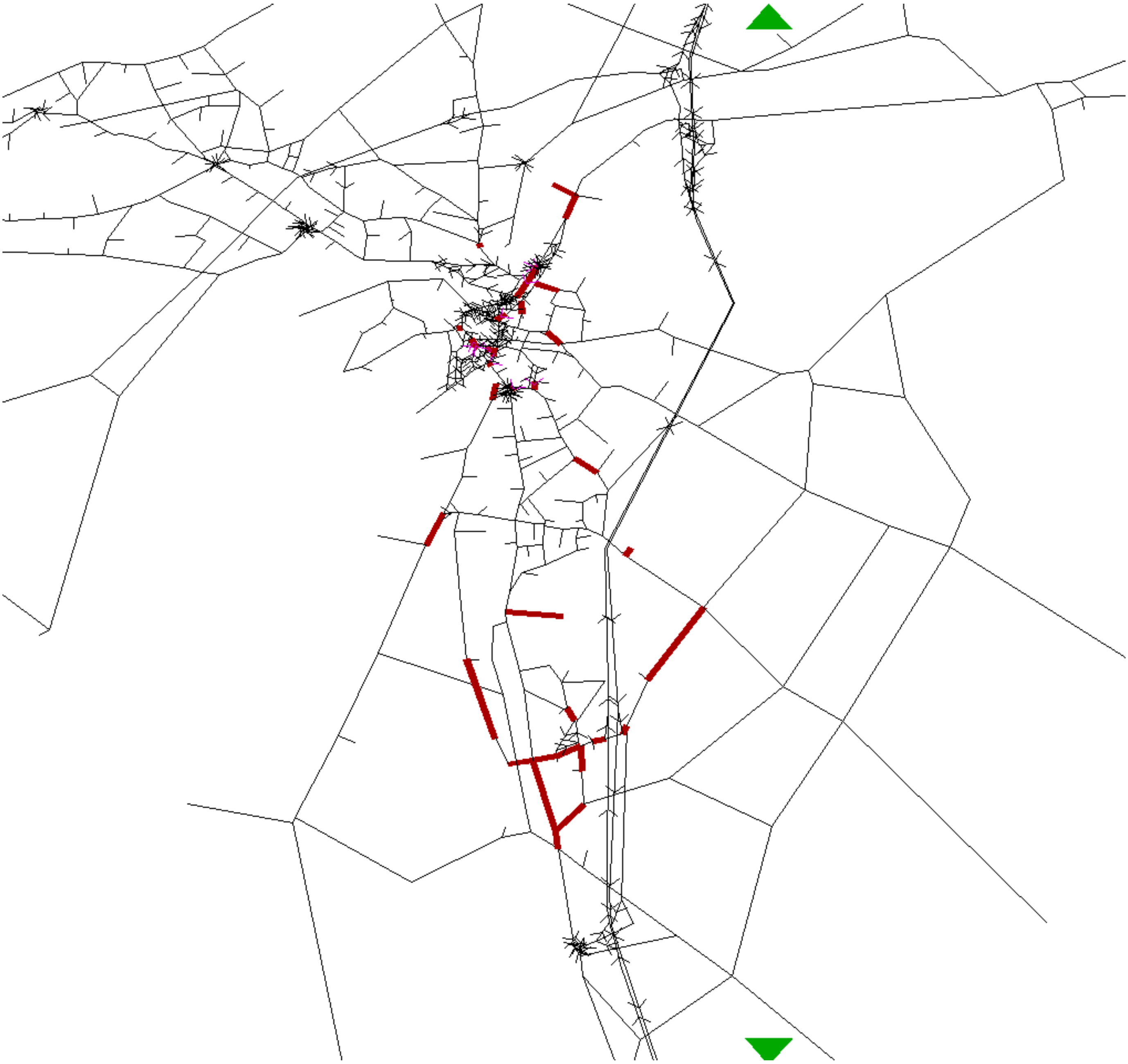


Figure 89: East 1, Volume over Capacity Ratio over 85%, 2040, PM peak

4.3.7 East 2

Figure 90, Figure 91 and Figure 92 show the traffic flow changes that occur on the transport network when East 2 route option is implemented, in comparison with the Do Minimum scenario. The results are for year 2040; results for year 2025 have been presented in Section 4.3.

These plots compare the flows with and without the East 2 route option. Links with a blue bar signify those sections of the network where flow decreases as a result of the route option implementation, while links with a green bar are those sections where flows go up once the route option is in place.

As vehicles use the new infrastructure, the following flow changes are observed:

- There is an overall flow reduction on the A6 section through Galgate, although it should be noted that most of the flow reduction is experienced in the SB direction while flows in the NB direction experience a mild increase in comparison with those observed in the DM;
- There is a pattern on flow increases in the northern sections of the A6 sections as development traffic travels along these links on their way to and from Lancaster and the M6. This includes the Bailrigg section during the PM peak;
- Flow increases in Hazelrigg Lane, which connects to the new infrastructure; and
- Flow on the A588 and Ashton Road declines as vehicles favour the new route option and the motorway.

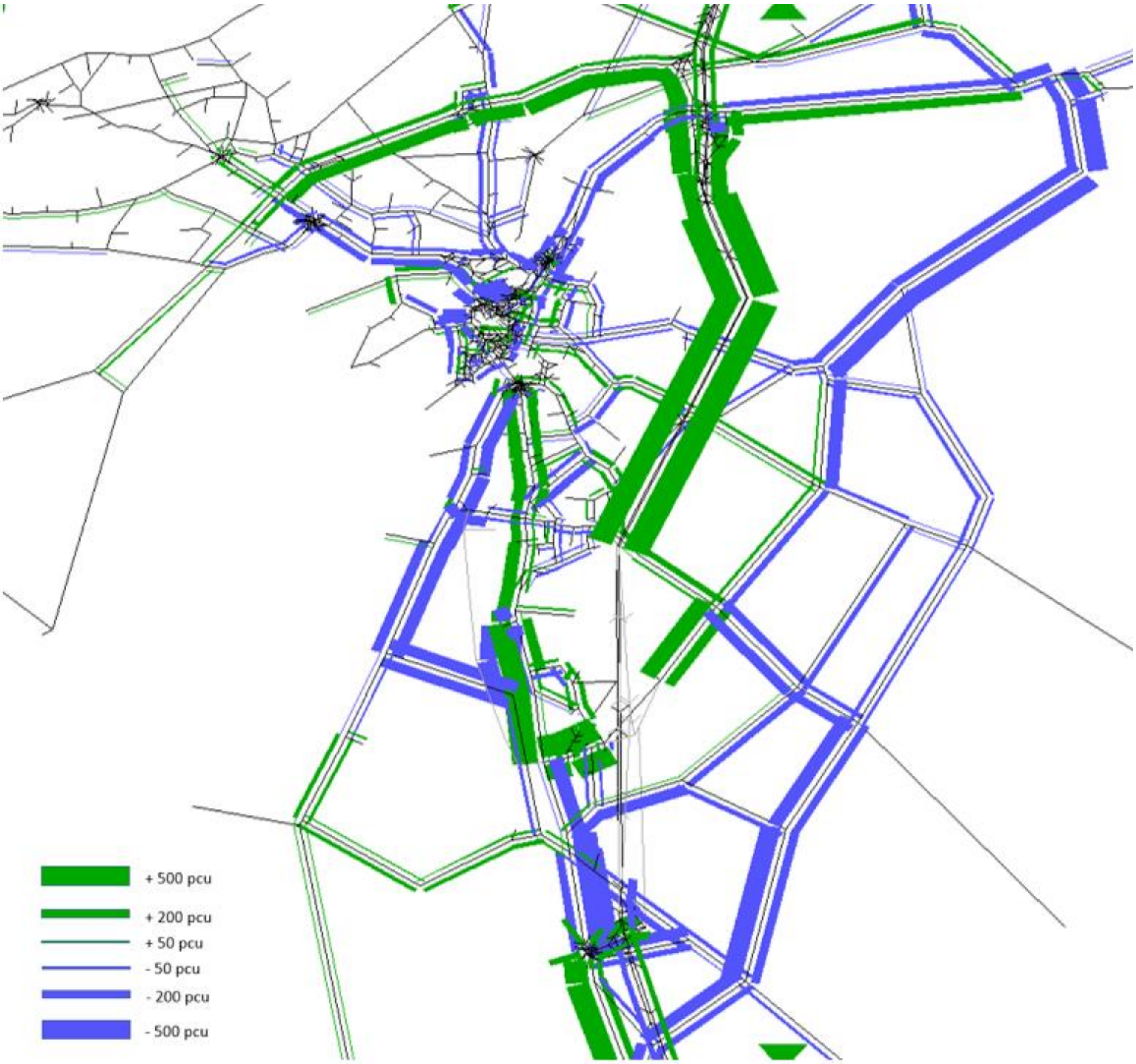


Figure 90: East 2 vs DM, Flow Comparison, 2040, AM Peak (PCU)

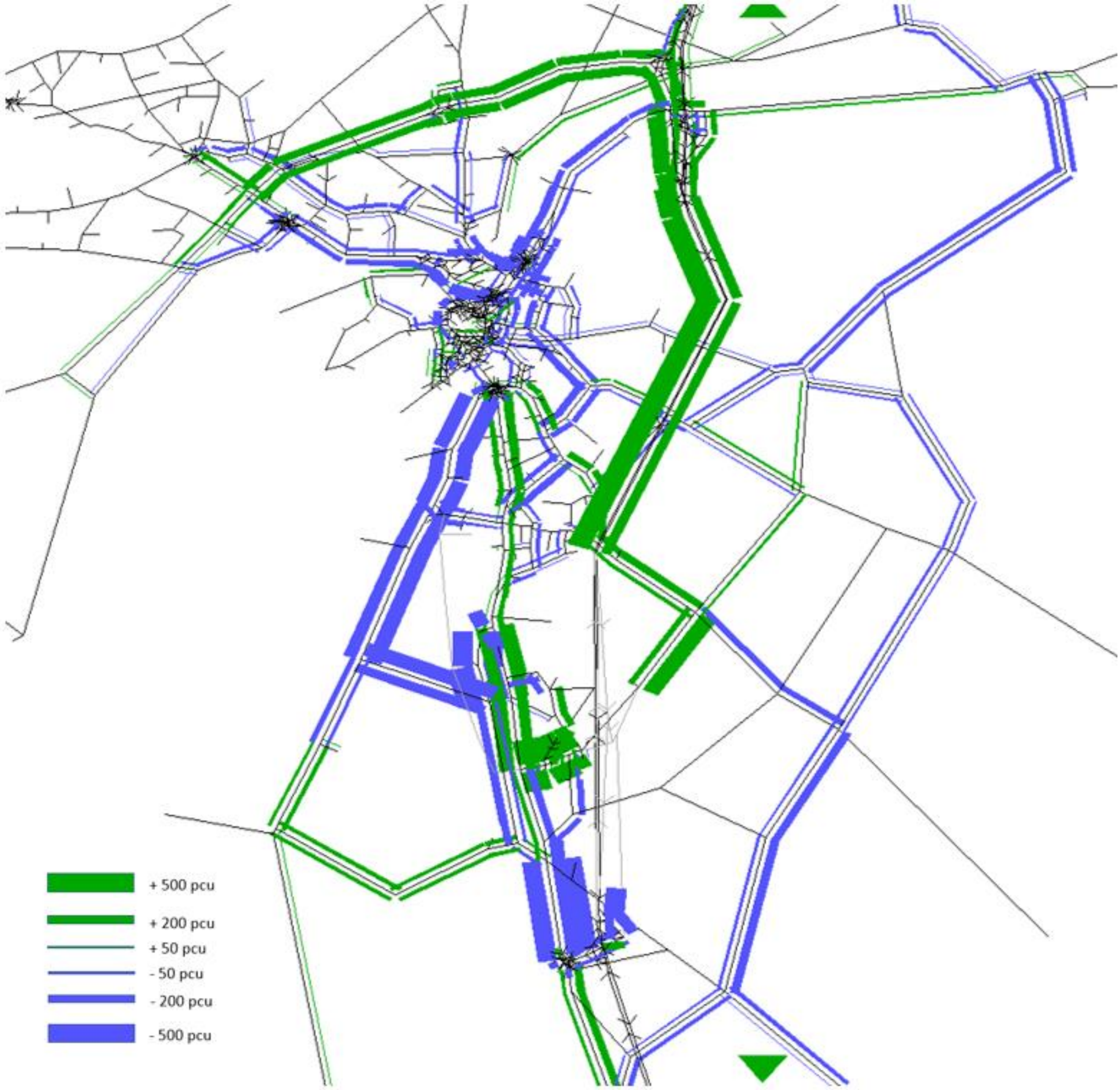


Figure 91: East 1 vs DM, Flow Comparison, 2040, Interpeak (PCU)

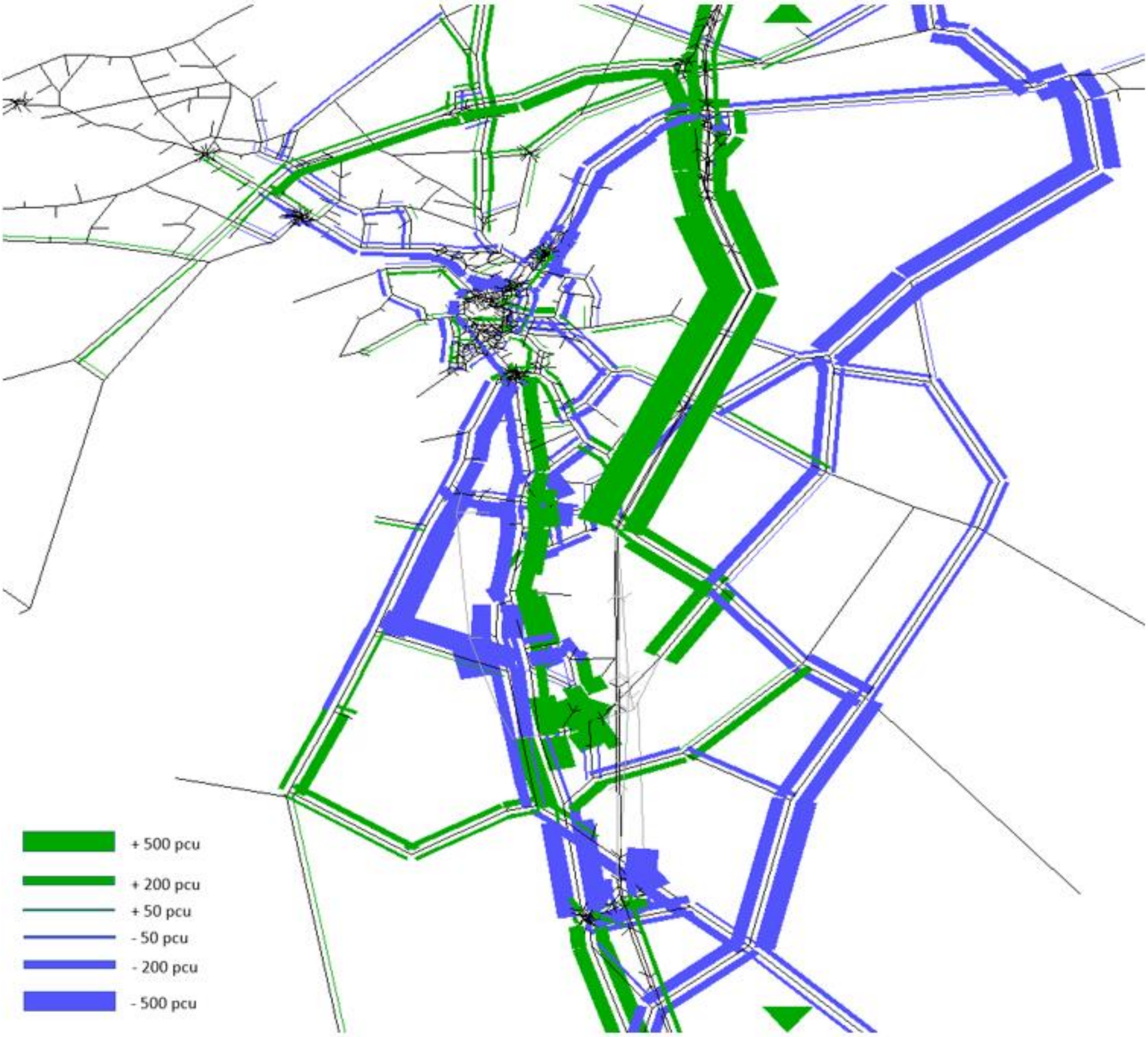


Figure 92: East 1 vs DM, Flow Comparison, 2040, PM Peak (PCU)

Table 4.14 shows the flow changes in the key links within the study area. The right hand columns contain the percentage change in modelled flows when East 2 is implemented.

A net flow reduction along Galgate is achieved during the three periods modelled; however, these figures are the average between a flow decrease in the SB direction and a mild increase on the NB direction, where flow goes up by 2% in the AM peak to 9% in the Interpeak. A version of Table 4.14 by direction can be found in Appendix A.

With respect to the links located east of the A6, flow goes up in Hazelrigg Lane and Blea Tarn Road, as vehicles travel along these routes to use the new infrastructure.

To the west of the A6, flow goes up in Birch Avenue and the south sections of the A588 while decreasing on the north part of the A588 and Ashton Road, as vehicles favour the new route option.

Table 4.14: East 2, 2040, Modelled flows (PCU)

	Road name	Between	Without scheme (2040)			With scheme East 2 (2040)			Change (%)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1167	1084	976	1598	1241	1388	37%	14%	42%
2	A6	M6 J33 & Stoney Lane	1666	1707	1678	1069	929	1046	-36%	-46%	-38%
3	A6	Stoney Lane & Chapel Lane	1531	1269	1253	1141	1106	1132	-25%	-13%	-10%
4	A6	Chapel Lane & Hazelrigg Lane	1278	1139	1077	1028	1080	1376	-20%	-5%	28%
5	A6	Hazelrigg Lane & Burrow Road	996	998	1137	1421	1405	1078	43%	41%	-5%
6	A6	Burrow Road & Ashford Road	1710	1658	1275	1945	1743	1374	14%	5%	8%
7	A6	Ashford Road & Ashton Road	1164	1269	1225	1509	1497	1329	30%	18%	8%
8	M6	J33 & J34	7321	7578	7360	8129	8085	8238	11%	7%	12%
9	Stoney Lane	A6 & Bay Horse Road	271	24	226	81	24	14	-70%	0%	-94%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	517	178	468	165	11	38	-68%	-94%	-92%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	274	15	122	86	19	168	-68%	26%	38%
12	Hazelrigg Lane	A6 & Procter Moss Road	859	492	685	1326	858	1094	54%	74%	60%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	544	251	566	488	279	376	-10%	11%	-34%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	499	164	394	168	48	190	-66%	-71%	-52%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	850	416	522	1002	612	886	18%	47%	70%
16	Bowerham Road	Barnton Road & A6	1557	1229	1613	1510	1177	1558	-3%	-4%	-3%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	156	74	142	79	21	35	-50%	-72%	-76%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	227	70	95	147	74	91	-35%	6%	-4%
19	Birch Avenue	A588 & Highland Brow	305	251	336	399	385	492	31%	53%	46%
20	A588	Birch Avenue & Tarnwater Lane	562	480	565	668	586	815	19%	22%	44%
21	A588	Tarnwater Lane & Ashford Road	1472	1236	1499	1108	785	1048	-25%	-36%	-30%
22	Ashton Road	Ashford Road & A6	1576	1357	1448	1268	864	1101	-20%	-36%	-24%

All values expressed in PCU's. All values are two-way link flows.

*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Figure 93, Figure 94 and Figure 95 show those links where the volume over capacity ratio (V/C) is higher than 85%, indicating the junction is operating at or over capacity.

In the AM peak, there is still some congestion on the A6 at Galgate, present in the north, south and west approaches to the A6 Lancaster Road and Stoney Lane. Congestion is equally present in the north sections of the A6. With respect to the new infrastructure, there is some congestion on Hazelrigg Lane and East link junction. In the PM peak, congestion is also present in the A6 and Hazelrigg. Consideration should be given to the design and capacity of junctions going forward.

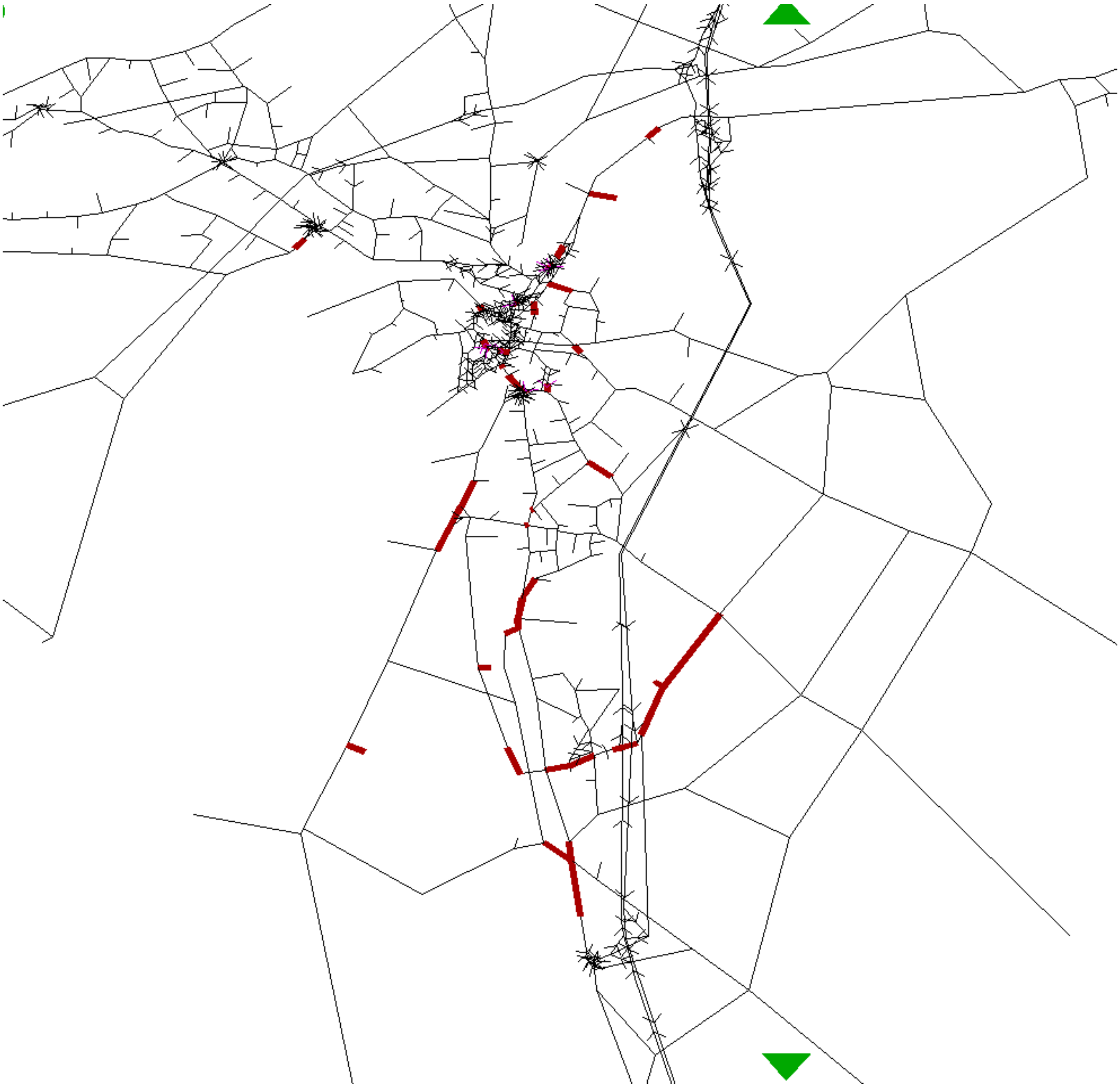


Figure 93: East 2, Volume over Capacity Ratio over 85%, 2040, AM peak

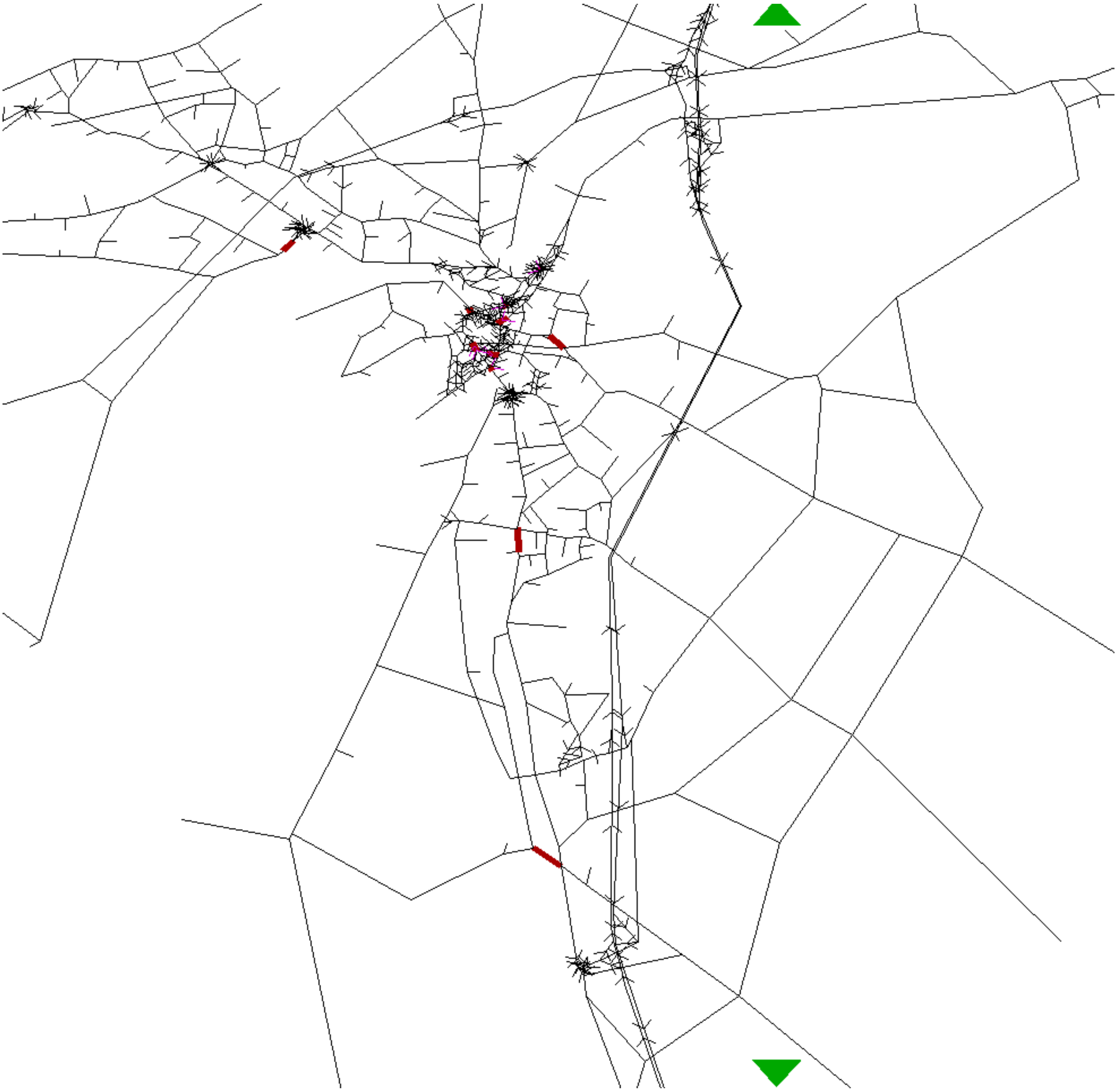


Figure 94: East 2, Volume over Capacity Ratio over 85%, 2040, Interpeak

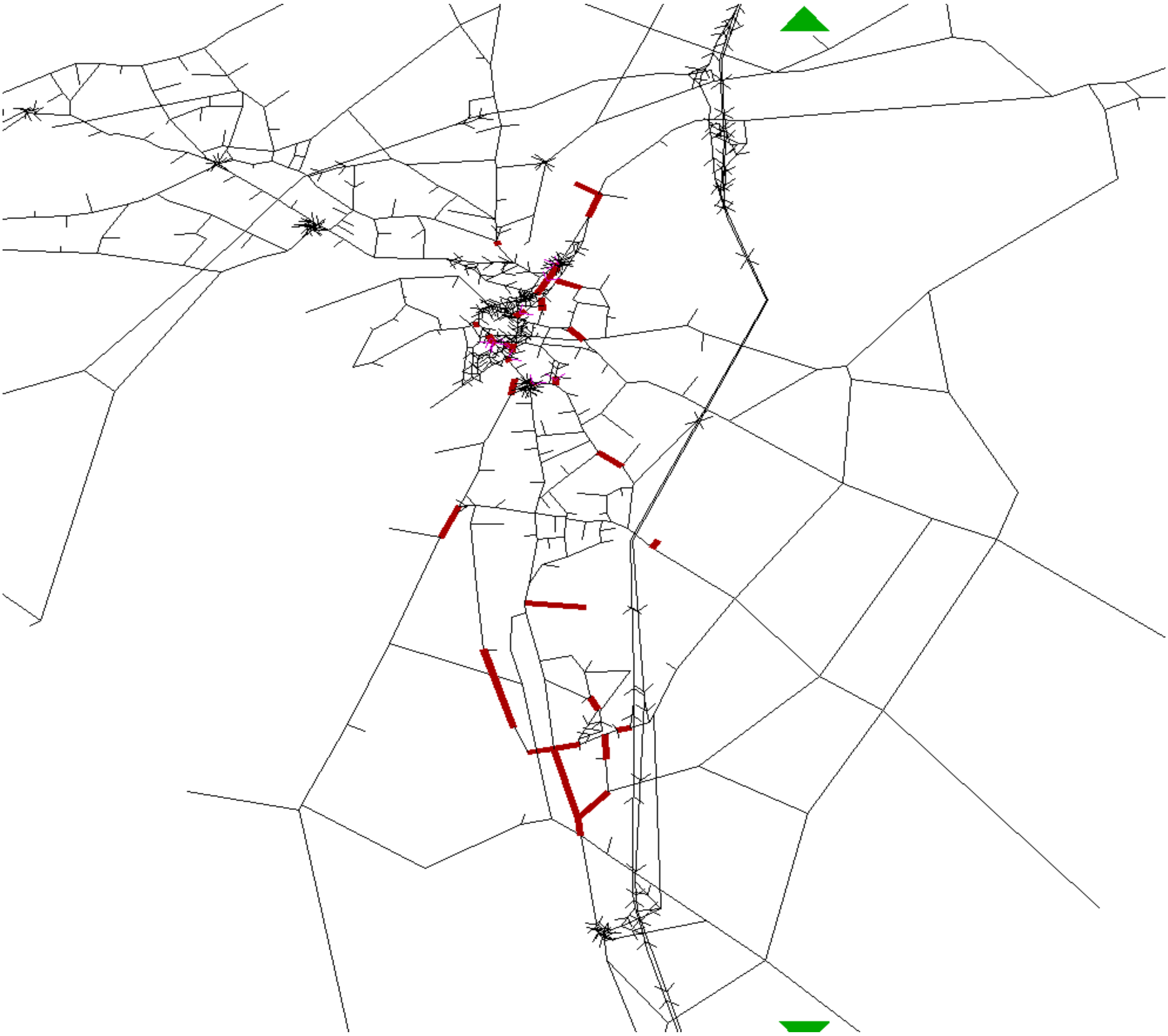


Figure 95: East 2, Volume over Capacity Ratio over 85%, 2040, PM peak

4.4 Summary

Sections 4.3 and 4.4 described the impact of each of the schemes in 2025 and 2040 traffic. Table 4.15 shows the flows travelling along each route option. The Central 1 route option is the one attracting most vehicles in all the peak periods and years modelled except in the 2040 AM, where East 1 achieves a higher throughput.

Table 4.15: Flow travelling along each route option

	AM			IP			PM		
Scheme	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)
Central 1	998	804	1801	416.5	528.3	944.7	684	833	1517
Central 2	992	775	1767	404.3	524.3	928.6	671	801	1472
West 1	365	293	658	163.6	156.1	319.7	279	228	507
West 2	34	106	140	0.4	6.8	7.2	104	280	385
East 1	510	902	1412	129.1	607.8	736.9	229	921	1150
East 2	408	444	852	83.1	301.0	384.1	170	540	710

Scheme	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)	2025 NB flow (pcu)	2025 SB flow (pcu)	2025 flow (pcu)
Central 1	949	669	1618	505.6	814.1	1319.7	845	790	1634
Central 2	958	651	1609	480.6	773.8	1254.4	693	717	1410
West 1	544	398	942	336.1	319.7	655.8	580	252	833
West 2	164	298	461	197.6	239.1	436.7	403	230	633
East 1	722	1041	1763	226.2	899.4	1125.6	508	1083	1591
East 2	678	682	1360	175.2	579.6	754.8	438	748	1186

Table 4.16 shows how effective each scheme is in achieving a reduction of flows in the A6 through Galgate. Central 1 is the only route option achieving a reduction of flow in the A6 through Galgate in both directions, in all peak periods and years modelled.

Table 4.16: Flow changes at the A6 though Galgate under each route option

Scheme	Dir	2025 change (%)			2040 change (%)		
		AM	IP	PM	AM	IP	PM
Central 1	NB	-21%	-20%	-31%	-1%	-7%	-38%
	SB	-39%	-30%	-36%	-65%	-37%	-1%
Central 2	NB	-25%	-24%	-33%	-1%	-14%	12%
	SB	-40%	-35%	-45%	-48%	-36%	2%
West 1	NB	3%	-19%	-13%	-2%	2%	56%
	SB	-20%	-14%	-5%	-9%	21%	27%
West 2	NB	-19%	1%	-25%	-30%	-19%	3%
	SB	-1%	5%	-13%	-5%	5%	34%
East 1	NB	-8%	-8%	-6%	-1%	3%	5%
	SB	-45%	-41%	-43%	-59%	-41%	-16%
East 2	NB	0%	-2%	1%	2%	9%	7%
	SB	-42%	-36%	-44%	-57%	-35%	-22%

Table 4.17 summarises the information related to congestion. The Central 1 route option, able to subtract more flows from the A6, achieves a greater congestion relief on the A6 Lancaster Preston Road and Stoney Road junction. For all the other schemes, congestion is still present at this junction, even in the 2025 opening year.

On the other hand, the new infrastructure also experiences some congestion. This is particularly noticeable in the Central 1 route option, around the new road junction with Hazelrigg Lane.

Table 4.17: Congestion changes under each route option

Criteria	Central 1	Central 2	West 1	West 2	East 1	East 2
Reduces congestion at A6/Stoney Lane in 2025	Yes	Yes	Partially	Partially	Partially	Partially
New infrastructure operates congestion free in 2025	No	No	Yes	Yes	Yes	Yes
Reduces congestion at A6/Stoney Lane in 2040	Partially	Partially	Partially	Partially	Partially	Partially
New infrastructure operates congestion free in 2040	No	No	No	No	No	No

The Central 1 route provides the most competitive alternative to the A6, in terms of travel distance. The Central 2 route option adds a link to the A588; however, in the future year this link is attracting additional flows from the A588 to the A6, causing a detrimental effect on traffic conditions along Galgate. Although none of the route options operate congestion free in 2040, the main disadvantage of the Central 1 route option is that the new junctions experience high levels of congestion. A feasible design that provides enough capacity needs to be studied in subsequent stages of work if this scheme is taken forward.

The West route options provide longer routes that do not offer additional connection to the motorway. These route options have a relatively lower rate of success, as they only achieve moderate flow reductions in the A6 in some of the peak periods and directions modelled. The West route options are more effective in attracting flow from the A588 instead of flow from the A6.

The East route options provide a similar arrangement to the Central ones, however due to slightly longer route alignments they are not successful in subtracting flow from the A6 in all periods and directions modelled.

5. Noise and vibration

5.1 Introduction

An assessment of potential noise and vibration impacts for all six options has been carried out in line with guidance contained within the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 – Noise and Vibration LA 111 Rev-0 (DMRB LA 111).

5.2 Regulatory Context

The following legislation, policy and guidance has been taken into account during the preparation of this assessment:

- National Planning Policy Framework (NPPF) 2019 – sets out the Government's planning policies for England and how these are expected to be applied;
- Noise Policy Statement for England (NPSE) 2010 – the aim of this policy is to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development;
- Planning Practice Guidance: Noise (PPG) – sets out how planning can manage potential noise impacts in new development;
- Land Compensation Act 1973;
- Control of Pollution Act (CoPA) 1974;
- Environmental Protection Act 1990;
- DMRB LA 111 - Noise and Vibration - Revision 0;
- Calculation of Road Traffic Noise, 1988 (CRTN); and,
- World Health Organization (WHO), Night Noise Guidelines for Europe (WHO NNG) 2009.

5.3 Methodology

5.3.1 Construction Noise – Assessment approach

For construction noise and vibration assessment, DMRB LA 111 refers to the use of British Standard 5228: 2009 +A1: 2014 – Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise (BS 5228-1) and Part 2: Vibration (BS 5228-2).

At this stage, it has not been possible to carry out a quantitative analysis of construction impacts, as there is no construction contractor appointed for the proposed scheme. Therefore, following the principles set out in BS 5228, a qualitative analysis has been undertaken based on the likely construction activities required to construct the proposed scheme and the proximity of the nearest sensitive receptors to these activities.

A footprint for each of the six route options has been created and used to determine the distance between potential construction activities and nearby sensitive receptors. The distance from each sensitive receptor within 300m of each alignment has been calculated and placed into a distance band in order to give an indication as to the number of sensitive receptors that lie near to each alignment. Noise from typical highways construction activities at these same distances have been calculated using noise emission data form Annex C of BS 5228-1, to give an indication as to the likely exposure of receptors within in each band.

5.3.2 Construction Noise – Magnitude of Impact and Significance

DMRB LA 111 states that the Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Level (SOAEL) shall be established and reported within the environmental assessment for all noise sensitive receptors within the construction activity Study Area. The LOAEL shall be established using baseline noise levels whilst the SOAEL shall be set as the threshold level, determined following BS 5228-1 Section E3.2 and Table E.1. Table E.1 of BS 5228-1 is reproduced below.

Table E.1 **Example threshold of [A1⟩ potential significant ⟨A1] effect at dwellings**

Assessment category and threshold value period	Threshold value, in decibels (dB) [A1⟩ ($L_{Aeq, T}$) ⟨A1]		
	Category A [A)]	Category B [B)]	Category C [C)]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D)]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

[A1⟩ *NOTE 1 A potential significant effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.*

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise. ⟨A1]

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

DMRB LA 111 states that the LOAEL and SOAEL are derived from ambient noise levels, however, at this stage, baseline noise monitoring has not been undertaken due to the number of route options under consideration and the vast amount of surveys that would be required. Additionally, for this assessment it is deemed unnecessary to assign a baseline noise level to each receptor and a corresponding LOAEL and SOAEL, given the lack of detailed construction information available.

At this stage, the LOAEL has not been defined as it is not required for the determination of significant effects. The SOAEL will be derived based on Category A from Table E.1 of BS 5228-1, which will give an appropriate overview of noise effects of potential construction activities, whilst also providing a worst case assessment.

DMRB LA 111 provides the following table to determine the magnitude of impact for construction noise levels.

Table 5.1: Construction Noise Level Magnitude of Impacts

Magnitude of Impact	Construction noise Level
Major	Above or equal to SOAEL +5 dB
Moderate	Above or equal to SOAEL and below SOAEL +5dB
Minor	Above or equal to LOAEL and below SOAEL
Negligible	Below LOAEL

Construction noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights;

2) A total of days exceeding 40 in any 6 consecutive months

5.3.3 Construction Vibration – Assessment approach

BS 5228-2 contains guidance on vibration levels in structures from construction works. It provides a prediction methodology for mechanised construction works, such as compaction and piling works. The standard also presents guidance for the control of vibration from construction works.

As with construction noise, it has not been possible to carry out a quantitative analysis of potential construction vibration impacts, as there is no construction contractor appointed for the proposed scheme and little is known about specific construction techniques that would be used. Therefore, following the principles set out in BS 5228-2, a qualitative analysis has been undertaken based on the typical construction activities required to construct the proposed scheme that are deemed to produce vibratory effects, and the proximity of the nearest sensitive receptors to these activities.

For building structure response, BS 5228-2 reproduces the advice given in BS 7385-2: 1993 - Evaluation and measurement for vibration in buildings: guide to damage levels from ground borne vibration (BS 7385-2). The response of a building to ground borne vibration is affected by the type of foundation, underlying ground conditions, the building construction and the state of repair of the building. Table 5.2 reproduces the guidance detailed on building classification and guide values for cosmetic building damage.

Table 5.2: Guidance on the effects of vibration levels on building structures from B5228-2

Type of Building	PPV in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures	50 mm/s	50 mm/s
Industrial and heavy commercial buildings		
Un-reinforced or light framed structures	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Residential or light commercial buildings		

Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 5.3, with major damage at values greater than four times the values in the table. BS 7385-2 also notes that the probability of cosmetic damage tends towards zero at 12.5 mm/s peak component particle velocity. Significant adverse effects are expected at levels where vibration can cause cosmetic damage to structures, however, significant adverse effects on humans may occur at lower levels of vibration than this. Table 5.3 (reproduced from BS 5228-2) shows potential adverse effect levels for the human response to vibration in terms of peak particle velocity (PPV).

Table 5.3: Guidance on the human response to vibration levels from B5228-2

Vibration Level	Effect
0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might just be perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10.0 mm/s	Vibration is likely to be intolerable for any more than very brief exposure to this level

The following effect levels for vibration on humans have been derived from the above. Table 5.4 provides the effect levels for construction vibration works.

Table 5.4: Effect levels for vibration on humans

Effect level	Peak Particle Velocity (PPV), mm/s
SOAEL	1.0
LOAEL	0.3

If the predicted vibration level at a sensitive receptor is above the SOAEL, then there is the potential for a significant effect to occur and mitigation should be proposed. However, the duration of the works, the number of receptors affected, and the character of the impact should also be considered.

5.3.3.1 Construction Vibration Calculations

It is expected that during earthworks construction phases, vibratory earthworks compaction using vibratory rollers will be required. BS 5228-2, Table E.1 gives empirical formulae for predicting vibration levels during steady state compaction and during the start-up and run-down transients. The formula used in this assessment are presented below.

Vibratory compaction (steady state):

$$V_{res} = k_s \sqrt{n_d} \left(\frac{A}{x + L_d} \right)^{1.5}$$

Where V_{res} is the resultant PPV (mm/s), n_d is the number vibrating drums, A is the maximum amplitude of drum vibration (mm), *x* is the distance measured along the ground surface (m), L_d is the vibrating roller drum width (m) and where K_s is the scaling factor for the probability of the predicted value being exceeded, and equates to 75 and 276 for a 50% and 5% probability of exceedance, respectively.

Vibratory compaction (start up and run down):

$$V_{res} = k_t \sqrt{n_d} \left(\frac{A^{1.5}}{(x + L_d)^{1.3}} \right)$$

Where K_t is the scaling factor for the probability of the predicted value being exceeded and equates to 65 and 177 for a 50% and 5% probability of exceedance respectively.

5.3.4 Operational Road Traffic Noise – Study Area

At this route options comparison stage, assessment of noise levels at various noise sensitive receptors has has been carried out through noise modelling for all six route options under consideration, using traffic data provided from a strategic traffic model. All committed highways options, as well as those in future delivery plans that are considered 'more than likely' to be built, were included in the traffic model. This includes Bailrigg Garden Village Option, which is included in both the Do Minimum (i.e. without the proposed scheme) and Do Something (i.e. with the proposed scheme) scenarios.

An operational Study Area for this project has been defined using guidance from DMRB LA 111 as follows:

i. The area within 600m of new road links or road links physically changed or bypassed by the project;

ii. The area within 50m of other road links with potential to experience a short-term BNL change of more than 1.0 dB(A) as a result of the project

The Study Area defined by (i) above has been modelled using CadnaA© noise modelling software. This Study Area includes a 600m area around the six route options, and around an identified bypassed route along Bay Horse Road and Procter Moss Road to the east of Galgate and Lancaster.

The additional Study Area defined by (ii) above has been assessed using Basic Noise Levels calculations, in accordance with DMRB LA 111.

It should be noted that the same Study Area has been used for assessment of all six options and is based on the amalgamation of the six proposed route alignments. This is so that the assessment of each option considers the same noise sensitive receptors.

5.3.4.1 Noise Important Areas

Defra have undertaken noise mapping exercises, the latest of which (Round 3 mapping) was published in 2019. Defra has produced a list of Noise Important Areas (NIA), identified as areas requiring action to reduce noise levels. The NIAs identified within the Study Area are listed below and have been included within the assessment of potential noise and vibration effects:

- ID 10526, located along the A6 in Galgate, owned by Lancashire County Council;
- ID 1024, located in Galgate, between Salford Road and the railway line, owned by Railway Safety and Standards Board (RSSB);
- ID 1023, located on the A6 in Scotforth, by Lancaster University Sports Centre, owned by RSSB;
- ID 1022, located in Scotforth, by the railway line and just to the north of Royal Albert Playing fields, owned by RSSB;
- ID 6804, located around the M6 but Scotforth, where Blea Tarn Road passes under the motorway, owned by Highways England;
- ID 6805, located just to the south of M6 J33, on the north bound carriageway side, owned by Highways England;

5.3.5 Operational Road Traffic Noise – Magnitude of Change

The assessment of operational road traffic noise has followed the assessment methodology outlined in DMRB LA 111. Noise levels have been calculated at all residential dwellings and other sensitive receptors (for example schools, hospitals, religious buildings and outdoor spaces) within the defined Study Area for the option.

This assessment considers noise level changes at dwellings and other noise sensitive receptors, with the following comparisons made for both daytime and night time assessments:

- Do Minimum scenario in the baseline year (2025) against Do Something scenario in the baseline year (2025);
- Do Minimum scenario in the baseline year (2025) against Do Something scenario in the future assessment year (2040); and
- Do Minimum scenario in the baseline year (2025) against Do Minimum scenario in the future assessment year (2040).

DMRB LA 111 defines the future year as “the year between opening year and the 15th year of operation”. For this assessment, the future year is the 15th year of operation which for this option is 2040.

Noise levels at 5,364 noise sensitive receptors have been calculated using CadnaA noise modelling software, which incorporates the methodology contained in CRTN and DMRB LA 111. CRTN is a technical memorandum which was produced by the Department of Transport and Welsh Office providing a method of predicting road traffic noise in the United Kingdom. Noise level predictions take account of the following variables:

- Typical weekday volumes of traffic during the eighteen-hour period from 6 am to midnight (18-hour AAWT flows);
- Percentage of heavy goods vehicles (defined as any vehicle with an unladen weight greater than 3.5 tonnes);

- Traffic speeds derived in accordance with the requirements of DMRB LA 111;
- Road gradient;
- Local topography;
- Nature of the ground cover between the road and the receptor;
- Shielding effects of any intervening structures, including allowances for limited angles of view from the road and any reflection effects from relevant surfaces; and
- Road surfacing type (for this assessment, it has been assumed that the road surface on all of the existing highway network, including the M6, is conventional Hot Rolled Asphalt (HRA)).

DMRB LA 111 states that the façade used to calculate noise change shall be chosen as the façade with the greatest magnitude of noise change, or where equal on more than once façade, the façade chosen should be that with the greatest magnitude of noise change and highest Do Something noise level. No guidance is given as to the scenario to assess for the greatest magnitude of noise change, and therefore this has been interpreted for this assessment as the short-term noise change.

For each noise sensitive receptor that is a building, noise level predictions have been made at first floor (4.0 m) height on all building facades, and the prediction point meeting the above criteria has been reported for that noise sensitive receptor. It should be noted that the assessed noise sensitive receptor locations vary slightly for each option considered. This is because some noise sensitive buildings have different noise change and noise level depending on the route option alignment being considered.

Section 3 of DMRB LA 111 provides guidance on the magnitude of impacts for road traffic noise. Magnitude of impact is considered for both the short-term and long-term. The classification of noise impact is set out in Table 5.5and Table 5.6 below.

Table 5.5: Classification of magnitude of noise impacts in the short-term

Noise Change (dB)	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5+	Major

Table 5.6: Classification of magnitude of noise impacts in the long-term

Noise Change (dB)	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10+	Major

Calculations have been performed for all noise sensitive receptors contained within the Study Area, and presented for each route option, for the short-term, long-term, daytime and night-time periods based on the example tables 3.55a and 3.55b in DMRB LA 111.

5.3.6 Operational Road Traffic Noise – Significant Effects

DMRB LA 111 states that the Lowest Observed Adverse Effect Level (LOAEL) and Significant Observed Adverse Effect Levels (SOAEL) shall be set for all noise sensitive receptors within the Study Area, for time periods when they are in use. LOAEL and SOAEL considered in this assessment are defined in Table 5.7 below, which is reproduced from Table 3.49.1 of DMRB LA 111. These LOAEL and SOAEL are considered to apply to both dwellings and other noise sensitive receptors for the purpose of this assessment.

Table 5.7: Operational noise LOAEL and SOAEL for all receptors

Time Period	LOAEL	SOAEL
Day (06:00 – 24:00)	55 dB $L_{A10,18hr}$ (façade)	68 dB $L_{A10,18hr}$ (façade)
Night (23:00-07:00)*	40 dB $L_{night,outside}$ (free-field)	55 dB $L_{night,outside}$ (free-field)
**Note that DMRB LA 111 states the night-time period is 00:00 – 06:00, however, consultation with Highways England has confirmed this period should read "(23:00 – 07:00)".*		

DMRB LA 111 states that the initial assessment of likely significant effects on noise sensitive buildings shall be determined using Table 5.8 below, which is reproduced from Table 3.58 of DMRB LA 111.

Table 5.8: Initial assessment of noise significance

Significance	Short term magnitude of change
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

DMRB LA 111 then asks that other factors are considered for noise sensitive receptors, or groups of noise sensitive receptors, to determine the final significance of effect assessment. The factors to be considered on a case by case basis are:

- Noise level change relative to minor/moderate boundary;
- Differing magnitude of impact in the long-term and/or future year, compared to the short-term;
- Absolute noise level with reference to LOAEL and SOAEL;
- Location of noise sensitive parts of a receptor, e.g. location of sensitive room windows or garden areas;
- Acoustic context e.g. does the proposed scheme change the acoustic character of the area; and,
- Likely perception of change by residents, e.g. changes to landscape or receptor setting.

Applying the above to six different route options would not reflect a proportionate assessment. Therefore, in order to establish the significance of the predicted noise change for this assessment, the following assessment criteria have been adopted for the purposes of conducting a proportionate assessment of six different route options. This criteria can be applied in an automated way based on noise model outputs, and is based on the significance assessment guidance provided in DMRB LA 111.

It is considered that a potentially significant noise change occurs when there is:

- A 1 dB change in noise level in either the short-term or long-term when the resulting noise level exceeds the SOAEL. In the long-term, the noise level must also change by at least 1 dB when comparing the Do Minimum 2040 and Do Something 2040 scenarios to ensure the change is as a result of the proposed scheme opposed to a change that would happen even if the proposed scheme did not go ahead;
- A 3 dB change in the short-term or 5 dB change in the long-term (i.e. "moderate" change from DMRB LA 111) where the resulting noise level is between the LOAEL and SOAEL; and,
- Where noise levels are below the LOAEL, significant effects are not expected.

5.4 Limitations

5.4.1 Construction Assessment

At this stage in the assessment process, there is no information available in terms of construction activities that might be required to construct the proposed scheme, as there is no construction contractor appointed for the proposed scheme. As such, a high-level qualitative assessment has been undertaken. Using professional judgement and previous experience of assessing similar road projects, likely construction activities and their proximity to nearby noise sensitive receptors has been assessed and detailed above.

5.4.2 Operational Assessment

Noise modelling studies are dependent on computer modelling of future traffic conditions. The noise model itself is dependent on input data taken from modelled traffic data and on a number of other assumptions. All computer modelled information is subject to an inherent degree of uncertainty and depends on a number of assumptions.

At any location, noise levels vary from time to time throughout the day and from day to day. Elements of prediction (e.g. the specific noise level at an individual receptor) should be taken as indicative rather than precise and are intended to represent the 'typical' noise level across a whole year, rather than the absolute noise level on a specific day or at a specific time. Caution should therefore be exercised in comparing measured noise levels with predicted noise levels.

Night time noise levels (L_{night}) have been calculated using Method 1 conversion technique described within the TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping'. For this conversion method, night-time noise levels should be derived from hourly night time traffic flows. As this level of traffic detail is rarely available, using the average hourly flow for the night time period, derived from the total traffic flow expected for the 23:00 – 07:00 period is considered sufficient.

It is considered that all data inputs for this assessment are of an adequate level to support the level of assessment as defined in DMRB LA 111.

5.5 Construction Noise Assessment

5.5.1 Construction Noise

The six route options being considered vary considerably in alignment. In order to assess the different construction impacts of each route option at this stage of the project, sensitive receptor counts from the footprint of each route option have been counted to give an indication as to the number of properties that could be impacted for each route option. The distance a sensitive receptor is from a route option gives an indication as to the potential significance of effect from construction noise. Calculations of typical construction activities associated with road options have been made at set distances, using noise emission data form Annex C of BS 5228-1, and are presented in Table 5.9 below. Please refer to Table A2 for a detailed plant and equipment list including the assumed noise emission data.

Table 5.9: Noise levels for typical construction activities at distance bands

Construction Activity	Calculated noise level at distance (dBA)[1]					
	10 m	20 m	50 m	100 m	200 m	300 m
Highway works						
Site and vegetation clearance	**89**	**83**	**75**	**68**	61	57
Earthworks (carriageway and embankments)	**87**	**81**	**72**	**65**	59	55
Construction of new road: Installation of new kerbs and carriageway pavement	**87**	**81**	**72**	**65**	59	55
Central reserve and island paving works	**87**	**80**	**72**	**65**	58	54
Drainage works	**86**	**79**	**71**	64	57	53
Installation of new lights, gantries and traffic signals	**90**	**84**	**75**	**68**	61	57
Placing of new road marking works	**85**	**79**	**70**	63	57	53
Structures works						
Earthworks: excavation and piling mat	**88**	**82**	**73**	**66**	59	56
Piles installation (rotatory bored piling assumed)	**83**	**77**	**68**	61	54	51
Concreting: abutments bases, stems and central reserve	**78**	**72**	**63**	56	49	45
Steel deck beams install	**86**	**80**	**72**	**65**	58	54
Surfacing works	**85**	**79**	**71**	**64**	57	53
Spray waterproofing	**83**	**77**	**68**	62	55	51
Bridge joints	**91**	**85**	**76**	**69**	62	59
Install parapet to bridges	**85**	**79**	**70**	63	57	53

[1] The reported noise level is a façade level. Calculations have considered noise emission data form Annex C of BS5228 Part 1: Noise (BSI, 2014). Refer to Appendix B for the noise emission list of plant and equipment.

[2] Values shown in red and bold are those which are above the assumed construction SOAEL for this assessment (65 dB $L_{Aeq,T}$)

As described in Section 5.3.1, footprints of the option alignments have been used to count how many sensitive properties lie within distance bands of each proposed scheme option. These distance counts are shown in Table 5.10 below.

Table 5.10: Number of properties within distance bands of route option footprint

Proposed Scheme Option	Number of properties within distance band from route option footprints					
	0-10 m	10-20 m	20-50 m	50-100 m	100-200 m	200-300 m
Central 1	1	0	31	106	290	347
Central 2	1	0	31	103	283	351
East 1	1	0	31	103	285	236
East 2	1	0	32	103	279	240
West 1	1	0	2	18	124	84
West 2	1	0	4	18	130	84

Table 5.9 shows that for most of the assumed construction activities, noise levels from construction works are expected to exceed the SOAEL for receptors within 100 m of the construction works, whilst the SOAEL is predicted to be exceeded for sensitive receptors within 50 m of the construction works for all construction activities.

Table 5.10 shows that of the receptors that lie within 100 m of each option, the western route options (West 1 and West 2) are predicted to impact the fewest numbers of sensitive receptors (between 21 and 23 sensitive receptors). For the other four route options (Central 1, Central 2, East 1 and East 2), the numbers of sensitive receptors within 100m of the works is comparable (between 135 and 138 sensitive receptors). Similarly, when considering the numbers of sensitive receptors within 50m of construction works (i.e. where the SOAEL is predicted to be exceeded for all construction activities), the western route options (West 1 and West 2) are again predicted to impact the fewest numbers of sensitive receptors (between 3 and 5 sensitive receptors). For the remaining four route options (Central 1, Central 2, East 1 and East 2) the numbers of sensitive receptors within 50m are comparable (between 32 and 33 sensitive receptors).

It should however be noted that the numbers of nearby sensitive receptors is only one indicator of potential construction noise impact and significance of effect. Other factors, such as the duration of noise levels above SOAEL, would influence whether predicted noise levels would be considered as significant effects. Therefore, at this stage, it is considered that West 1 and West 2 would be preferable from a construction noise perspective, however, further assessment would be required at Environmental Statement stage, where more construction details should be known, to determine the significance of construction noise effects. Where significant construction noise effects are likely, mitigation measures should be considered, following guidance in Section 5.6.5.1.

5.5.2 Construction Vibration

In order to assess the potential construction vibration impact of each proposed scheme option on vibration sensitive properties, vibration calculations, using formulas shown in Section 5.3.3.1, have been made at distances to match those of the property counts in Table 5.10. At this stage, calculations for only earthworks compaction works have been made. There is potential that some route options would require piling, however, in order to calculate the predicted PPV for piling, the exact distance from piling rig to property is required. At the time of writing, the method of construction and therefore the need for piling works for the proposed structures (e.g. bridges) is not known, therefore no further assessment of piling works has been undertaken at this stage.

For the purposes of the earthwork's compaction calculations, it has been assumed that an 18t Bomag BW 216 PD-5 single drum vibratory compactor would be used. It has been assumed (based on information in the datasheet for this roller) that this compactor has a single vibratory drum, a drum width of 2.13 m and has a maximum amplitude of vibration of 1.7 mm.

Table 5.11 provides a summary of the predicted vibration levels during vibratory compaction works at the same distances as the receptors counts performed for the construction noise assessment and reported in Table 5.10.

Table 5.11: Predicted PPV values due to vibratory earthworks compaction

Predicted vibration level from vibratory compaction works for 5% and 50% probability of predicted value being exceeded.								
		10 m	20 m	50 m	100 m	200 m	300 m
Steady State	Predicted PPV (mm/s)5%	**14.5**	**5.9**	**1.6**	0.6	0.2	0.1
	Predicted PPV (mm/s) 50%	**3.9**	**1.6**	0.4	0.2	0.1	0.0
Start up and run down	Predicted PPV (mm/s) 5%	**15.3**	**7.0**	**2.3**	**1.0**	0.4	0.2
	Predicted PPV (mm/s) 50%	**5.6**	**2.6**	0.8	0.4	0.1	0.1
Note: Values shown in red and bold are those which are above the assumed construction vibration SOAEL for this assessment							

Table 5.11 indicates that properties within 50 m of vibratory compaction works could experience significant adverse effects, with PPV values above 1 mm/s, the level at which vibrations would be perceptible and cause possible annoyance, as set out in Table 5.3. It is recommended that in these instances, mitigation measures be implemented to reduce the impact of vibratory compaction on the nearest receptors, following guidance in Section 5.6.5.1.

When considering the numbers of sensitive receptors within 50m of construction works (i.e. where the SOAEL is potentially exceeded for vibratory compaction works), the western route options (West 1 and West 2) are predicted to impact the fewest numbers of sensitive receptors (between 3 and 5 sensitive receptors). For the remaining four route options (Central 1, Central 2, East 1 and East 2) the numbers of sensitive receptors within 50m are comparable (between 32 and 33 sensitive receptors).

5.6 Operational Noise Assessment

5.6.1 Impact of the options at sample receptor locations

Whilst all noise sensitive receptors have been assessed in this assessment, 18 sample receptors have been selected within the Study Area which largely correspond with the sample roads presented in the traffic assessment (Chapter 4), and six of which are also contained within NIA. The aim of the sample receptor locations is to present a more detailed assessment of sample locations across the route options. For the purposes of reporting and discussion, consideration is given to properties predicted to experience, minor, moderate and major magnitudes of impact as negligible impacts are not considered significant. Sample receptor locations are shown in Figure 5.1.

Table 5.12 presents the daytime Do Minimum noise levels for 2025 and 2040 for all six route options. For each route option, the assessment location chosen for each noise sensitive building was chosen in accordance with DMRB LA 111. For most of the route options, this has resulted in identical receptor placement, however there are some exceptions and therefore the Do Minimum noise levels can differ for different route options, dependent upon which façade was predicted to experience the largest magnitude of change. The Do Minimum noise change from 2025 to 2040 is also presented, which shows the predicted long-term noise impacts should none of the route options go ahead.

Table 5.12: Summary of predicted noise levels in the opening and future year Do Minimum scenarios for all route options at sample receptor locations

Receptor Name	Predicted day-time $L_{A10,18hr}$ (dB) noise level (Façade) and noise change for Do Minimum scenario																	
	Central 1			Central 2			East 1			East 2			West 1			West 2		
	2025	2040	LT DM	2025	2040	LT DM	2025	2040	LT DM	2025	2040	LT DM	2025	2040	LT DM	2025	2040	LT DM
3 Oakwood Gardens	68.9	68.8	-0.1	68.9	68.8	-0.1	68.9	68.8	-0.1	68.9	68.8	-0.1	68.9	68.8	-0.1	68.9	68.8	-0.1
Canal Cottage, Main Road, Galgate*	73.4	73.9	0.5	73.4	73.9	0.5	73.4	73.9	0.5	73.4	73.9	0.5	73.4	73.9	0.5	63.3	63.7	0.4
23a Salford Road, Galgate*	64.9	68.7	**3.8**	64.9	68.7	**3.8**	64.9	68.7	**3.8**	52.7	53.6	0.9	64.9	68.7	**3.8**	64.9	68.7	**3.8**
Corner House, Bay Horse Road	56.6	60.7	**4.1**	56.6	60.7	**4.1**	56.6	60.7	**4.1**	56.6	60.7	**4.1**	56.6	60.7	**4.1**	56.6	60.7	**4.1**
Hampson Cottages, Hampson Lane*	73.3	73.7	0.4	73.3	73.7	0.4	73.3	73.7	0.4	69.7	70.1	0.4	61.9	62.3	0.4	73.3	73.7	0.4
Beechcroft, Hazelrigg Lane	55.1	58.9	**3.8**	55.1	58.9	**3.8**	55.1	58.9	**3.8**	55.1	58.9	**3.8**	55.1	58.9	**3.8**	55.5	58.5	**3.0**
Langthwaite Terrace, Littlefell Lane	52.9	55.6	2.7	52.9	55.6	2.7	54.3	57.2	2.9	52.9	55.6	2.7	54.3	57.2	2.9	54.3	57.2	2.9
Sellerley Farm, Conder Green Road	62.4	68.5	**6.1**	62.4	68.5	**6.1**	62.4	68.5	**6.1**	62.4	68.5	**6.1**	62.4	68.5	**6.1**	62.4	68.5	**6.1**
Woodside, Ashton Road	48.9	50.2	1.3	44.9	46.3	1.4	48.9	50.2	1.3	48.9	50.2	1.3	48.9	50.2	1.3	48.9	50.2	1.3
Romar, Langshaw Lane	65.0	65.5	0.5	65.0	65.5	0.5	55.2	56.4	1.2	55.2	56.4	1.2	65.0	65.5	0.5	62.9	63.3	0.4
Salt Oke, Bay Horse Lane	74.3	74.2	-0.1	74.3	74.2	-0.1	59.7	59.8	0.1	74.3	74.2	-0.1	74.3	74.2	-0.1	70.3	70.2	-0.1
5 Leach House Lane	65.9	66.0	0.1	57.8	58.1	0.3	68.0	68.2	0.2	65.9	66.0	0.1	68.0	68.2	0.2	57.8	58.1	0.3
Deep Cutting Farm, Ashton Road	69.0	72.2	**3.2**	56.2	59.3	**3.1**	69.0	72.2	**3.2**	56.2	59.3	**3.1**	56.2	59.3	**3.1**	69.0	72.2	**3.2**
33 Spruce Avenue*	46.8	47.6	0.8	46.8	47.6	0.8	46.8	47.6	0.8	46.8	47.6	0.8	46.8	47.6	0.8	46.8	47.6	0.8
Oubeck Cottage, Scotforth Road*	71.9	71.5	-0.4	71.9	71.5	-0.4	71.9	71.5	-0.4	71.9	71.5	-0.4	71.9	71.5	-0.4	71.9	71.5	-0.4
294 Bowerham Road*	74.8	75.3	0.5	74.8	75.4	0.6	74.8	75.4	0.6	74.8	75.4	0.6	74.4	74.9	0.5	74.8	75.4	0.6
Lily Croft, Stoney Lane	60.3	61.6	1.3	62.1	62.8	0.7	63.9	64.3	0.4	63.9	64.3	0.4	60.3	61.6	1.3	60.3	61.6	1.3
Dam Head Farm, Procter Moss Road	51.4	54.9	**3.5**	51.4	54.9	**3.5**	51.4	54.9	**3.5**	51.4	54.9	**3.5**	51.4	54.9	**3.5**	54.4	57.4	**3.0**

** These receptors are inside a NIA as described in Section Section 5.3.4.1*

LT DM = Long-Term Do Minimum noise change (Do Minimum 2040 – Do Minimum 2025)

Table 5.12 shows that most of the sample receptors are predicted to experience negligible noise impacts should the proposed scheme not go ahead. For each route option, a small number of sample receptors (up to six) are predicted to experience a minor adverse impact (3dB or more in the long-term), one of which is located within a NIA. A single sample receptor is predicted to experience a moderate adverse increase in noise (5 dB or more in the long-term) should the proposed scheme not go ahead.

Table 5.13 presents the predicted Do Something 2025 and Do Something 2040 and associated short-term and long-term daytime noise impacts at the sample receptor locations, for each of the route options.

Table 5.13: Summary of noise levels in the opening and future year Do Something scenarios for all route options at sample receptors

Receptor Name	**Predicted day-time $L_{A10,18hr}$ (dB) noise level (Façade) and noise change for Do Something scenarios**																							
	Central 1				**Central 2**				**East 1**				**East 2**				**West 1**				**West 2**			
	2025	**2040**	**ST**	**LT**	**2025**	**2040**	**ST**	**LT**	**2025**	**2040**	**ST**	**LT**	**2025**	**2040**	**ST**	**LT**	**2025**	**2040**	**ST**	**LT**	**2025**	**2040**	**ST**	**LT**
3 Oakwood Gardens	68.0	68.5	-0.9	-0.4	68.0	68.9	-0.9	0.0	67.5	68.7	-1.4	-0.2	67.7	68.9	-1.2	0.0	67.9	69.2	-1.0	0.30.4	68.3	69.0	-0.6	0.1
Canal Cottage, Main Road, Galgate*	72.3	71.8	-1.1	-1.6	72.5	72.5	-0.9	-0.9	72.2	71.9	-1.2	-1.5	72.1	72.2	-1.3	-1.2	73.1	73.7	-0.3	0.3	64.6	64.7	1.3	1.4
23a Salford Road, Galgate*	66.0	68.0	1.1	3.1	63.6	65.1	-1.3	0.2	65.9	68.0	1.0	3.1	52.5	53.3	-0.2	0.6	64.2	67.4	-0.7	2.5	63.8	67.4	-1.1	2.5
Corner House, Bay Horse Road	50.3	58.8	-6.3	2.2	50.2	56.9	-6.4	0.3	50.0	54.2	-6.6	-2.4	50.6	54.6	-6.0	-2.0	53.4	60.1	-3.2	3.5	57.0	61.3	0.4	4.7
Hampson Cottages, Hampson Lane*	73.3	73.7	0.0	0.4	73.3	73.7	0.0	0.4	73.3	73.7	0.0	0.4	69.6	70.1	-0.1	0.4	61.9	62.4	0.0	0.5	73.3	73.7	0.0	0.4
Beechcroft, Hazelrigg Lane	58.1	60.4	3.0	5.3	57.7	60.0	2.6	4.9	59.1	61.0	4.0	5.9	58.6	60.5	3.5	5.4	54.8	59.5	-0.3	4.4	55.4	59.0	-0.1	3.5
Langthwaite Terrace, Littlefell Lane	53.1	55.3	0.2	2.4	53.1	54.8	0.2	1.9	54.9	57.6	0.6	3.3	53.2	55.7	0.3	2.8	54.1	57.6	-0.2	3.3	54.2	57.6	-0.1	3.3
Sellerley Farm, Conder Green Road	65.8	69.8	3.4	7.4	61.6	65.5	-0.8	3.1	65.7	70.2	3.3	7.8	64.7	70.1	2.3	7.7	63.8	69.4	1.4	7.0	63.2	69.5	0.8	7.1
Woodside, Ashton Road	48.7	51.2	-0.2	2.3	45.4	46.8	0.5	1.9	48.7	50.9	-0.2	2.0	48.7	50.9	-0.2	2.0	48.6	50.9	-0.3	2	48.8	50.9	-0.1	2.0
Romar, Langshaw Lane	65.2	65.7	0.2	0.7	65.2	65.6	0.2	0.6	57.5	58.5	2.3	3.3	57.0	58.4	1.8	3.2	64.9	65.5	-0.1	0.5	62.9	63.4	0.0	0.5
Salt Oke, Bay Horse Lane	74.4	74.3	0.1	0.0	74.4	74.4	0.1	0.1	59.6	59.9	-0.1	0.2	74.5	74.7	0.2	0.4	74.4	74.3	0.1	0.0	70.1	71.0	-0.2	0.7
5 Leach House Lane	65.7	65.7	-0.2	-0.2	58.0	59.5	0.2	1.7	67.5	67.6	-0.5	-0.4	65.5	65.9	-0.4	0.0	68.0	68.8	0.0	0.8	58.1	59.6	0.3	1.8
Deep Cutting Farm, Ashton Road	69.1	71.3	0.1	2.3	55.9	59.2	-0.3	3.0	69.0	71.2	0.0	2.2	56.2	58.3	0.0	2.1	55.9	58.4	-0.3	2.2	69.2	71.3	0.2	2.3
33 Spruce Avenue*	46.7	47.3	-0.1	0.5	46.7	47.3	-0.1	0.5	46.6	47.2	-0.2	0.4	46.7	47.2	-0.1	0.4	47.1	47.5	0.3	0.7	47.0	47.5	0.2	0.7
Oubeck Cottage, Scotforth Road*	71.4	72.2	-0.5	0.3	71.4	72.4	-0.5	0.5	70.7	71.9	-1.2	0.0	71.0	72.3	-0.9	0.4	71.6	72.7	-0.3	0.8	71.8	72.5	-0.1	0.6
294 Bowerham Road*	75.0	75.6	0.2	0.8	75.1	75.7	0.3	0.9	75.3	75.8	0.5	1.0	75.2	75.7	0.4	0.9	74.3	75.1	-0.1	0.7	74.9	75.5	0.1	0.7
Lily Croft, Stoney Lane	59.3	59.1	-1.0	-1.2	61.2	61.4	-0.9	-0.7	64.5	64.9	0.6	1.0	63.5	63.8	-0.4	-0.1	60.0	60.0	-0.3	-0.3	61.5	63.0	1.2	2.7
Dam Head Farm, Procter Moss Road	49.4	54.0	-2.0	2.6	49.4	52.6	-2.0	1.2	49.5	52.2	-1.9	0.8	49.7	52.1	-1.7	0.7	49.4	54.2	-2.0	2.8	54.5	57.6	0.1	3.2

** These receptors are inside a NIA as described in Section 5.3.4.1*

ST = Short-Term noise change (Do Something 2025 – Do Minimum 2025) LT = Long Term noise change (Do Something 2040 – Do Minimum 2025)

Table 5.13 shows that of the 18 sample receptors, six are predicted to experience negligible impacts irrespective of which proposed scheme option is considered. For the remaining sample receptors, impacts of minor or greater are predicted and are therefore discussed in greater detail below.

3 Oakwood Gardens is predicted to experience minor beneficial noise impacts for the East 1, East 2 and West 1 route options. Table 5.12 shows that in Do Minimum 2025, noise levels are currently above SOAEL for this property, and therefore, for the East 1, East 2 and West 1 route options, a significant beneficial effect is predicted.

Canal Cottage, which lies inside NIA 10526, is predicted to experience short-term minor beneficial noise impacts for the Central 1, East 1 and East 2 route options, and a short-term minor adverse noise impact for the West 2 route option. In Central and Eastern route options, traffic flows reduce through Galgate with the addition of link roads between the existing M6 J33 and a new junction proposed at Hazelrigg Lane, leading to reductions in nose level along the A6 through Galgate. The West 2 option however introduces a link road from the A6 south of Galgate to the A6 north of Galgate, which increases traffic flow around the south of the A6 in Galgate, including within NIA 10526. Table 5.12 shows that in Do Minimum 2025, noise levels are currently above SOAEL for this property, and therefore the predicted beneficial noise impacts in Central 1, East 1, East 2 route options and the adverse noise impact in West 2 route option are considered as significant effects.

23a Salford Road, which lies inside NIA 1024, is predicted to experience a minor adverse noise impact in both the short-term and long-term for the Central 1 and East 1 route options. The small noise increase between opening years is attributed to small changes in traffic flow and speed. In the long-term, there is a large increase in traffic flow, which in turn causes an increase in noise level. This increase however is present in both the future year Do Minimum and Do Something scenarios, and so it is considered that this increase is not as a result of the proposed scheme options, but other factors which includes a higher demand for this route in 2040, with or without the proposed scheme in place. For the West 2 and Central 2 route options, minor beneficial short-term noise impacts are predicted for this sample receptor. This is because these options introduce link roads to the west (for West 2) and parallel to the M6 (for Central 2), which reduce traffic flows, and therefore predicted noise levels along Salford Road in the Galgate area, demonstrates that in Do Minimum 2040, noise levels are predicted to be above SOAEL for this property, and therefore the adverse noise impacts predicted for route options Central 1 and East 1, and the beneficial noise impacts predicted for West 2 and Central 2 route options are considered as significant adverse and beneficial effects respectively.

Corner House, Bay Horse Road, lies on the assumed bypassed route to the east of the Study Area and is predicted to experience major beneficial short-term noise impacts for the Central and Eastern route options, and a minor beneficial short-term noise impact for the West 1 route option. This is due to a short-term reduction in demand along Bay Horse Road with the introduction of the Central and Eastern route options. However, in the long-term, these benefits are not predicted. This is because there is a predicted increase in traffic flow in this area in the long-term Do Minimum scenario, illustrated by the predicted minor adverse noise impact without the proposed scheme in place. Table 5.12 shows that predicted noise levels at this property in Do Minimum 2040 for all route options is between LOAEL and SOAEL levels and therefore any minor noise impact is not considered significant, however all Central and Eastern route options are considered to have predicted significant beneficial noise effects due to the predicted major beneficial noise impact in the short-term.

Beechcroft, Hazelrigg Lane, is predicted to experience moderate adverse noise impacts in both the short-term and long-term scenarios for Central 1, East 1 and East 2 route options. Minor adverse impacts are predicted for the Central 2 route option in both the short-term and long-term, and for the West 1 and West 2 route options in the long-term. Table 5.12 shows that in the long-term, minor adverse noise impacts are predicted at this location without the proposed scheme in place. This is due to an increase in traffic flow along Hazelrigg Lane in 2040, even without the proposed scheme in place. The predicted noise levels for all scenarios are between LOAEL and SOAEL at this sample receptor and so the predicted minor noise impacts are not considered significant. However, for the Central 1, East 1 and East 2 route options, significant adverse noise effects are predicted as a result of the predicted moderate noise impacts.

Langthwaite Terrace is predicted to experience minor adverse impacts in the long-term for East 1, West 1 and West 2 route options. In all options, the long-term impact is greater than the short-term and in the long-term Do Minimum comparison, as demonstrated by Table 5.12 which shows the East 1, West 1 and West 2 route options are predicted to see an increase in noise level of 2.7dB without the proposed scheme in place, due to long-term increases in traffic flow in this area. Table 5.13 illustrates that noise levels in the Do Something scenarios at this property are predicted to be between LOAEL and SOAEL and therefore minor noise impacts are not considered significant.

Sellerley Farm, located in the west of the Study Area, is predicted to experience a moderate adverse noise impact in the long-term scenario for all options with the exception of the Central 2 route option, where a minor adverse noise impact is predicted. In the short-term, moderate adverse noise impacts are predicted for Central 1 and East 1, and minor adverse noise impacts for East 2 and West 1 route options. However, for this sample receptor, moderate adverse noise impacts are also predicted in the long-term Do Minimum scenario. Predicted noise levels in the Do Minimum 2025 scenario are below SOAEL, however, for the Central 1, East 1, East 2, West 1 and West 2 options, Do Something 2040 noise levels are predicted to be above SOAEL, and therefore significant adverse effects are expected for these options as a result of the long-term moderate adverse noise impacts.

Romar, Langshaw Lane, is located to the east of the M6 motorway. For the East 1 and East 2 options, minor adverse impacts are predicted in both the short-term and long-term scenarios. This is due to the introduction of a new road (noise source) in close proximity to the sample receptor location. Predicted noise levels at this sample receptor are between LOAEL and SOAEL therefore minor adverse impacts are not considered to result in significant effects.

Deep Cutting Farm is predicted to experience a noise level increase of between 2.9 and 3dB in the long-term if the proposed scheme does not go ahead. However, for all route options with the exception of Central 2, negligible adverse impacts are predicted. For the Central 2 option, a minor adverse impact of 3 dB is predicted in the long-term, however, without the proposed scheme in place, a 2.9 dB increase is predicted for this sample receptor location. Therefore, no options are considered to result in significant effects for this sample receptor.

Oubeck Cottage, which lies inside NIA 1023, is predicted to experience a minor beneficial noise impact for the East 1 route option in the short-term. Table 5.12 and Table 5.13 demonstrate that all predicted noise levels in all scenarios and options are above SOAEL, and therefore this minor beneficial noise impact is considered to result in a significant beneficial effect for this sample receptor.

Lily Croft, Stony Lane, lies to the east of M6 J33 and is predicted to experience a minor beneficial short-term impact for the Central 1 route option, and a minor adverse short-term impact for the West 2 route option. As predicted noise levels in all scenarios and options are between LOAEL and SOAEL, these minor impacts are not considered to result in significant effects.

Dam Head Farm on Proctor Moss Road is located on the identified bypassed route to the east of the Study Area. This sample receptor is predicted to experience short-term minor beneficial noise impacts for all route options with the exception of the West 2 route option where a minor adverse impact is predicted in the long-term. Noise levels are below the LOAEL for all options with the exception of West 2, where noise levels are just above LOAEL, therefore minor impacts are not considered to result in significant effects.

5.6.2 Magnitude of Impact

Table 5.14 to Table 5.18 provide the noise level change comparisons in accordance with the reporting requirements within DMRB LA 111. It should be noted that in the commentary that follows these tables, emphasis is placed on discussion of noise changes of minor magnitude or more (more than 1 dB change in the short-term and 3dB in the long-term).

5.6.2.1 Short-term impacts

Table 5.14: Daytime short-term noise impact Do Minimum 2025 vs Do Something 2025

Scenario / Comparison: Daytime Do Minimum 2025 against Do Something 2025														
Change in noise level			Central 1		Central 2		East 1		East 2		West 1		West 2	
			Dwelling	Other	Dwelling	Other	Dwelling	Other	Dwelling	Other	Dwelling	Other	Dwelling	Other
Increase in noise level, $L_{A10,\ 18hr}$	0.1 – 0.9	Negligible	1,271	13	1,100	12	1,552	14	1,544	16	1,958	14	3,039	21
	1.0 – 2.9	Minor	1,030	5	879	4	1,185	5	1,121	4	273	0	143	0
	3.0 – 4.9	Moderate	257	0	231	0	88	0	79	0	25	0	7	0
	5+	Major	1	0	1	0	1	0	3	0	11	0	2	0
No change	0		102	0	102	0	101	1	167	0	1,116	6	735	1
Decrease in noise level, $L_{A10,\ 18hr}$	0.1 – 0.9	Negligible	2,293	13	2,643	16	1,953	10	1,998	10	1,830	13	1,273	11
	1.0 – 2.9	Minor	290	2	285	1	378	3	349	3	67	0	105	0
	3.0 – 4.9	Moderate	62	0	49	0	53	0	56	0	26	0	24	0
	5+	Major	25	0	41	0	20	0	14	0	25	0	3	0

Table 5.14 indicates that for most options in the short-term daytime, the majority of noise sensitive receptors are predicted to experience negligible or minor operational noise impacts. In terms of non-negligible noise impacts, the following is predicted:

- Central 1 route option – 1,293 receptors (1,288 dwellings and five others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 257 moderate and 1,035 minor), compared to 379 receptors (377 dwellings and two others) experiencing beneficial noise impacts of minor magnitude or more (25 major, 62 moderate and 292 minor);
- Central 2 route option – 1,115 receptors (1,111 dwellings and four others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 231 moderate and 883 minor), compared to 376 receptors (375 dwellings and one other) experiencing beneficial noise impacts of minor magnitude or more (41 major, 49 moderate and 286 minor);
- East 1 route option – 1,279 receptors (1,274 dwellings and five others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 88 moderate and 1,190 minor), compared to 454 receptors (451 dwellings and three others) experiencing beneficial noise impacts of minor magnitude or more (20 major, 53 moderate and 381 minor);
- East 2 route option – 1,207 receptors (1,203 dwellings and four others) are predicted to experience adverse noise impacts of minor magnitude or more (three major, 79 moderate and 1,125 minor), compared to 422 receptors (419 dwellings and three others) experiencing beneficial noise impacts of minor magnitude or more (14 major, 56 moderate and 352 minor);
- West 1 route option – 309 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (11 major, 25 moderate and 273 minor), compared to 118 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude or more (25 major, 26 moderate and 67 minor);
- West 2 route option – 149 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (two major, seven moderate and 143 minor), compared to 132 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude or more (three major, 24 moderate and 105 minor);

- The Central and East route options have similar predicted adverse impacts in the short-term, although the East route options are predicted to result in more beneficial impacts. The West route options have substantially lower numbers of adverse impacts when compared to the Central and East route options, due largely to the new roads being routed through more rural areas for the West route options, whereas the Central and East route options run through Bailrigg and other more densely populated areas.

- Overall, it is considered that, for the short-term daytime period, West 2 is the most preferable option from a noise perspective, as it results in the least number of adverse impacts of minor magnitude or more (149), and also provides a substantial number of beneficial impacts of minor magnitude or more (132). The second most preferable option from a noise perspective is West 1, as this also provides a comparatively lower number of adverse impacts of minor magnitude or more (309), but also provides a substantial number of beneficial impacts of minor magnitude or more (132). Of the remaining proposed scheme options, there is little to choose between them as they all provide a similar number of adverse impacts of minor magnitude or more (between 1,115 and 1,293) and a similar number of beneficial impacts of minor magnitude or more (between 376 and 454). Table 5.15 below presents the predicted short-term night-time noise impacts.

Table 5.15: Night-time short-term noise impact - Do Minimum 2025 vs Do Something 2025

Scenario / Comparison: Night time Do Minimum 2025 against Do Something 2025														
Change in noise level			**Central 1**		**Central 2**		**East 1**		**East 2**		**West 1**		**West 2**	
			Dwelling	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**
Increase in noise level, $L_{A10,\ 18hr}$	0.1 – 0.9	Negligible	1,299	13	1,055	12	1,572	14	1,535	15	1,971	13	2,707	17
	1.0 – 2.9	Minor	1,201	5	1,085	4	1,208	5	1,170	4	250	0	105	0
	3.0 – 4.9	Moderate	30	0	23	0	15	0	9	0	24	0	6	0
	5+	Major	1	0	1	0	1	0	3	0	5	0	1	0
No change	0		200	3	204	0	231	0	273	1	1,316	8	1,189	6
Decrease in noise level, $L_{A10,\ 18hr}$	0.1 – 0.9	Negligible	2,307	11	2,654	16	1,919	11	2,000	11	1,658	12	1,209	10
	1.0 – 2.9	Minor	225	1	228	1	321	3	279	2	65	0	92	0
	3.0 – 4.9	Moderate	56	0	49	0	55	0	55	0	29	0	19	0
	5+	Major	12	0	32	0	9	0	7	0	13	0	3	0

Table 5.15 shows that in the short-term night-time, the situation is largely similar to the daytime and can be summarised as follows:

- Central 1 route option – 1,237 receptors (1,232 dwellings and five others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 30 moderate and 1,206 minor), compared to 294 receptors (293 dwellings and one other) experiencing beneficial noise impacts of minor magnitude or more (12 major, 56 moderate and 225 minor);
- Central 2 route option – 1,109 receptors (1,109 dwellings and four others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 23 moderate and 1,089 minor), compared to 310 receptors (309 dwellings and one other) experiencing beneficial noise impacts of minor magnitude or more (32 major, 49 moderate and 229 minor);
- East 1 route option – 1,229 receptors (1,224 dwellings and five others) are predicted to experience adverse noise impacts of minor magnitude or more (one major, 15 moderate and 1,213 minor), compared to 388 receptors (385 dwellings and three others) experiencing beneficial noise impacts of minor magnitude or more (nine major, 55 moderate and 324 minor);
- East 2 route option – 1,186 receptors (1,182 dwellings and four others) are predicted to experience adverse noise impacts of minor magnitude or more (three major, nine moderate and 1,174 minor), compared to 343 receptors (341 dwellings and two others) experiencing beneficial noise impacts of minor magnitude or more (seven major, 55 moderate and 281 minor);
- West 1 route option – 279 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (five major, 24 moderate and 250 minor), compared to 107 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude or more (13 major, 29 moderate and 65 minor); and,
- West 2 route option – 112 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (one major, six moderate and 105 minor), compared to 114 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude or more (three major, 19 moderate and 92 minor).

In summary, all route options with the exception of West 2, would be regarded as adverse in the short-term night time owing to the much larger numbers of adverse impacts of minor magnitude or more compared to the number of beneficial impacts of minor magnitude or more. Therefore, West 2 is considered the most preferable route option from a noise point of view. As with the short-term daytime period, West 1 would be considered the second most favourable route option from a noise perspective as it results in a lower number of adverse impacts compared to the other route options, whilst also providing a number of beneficial impacts. As with the daytime short-term assessment, the remaining route options are considered to be comparable from a noise perspective as they provide similar numbers of impacts to one another.

5.6.2.2 Long-term impacts

Table 5.16 below presents the predicted long-term noise change for the Do Minimum scenario, i.e. without any route option in place.

Table 5.16: Long-term Do Minimum noise impact - Do Minimum 2025 vs Do Minimum 2040

Scenario / Comparison: Do Minimum 2025 against Do Minimum 2040						
Change in Noise Level			Daytime		Night-time	
			No of dwellings	No of other sensitive receptors	No of dwellings	No of other sensitive receptors
Increase in noise level, $L_{A10,\ 18hr}$	0.1 – 2.9	Negligible	4,676	28	4,809	28
	3.0 – 4.9	Minor	290	1	215	1
	5.0 – 9.9	Moderate	51	0	27	0
	10+	Major	10	0	8	0
No change	0	No Change	82	1	73	2
Decrease in noise level, $L_{A10,\ 18hr}$	0.1 – 2.9	Negligible	222	3	199	2
	3.0 – 4.9	Minor	0	0	0	0
	5.0 – 9.9	Moderate	0	0	0	0
	10+	Major	0	0	0	0

Table 5.16 indicates that without the proposed scheme in place, 352 properties (351 dwellings and one other) in the daytime period and 251 (250 dwellings and one other) in the night-time period are predicted to experience adverse noise impacts of minor magnitude or more in the long-term whilst no properties are predicted to experience beneficial noise impacts without the proposed scheme in place. As such, if none of the route options go ahead, an adverse impact is predicted as a result of the expected traffic growth in the Study Area

Table 5.17: Long-term daytime noise impact - Do Minimum 2025 vs Do Something 2040

Scenario / Comparison: Do Minimum 2025 against Do Something 2040 daytime														
Change in noise level			**Central 1**		**Central 2**		**East 1**		**East 2**		**West 1**		**West 2**	
			Dwelling	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**
Increase in noise level, $L_{A10, 18hr}$	0.1 – 2.9	Negligible	3,893	24	3,849	22	3,518	22	4,074	25	4,721	29	4,598	30
	3.0 – 4.9	Minor	404	3	468	3	690	3	385	3	252	2	463	0
	5.0 – 9.9	Moderate	281	0	83	0	285	0	288	0	251	0	80	0
	10+	Major	0	0	0	0	0	0	0	0	0	0	0	0
No change	0		176	1	236	2	229	2	107	1	32	1	25	1
Decrease in noise level, $L_{A10, 18hr}$	0.1 – 2.9	Negligible	575	5	668	6	607	6	475	4	75	1	165	2
	3.0 – 4.9	Minor	1	0	24	0	1	0	1	0	0	0	0	0
	5.0 – 9.9	Moderate	1	0	3	0	1	0	1	0	0	0	0	0
	10+	Major	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.17 indicates that in the long-term, the majority of noise sensitive receptors are predicted to experience negligible noise impacts. In terms of long-term noise impacts of minor magnitude or more, the following is predicted:

- Central 1 route option – 688 receptors (685 dwellings and three others) are predicted to experience adverse noise impacts of minor magnitude or more (281 moderate and 407 minor), compared to two receptors (both dwellings) experiencing beneficial noise impacts of minor magnitude or more (one moderate and one minor);
- Central 2 route option – 554 receptors (551 dwellings and three others) are predicted to experience adverse noise impacts of minor magnitude or more (83 moderate and 471 minor), compared to 27 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude or more (three moderate and 24 minor);
- East 1 route option – 978 receptors (975 dwellings and three others) are predicted to experience adverse noise impacts of minor magnitude or more (285 moderate and 693 minor), compared to two receptors (both dwellings) experiencing beneficial noise impacts of minor magnitude or more (one moderate and one minor);
- East 2 route option – 676 receptors (673 dwellings and three others) are predicted to experience adverse noise impacts of minor magnitude or more (288 moderate and 388 minor), compared to two receptors (both dwellings) experiencing beneficial noise impacts of minor magnitude or more (one moderate and one minor);
- West 1 route option – 505 receptors (503 dwellings and two other) are predicted to experience adverse noise impacts of minor magnitude or more (251 moderate and 254 minor), compared to no receptors experiencing beneficial noise impacts of minor magnitude or more; and,
- West 2 route option – 543 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (80 moderate and 463 minor), compared to no receptors experiencing beneficial noise impacts of minor magnitude or more.

The number of long-term daytime impacts is considerably less than in the short-term and there is more similarity between all six route options in the long-term.

Overall, it is considered that, for the long-term daytime period, West 1 is the most preferable route option from a noise perspective, as it results in the least number of adverse impacts of minor magnitude or more (505). The second most preferable route option from a noise perspective is considered to be two options, Central 2 and West 2, as these provide a comparable number of adverse impacts of minor magnitude or more (554 and 543 respectively) whilst Central 2 also provides a small number (27) of beneficial effects of minor magnitude or more. Of the remaining route options, Central 1 and East 2 provide very similar numbers of adverse impacts of minor magnitude or more (688 and 676 respectively) and are therefore considered to be joint third most preferable from a noise point of view, whilst lastly, East 1 is considered to be most adverse as a result of the highest numbers of adverse noise impacts of minor magnitude or more (978) whilst providing two beneficial impacts of minor magnitude or more.

Table 5.18: Long term night-time noise impact - Do Minimum 2025 vs do Something 2040

Scenario / Comparison: Do Minimum 2025 against Do Something 2040 Night Time														
Change in noise level			**Central 1**		**Central 2**		**East 1**		**East 2**		**West 1**		**West 2**	
			Dwelling	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**	**Dwelling**	**Other**
Increase in noise level, $L_{A10, 18hr}$	0.1 – 2.9	Negligible	4,275	28	4,055	26	4,183	27	4,342	29	4,780	32	4,675	31
	3.0 – 4.9	Minor	336	0	500	1	350	0	349	0	400	0	433	0
	5.0 – 9.9	Moderate	70	0	14	0	74	0	76	0	54	0	44	0
	10+	Major	0	0	0	0	0	0	0	0	0	0	0	0
No change	0		145	0	182	1	174	0	131	1	46	1	43	1
Decrease in noise level, $L_{A10, 18hr}$	0.1 – 2.9	Negligible	504	5	560	5	549	6	432	3	51	0	136	1
	3.0 – 4.9	Minor	1	0	20	0	1	0	1	0	0	0	0	0
	5.0 – 9.9	Moderate	0	0	0	0	0	0	0	0	0	0	0	0
	10+	Major	0	0	0	0	0	0	0	0	0	0	0	0

Table 5.18 indicates that, similar to the short-term, the long-term night time impacts are slightly less than the long-term daytime, and can be summarised as follows:

- Central 1 route option – 406 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (70 moderate and 336 minor), compared to one receptor (a dwelling) experiencing a beneficial noise impact of minor magnitude;
- Central 2 route option – 515 receptors (514 dwellings and one other) are predicted to experience adverse noise impacts of minor magnitude or more (14 moderate and 501 minor), compared to 20 receptors (all dwellings) experiencing beneficial noise impacts of minor magnitude;
- East 1 route option – 424 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (74 moderate and 350 minor), compared to one receptor (a dwelling) experiencing a beneficial noise impact of minor magnitude;
- East 2 route option – 425 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (76 moderate and 349 minor), compared to one receptor (a dwelling) experiencing a beneficial noise impact of minor magnitude;
- West 1 route option – 454 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (54 moderate and 400 minor), compared to no receptors experiencing beneficial noise impacts of minor magnitude or more; and,
- West 2 route option – 477 receptors (all dwellings) are predicted to experience adverse noise impacts of minor magnitude or more (44 moderate and 433 minor), compared to no receptors experiencing beneficial noise impacts of minor magnitude or more.

All route options would be regarded as adverse in the long-term owing to the larger numbers of adverse impacts of minor magnitude or more compared to the beneficial impacts of minor magnitude or more. There is not a large variation between the route options in the long-term night-time, with Central 2 route option predicted to experience the greatest number of long-term night time adverse impacts of minor magnitude or more (515) and Central 1 predicted to experience the least number of long-term night time adverse impacts of minor magnitude or more (406). Central 2 does result in 20 beneficial impacts of minor magnitude or more, however, for the long-term night-time period, all options are considered to be comparable in terms of preference from a noise point of view.

5.6.2.3 Summary

Variations between the 2025 and 2040 traffic flow have resulted in differing impacts in the short-term and long-term scenarios for all route options. Whilst in the short-term, there is a clear distinction between the most adversely and least adversely impacted route options, in the long-term these differences are less pronounced.

Based on the magnitude of impact assessment, it is evident that the West 1 and West 2 route options are both the most preferable proposed scheme options from a noise point of view. The joint second most preferable route options are considered to be the Central 1 and Central 2 options, whilst the least preferable are East 1 and East 2.

5.6.3 Significance of Effect

An assessment of the significance of effects has been carried out using the criteria detailed in Section 5.3.6. Analysis of the predicted noise levels in the assessment scenarios and the resultant change in noise levels has been undertaken for all of the noise sensitive receptors within the noise model Study Area.

Table 5.19 and Table 5.20 below presents a summary of the number of noise sensitive receptors that meet the significance criteria, in terms of meeting the absolute noise level thresholds (LOAEL and SOAEL) and the required noise change to result in a significant effect, in both the short-term and long-term. Figures 5.2 to 5.13 illustrate the locations of the predicted significant effects during the daytime and night-time periods. It should be noted that the total numbers of significant adverse and beneficial effects shown on these figures are a combined number of daytime and night-time effects at each noise sensitive receptor, whereas Table 5.19 and Table 5.20 present the daytime and night-time effects separately. Therefore, the total numbers of significant adverse and beneficial effects may differ between the figures and Table 5.19 and Table 5.20 below.

Table 5.19: Significance of effect assessment, short-term

	Number of noise sensitive receptors meeting significance criteria in the short-term for each route option																							
	Central 1				Central 2				East 1				East 2				West 1				West 2			
	Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
>SOAEL	24	673	101	223	21	581	53	236	25	659	123	323	115	637	144	289	25	71	1	58	14	60	0	87
LOAEL<X<SOAEL	249	4	72	35	252	3	74	38	248	4	60	34	76	5	57	32	22	16	49	23	4	7	27	8
Total	**273**	**677**	**173**	**258**	**273**	**584**	**127**	**274**	**273**	**663**	**183**	**357**	**191**	**642**	**201**	**321**	**47**	**87**	**50**	**81**	**18**	**67**	**27**	**95**

Table 5.20: Significance of effect assessment, long-term

	Number of noise sensitive receptors meeting significance criteria in the long-term for each route option																							
	Central 1				Central 2				East 1				East 2				West 1				West 2			
	Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial		Adverse		Beneficial	
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
>SOAEL	24	465	86	117	6	573	7	74	24	612	83	137	132	652	35	75	18	269	0	14	20	288	0	18
LOAEL<X<SOAEL	233	7	22	0	68	6	37	0	235	6	18	0	235	7	13	0	199	19	25	0	30	10	3	0
Total	**257**	**472**	**108**	**117**	**74**	**579**	**44**	**74**	**259**	**618**	**101**	**137**	**367**	**659**	**48**	**75**	**217**	**288**	**25**	**14**	**50**	**298**	**3**	**18**

The tables above demonstrate that all route options are predicted to result in both significant adverse and significant beneficial effects in the daytime and night-time periods, although all route options result in more significant adverse effects than significant beneficial effects.

In terms of significant adverse noise effects, route option West 2 is the least adverse with 18 adverse effects in the short-term daytime, 67 in the short-term night time, 50 in the long-term daytime and 298 in the long-term night-time. The West 1 route option is predicted to have similar effects to the West 2 route option in the short-term, but in the long-term-term has considerably more adverse effects, 217 in the long-term daytime and 288 in the long-term night-time.

In contrast, the East 1 and East 2 route options have the greatest number of adverse noise effects. East 2 has 191 adverse effects in the short-term daytime, 642 in the short-term night-time, 367 in the long-term daytime and 659 in the long-term night-time whilst East 1 has a similar number of effects (273 adverse effects in the short-term daytime, 663 in the short-term night-time, 259 in the long-term daytime and 618 in the long-term night-time. Both Central route options have similar numbers of adverse effects in all scenarios and would lie in the middle of the six route options in terms of ranking of significant adverse effects.

In summary, from a noise significance perspective, the West route options are most preferred, the Central route options second most preferred, and the East route options are least preferred.

5.6.3.1 Noise Important Areas

A summary of noise sensitive receptors within NIA predicted to experience either adverse or beneficial effects, in either the short-term or long-term, day or night is presented in Table 5.21 below.

Table 5.21: Noise sensitive properties predicted to experience a significant effect inside NIAs for each route option

NIA	Number of noise sensitive receptors meeting significance criteria in the short-term and long-term, day and night for each route option inside Noise Important Areas (NIAs)											
	Central 1		Central 2		East 1		East 2		West 1		West 2	
	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial
10525	0	0	0	0	0	2	0	0	0	0	0	0
10526	0	43	0	10	0	43	0	44	0	0	2	0
1023	0	0	0	0	0	2	0	0	0	0	0	0
1024	2	0	0	3	0	0	0	0	0	0	0	2

The above table indicates that all options, with the exception of West 1, provide beneficial effects for noise sensitive receptors within NIAs inside the Study Area. Adverse effects are predicted at just two properties inside NIA 1024 for the Central 1 route option and two properties in NIA 10526 for West 2 route option.

5.6.4 Basic Noise Level (BNL) changes outside of the model Study Area

As described in Section 2.3.4 above, the Study Area consists of a 600m buffer around all route option alignments and the bypassed route to the east of the route options, and a 50m buffer around roads outside of this Study Area that are predicted to experience Basic Noise Level (BNL) changes of 1dB or more in the short-term.

For the 600m buffer around the route option alignments and bypassed route, noise model calculations have been performed to demonstrate predicted noise changes associated with the route options. DMRB LA 111 requires that any roads predicted to have a 1dB change in BNL beyond the 600m buffer should also be assessed, however these roads can be assessed in terms of BNL calculations opposed to noise model calculations.

Therefore, for each road predicted to change by 1dB or more, the total number of noise sensitive properties within 50m of such a road has been summed to give a total number of adverse and beneficial impacts for each route option. This is reported in Table 5.22.

Table 5.22: Basic Noise Level counts for roads outside of the modelled Study Area

Option	Properties within 50m of a beneficial road link	Properties within 50m of an adverse road link
Central 1	226	171
Central 2	226	708
East 1	269	708
East 2	293	184
West 1	18	0
West 2	0	0

Table 5.22 indicates that Central 2 and East 1 route options have considerably more properties near to adverse impact roads, whilst the West route options have no properties near to adverse impact roads. Central 1 and East 2 are largely similar to one another.

5.6.5 Mitigation

5.6.5.1 Construction

At this stage, a qualitative assessment of construction impacts has been undertaken. During the next stage of assessment (Environmental Impact Assessment) a quantitative assessment should be undertaken following the principles set out in DMRB LA 111 and BS 5228, which would include the identification of areas where mitigation would be required. Notwithstanding this, the qualitative assessment undertaken demonstrates the potential for significant effects during the construction phase, therefore, noise and vibration mitigation measures are likely to be required during the construction phase.

The below best practice measures would form the minimum requirement for mitigation during the construction phase:

All work would be undertaken to the guidance detailed in BS 5228- and BS 5228-2. It is anticipated that the following mitigation measures would be employed on site to ensure that noise and vibration levels are adequately controlled (all of which are considered to be examples of Best Practicable Means (BPM)):

- Appropriate selection of plant and equipment, construction methods and programming. Only plant conforming with or better than relevant national or international standards, directives or recommendations on noise or vibration emissions would be used. Construction plant would be maintained in good condition with regards to minimising noise and vibration emission;
- The contractor should obtain "Prior Consent" under Section 61 of the Control of Pollution Act 1974 (CoPA) from the Environmental Health Department at Lancaster City Council prior to undertaking particularly noisy or high vibratory works;
- Plant would be operated and maintained appropriately, with due regard for manufacturer recommendations. All vehicles, plant and equipment would be switched off when not in use;

- Use of appropriate noise abatement site hoardings and screens, where appropriate. Where practicable, gates would not be located opposite noise sensitive receptors;
- Careful selection of routes and programming for the transport of construction materials, spoil and personnel so as to reduce the risk of increased noise and vibration impacts during construction;
- Vehicle and mechanical plant/equipment used for the purpose of the works should be fitted with effective exhaust silencers, to be maintained in good working order and operated in such a manner so as to minimise noise emissions;
- The positioning of construction plant and activities to minimise noise and vibration at sensitive locations;
- Equipment that breaks concrete by pulverising or similar, rather than by percussion, would be used where practicable;
- Mufflers shall be used on pneumatic tools;
- The use, where necessary, of effective sound reducing enclosures.
- Programming works so that the requirement for working outside normal working hours is minimised;
- Minimise the potential for higher vibration levels from the vibratory roller, by taking into account the guidance within TRL report 429 (ensure that the vibratory roller is not started, stopped, or the direction of travel reversed close to sensitive receptors). TRL report 429 states *"…it should be remembered that for vibrating rollers there are likely to be transients at starting and stopping which may generate particle velocities which can be twice as large as for steady state operation. Significantly lower speeds than the 1.5 to 2.5 kph specified will also result in higher particle velocities. The implications of this are that rollers should not be started, stopped, or the direction of travel reversed near to sensitive structures."*

It is anticipated that a schedule of noise and vibration monitoring would be agreed with The Environmental Department at Lancaster City Council and noise and vibration limits be included within any Construction Environmental Management Plan (CEMP) agreed.

It would be expected that the contractor shall endeavour to undertake construction works between the following hours:

- 08:00 to 18:00 Monday to Friday;
- 08:00 to 13:00 Saturdays; and,
- No work on Sundays or Bank Holidays.

Some limited night-time and/or weekend working is likely to be required on occasion for activities such as the bridge over the West Coast Main Line railway. The contractor would be required to obtain "Prior Consent", under the conditions of Section 61 of CoPA, from the Environmental Health Department at Lancaster City Council prior to undertaking such works.

5.6.5.2 Operation

The assessment performed has illustrated that noise mitigation should be considered for the route options, irrespective of what route option is taken forward to the next stage of assessment. This is due to the large numbers of noise increases of minor magnitude or more, and the potential significant adverse effects predicted.

Specific mitigation and enhancement measures such as the use of earth bunds or noise barriers would be developed as appropriate at a later stage of project development as part of an iterative design and assessment process.

A summary of potential mitigation measures, which should be further investigated through further stages of project development, include the following:

- Installation of noise barriers and re-location of existing noise barriers – noise barriers are a common mitigation measure used to mitigate noise from road traffic. The intention is to block the direct propagation path between the noise source (road) and receptor (sensitive receptors), meaning sound energy must travel around or over the barrier to reach the receptor. The attenuation achieved by a barrier installation is a function of the path difference created (the additional distance that sound energy must travel over/around a barrier). Noise barriers can be reflective (i.e. they reflect sound energy incident with the barrier) or absorptive (they absorb sound energy incident with the barrier). The benefit of noise barriers is that they require a relatively small space to construct (whilst needing enough room to be safe), and can therefore be located relatively close to the road traffic noise source, increasing their effectiveness;

- Installation of noise bunds – noise bunds work in a similar way as noise barriers, however, they generally require more land take than for an equivalent height noise barrier, owing to the requirement for sloped sides. The top of the bund is also located further from the noise source than an equivalent height noise barrier would be and is therefore less effective. The benefits of noise bunds however are that they can sometimes be constructed from surplus material won from site, leading to savings on transportation and disposal costs, and impacts associated with disposal of material. They also provide a more natural looking finish than a noise barrier often does;

- Installation of Low Noise Road Surface (LNRS) – LNRS is a porous road surfacing material which acts to absorb noise generated by car engines and noise generated by the interaction of car tyres and the road surface. When first laid, LNRS can provide noise reductions of around 5 dB, however its lifespan is around 10 to 15 years during which the performance deteriorates linearly as the porosity of the material becomes less due to weathering and silts etc clogging up the road surface. To remain effective, LNRS is normally re-laid every 10 to 15 years or so but maintenance of the road surface such as high pressure washing can improve its acoustic performance as it prevents the pores from blocking up. Additionally, there are road surfaces available which are classed as very Low Noise Road Surface (vLNRS). vLNRS works in the same way as LNRS but provides an enhanced acoustic performance;

- Locating new roads within cuttings where feasible – cutting slopes work in a similar way as noise bunds do, by blocking the direct propagation path between the noise source and receptor. They do however generate surplus material that would need relocating or completely removing from site; and,

- Moving roads further from sensitive receptors – where possible, proposed roads should be located as far away from sensitive receptors as is reasonably practicable. Noise propagation is a function of distance, and therefore maximising the distance between the noise source (road) and receptors (sensitive receptors) would aid the reduction of noise levels for sensitive receptors.

5.6.6 Residual impacts

At this stage, no specific noise mitigation measures are proposed for the various route option alignments. Therefore, the residual impacts are as presented in the various assessments performed within Sections 5.5 and 5.6.

During the next stage of proposed scheme development, assessment of a single route option is likely to be undertaken, and specific noise mitigation measures would be proposed. It is therefore likely that some of the predicted impacts and effects described in Sections 5.5 and 5.6 could be mitigated, however it is also likely that significant effects would remain, even with mitigation measures proposed

6. Air quality

6.1 Introduction

Air quality is a consideration for any development proposal involving changes in the nature and locations of emissions to air. As well as introducing new road traffic emission sources, the route options have the potential to change traffic conditions on the local road network, as well as other roads in the wider area, both positively and negatively. These changes have the potential to effect emissions from vehicle traffic and ultimately ambient air quality concentrations at nearby sensitive receptors. During construction, there is also the potential, primarily, for construction related dust emissions.

An air quality assessment has therefore been undertaken of the six route options to establish the potential effects of the route options on local air quality. This chapter describes the assessment undertaken and the potential air quality effects arising from each of the route options.

6.2 Legislative and Policy Context

6.2.1 Legislation

Key legislation relevant to the protection of air quality is summarised in Table 6.1 whilst further details regarding relevant air quality legislation and how air quality is managed at both a national and local scale are provided below.

Table 6.1: Key Air Quality Legislation

Legislation	Description
Environment Protection Act 1990; amended by the Pollution Prevention and Control Act 1999.	Part III Provides statutory nuisance provisions for dust and odour.
Environment Act 1995, Part IV.	Introduced a system of Local Air Quality Management (LAQM) in the UK. This requires local authorities to review and assess air quality within their boundaries regularly and systematically against Air Quality Objectives (AQOs), appraise development and transport plans in the context of these assessments and make plans to meet the AQOs where these are exceeded. Where relevant, an air quality assessment should demonstrate the potential interaction with the LAQM process being undertaken by local authorities.
The Air Quality (England) (Amendment) 2000 / 2002 Regulations.	Legislates for the AQOs for pollutants set out in the 2000 Air Quality Strategy, which was revised in 2007. AQOs exist for a variety of pollutants including NOx, NO_2, PM_{10} and $PM_{2.5}$. These are established for both the protection of human health and the protection of vegetation and ecosystems (see Table 6.3 for AQOs relevant to this assessment). This air quality assessment makes a comparison between the predicted concentrations of these pollutants with the route options against the relevant AQOs, taking existing levels into account.

Legislation	Description
The Air Quality Standards (England) Regulations 2010.	Transposes the air quality limit values set out in the European Union (EU) ambient air quality directive 2008/50/EC (European Commission, 2008) to UK law. The UK Government is responsible to the European Commission (EC) for ensuring that it complies with the provisions of EU Directives. On the UK Government's behalf, the Department for Transport and Defra have Public Service Agreements relating to EU limit values. The responsibilities of local authorities with respect to meeting air quality standards are not the same as the responsibilities of the UK Government to the EC. Local authorities do have statutory duties for LAQM but are not obliged to ensure AQOs are met.

The European Union Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe were published to consolidate previous European Directives on ambient air quality. These European Directives form the basis for UK air quality legislation. Although published in 2007, the Air Quality Strategy is consistent with The Air Quality Standards Regulations (England) 2010.

The UK Government is responsible to the European Commission (EC) for ensuring that it complies with the provisions of the EU Directives. The UK currently is in breach of the limit values for nitrogen dioxide (NO_2) at a number of roadside locations.

On the UK government's behalf, the Department for Transport (DfT) and Department for Environment Food and Rural Affairs (Defra) have Public Service Agreements relating to EU Limit Values.

The responsibilities of local authorities with respect to meeting air quality standards are not the same as the responsibilities of the UK Government to the EC. Local authorities do have statutory duties for Local Air Quality Management (LAQM) but are not obliged to ensure Air Quality Objectives (AQOs) are met. Instead they are obliged to work towards achieving AQOs in the shortest practical time. It is important to recognise the difference between the EU Limit Values (for which compliance is determined at a national level by Government) and the AQOs (for which compliance is determined at a local level by local authorities under the LAQM regime).

Whilst the Limit Values and AQOs for the relevant pollutants (NO_2 and PM_{10}) are set at the same concentration value (e.g. 40 $\mu g/m^3$, as an annual mean) the means of determining compliance are fundamentally different, and they must be considered separately.

Article 3 of the EU Directive requires Member States to nominate the competent authority for the assessment of air quality (which in the UK is the Secretary of State for the Environment) and it may be interpreted that only the competent authority can determine compliance with the Limit Values. Compliance is determined via the national monitoring network and national model (the Pollution Climate Mapping (PCM) model), and there are a number of important differences between this and the monitoring / modelling carried out by local authorities to determine compliance with the objectives. Some of these differences are summarised in Table 6.2.

Table 6.2: Comparison Between National and Local Compliance Approaches

Factor	National Compliance	Local Compliance
Relevant exposure	Limit values apply everywhere there is public access.	Annual mean objectives only apply at locations where public exposure is relevant to the averaging period, e.g. at residential building façades.
Treatment of junctions	Monitoring is not carried out within 25 m of a junction and the same constraint is applied to the modelling.	Junctions are specifically considered in both monitoring and modelling.

Factor	National Compliance	Local Compliance
Microscale	Excludes micro-environments and focuses on locations representative of 100 m lengths of roads.	Focuses on "hot-spot" locations.
Roadside	Modelled concentrations apply to a distance of 4 m from kerbside of the national road network. Local roads are excluded from the model.	Focus is on concentrations at the building façade, whatever distance from the kerb and alongside any road.
Monitoring	Restricted to monitoring stations in the national network, operated to meet the Data Quality Objectives of the Directive	Principally based on local authority monitoring, including both automatic and passive diffusion samplers.

As a result of these differences, there are many locations across the UK where the assessment of national compliance with EU Limit Values and local compliance with AQOs, is not in agreement. For the purpose of this assessment, they are therefore treated separately.

The UK is currently failing to meet the annual mean NO_2 AQO and EU Limit Value in some locations. The first Air Quality Plan, which included Wales, for NO_2 in the UK (DEFRA, 2015) outlined how air quality in the UK would be improved by reducing NO_2 emissions in towns and cities. A revised UK Air Quality Plan was published in July 2017 (DEFRA & DfT, 2017), but the most recent ruling from the High Court in February 2018 (ClientEarth (No.3) versus SoSEFRA, 2018) concluded that this plan is insufficient to bring compliance with the EU air quality Limit Values within the soonest timeframe possible.

In May 2018, Defra released a consultation draft of the Clean Air Strategy 2018, outlining actions to tackle emissions from a range of pollutant sources. The consultation on this draft informed the final Clean Air Strategy (Defra, 2019a) and National Air Pollution Control Programme (Defra, 2019b) published in January 2019 and March 2019 respectively.

Table 6.3: Relevant National Air Quality Objectives

Pollutant	Threshold Concentration (µg/m^3)	Averaging Period
NO_2 (for human-health)	40	Annual Mean
	200	1-hour mean, not to be exceeded more than 18 times per year (equivalent to the 99.79th percentile of 1-hour means)
Particulate Matter (PM_{10}) (for human health)	40	Annual Mean
	50	24-hour mean, not to be exceeded more than 35 times per year (equivalent to the 90.08th percentile of 24-hour means)
Particulate Matter ($PM_{2.5}$) (for human health)	25	Annual Mean
Nitrogen oxides (NO_x) (for vegetation and ecosystems)	30	Annual Mean

6.2.2 Planning Policy

The Proposed Scheme will be situated entirely in the area administered by Lancaster City Council (LCC). The relevant national and local plans and policies (and how these relate to the air quality assessment) are described in Table 6.4.

Table 6.4: Summary of Key Policy

Document	Description	Relevant Policies
National Policy		
The National Planning Policy Framework (NPPF) (Department for Communities and Local Government, February 2019)	Sets out the governments planning policies for England and how these are expected to be applied. The NPPF introduces the presumption in favour of sustainable development in England, where a local plan is "absent, silent or out of date".	Paragraph 181 of NPPF references air quality: "Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas… Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 (Defra, 2007)	Updates the 2000 Air Quality Strategy and provides an overview and outline of the UK Government and devolved administrations' ambient (outdoor) air quality policy.	The strategy sets out the AQOs and the measures selected to achieve the desired improvements in air quality.
Local Policy		
A Local Plan for Lancaster District (2011-2031) Development Management Development Plan Document (DPD) (Lancaster City Council, 2014)	Sets out a series of generic planning policies which are used by LCC to determine planning applications. The DPD contains policies relating to economic, environmental and social matters. This document now forms a key part of the new Local Plan for Lancaster District 2011 – 2031.	The DPD states that "The council will seek to ensure that proposals for all new development regardless of location will not have an unacceptable negative impact on air quality and will not further exacerbate air quality in AQMAs". Policy DM37: Air Quality Management and Pollution also states that "Air Quality Assessments (AQA) must be submitted for any development proposal within or adjacent to an Air Quality Management Area (AQMA)".

6.2.3 Guidance

Key guidance for the air quality assessment are summarised in Table 6.5.

Table 6.5: Summary of Key Guidance

Document	Description
Design Manual for Roads and Bridges DMRB, Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, LA 105 Air Quality (Highways England, 2019).	This guidance document provides supplementary advice relating to the assessment of road traffic emissions. This guidance also contains advice on the assessment of air quality from road traffic, particularly that from new / altered roads.
Local Air Quality Management Technical Guidance TG16, Defra and the devolved administrations (Defra, 2018).	This is designed to guide local authorities through the LAQM process and includes detailed technical guidance on air quality screening, modelling and assessment. It also provides guidance on where the AQOs apply.
A Local Plan for Lancaster District (2011-2031) Low Emission and Air Quality Planning Advisory Note (Lancaster City Council, 2018a)	Provides guidance and encourages developers to support action through the planning system to improve air quality and lower transport emissions. It also provides guidelines for the treatment of development sites through a planning appraisal.

6.3 Methodology

6.3.1 Assessment Approach

This assessment has been carried out following guidance detailed within DMRB LA 105 (Highways England, 2019) and Local Air Quality Management Technical Guidance (LAQM.TG16) (Defra, 2018), where appropriate.

The key elements of the assessment are:

- A review of baseline conditions;
- A high level, qualitative risk assessment of potential construction dust impacts; and
- A local air quality assessment for NO_2, PM_{10} and $PM_{2.5}$, for each of the six options, at sensitive human health, compliance risk and ecological receptors within 200m of the affected road network, using air dispersion modelling.

6.3.2 Study Area

6.3.2.1 Construction

With regard to construction traffic, DMRB LA 105 (Highways England, 2019) states that if "*construction activities are less than 2 years it is unlikely that the construction activities would constitute a significant air quality effect … given the short term duration of the construction activities as opposed to the long term operation of the project*". Furthermore, DMRB LA 105 (Highways England, 2019) indicates that should construction activities be greater than 2 years in duration, the traffic scoping criteria (described in Section 6.3.2.1) should be used to determine whether changes in traffic as a consequence of construction activities require further assessment. As such, an assessment of the impact of construction phase traffic on local air quality has not been undertaken at this stage as, whilst construction phase traffic data are not currently available, it is considered unlikely that construction activities would occur for a period greater than 2 years in duration and / or result in changes in traffic conditions in excess of the DMRB LA 105 (Highways England, 2019) screening criteria on the local road network for an extended period.

6.3.2.2 Operational

The study area for the assessment of local air quality has been defined in line with DMRB LA 105 (Highways England, 2019). The extent of the air quality study area, also referred to as the Affected Road Network (ARN), was defined by identifying any road links (and adjoining roads within 200m) likely to experience any of the following changes between the Do-Something traffic (with the project) compared to the Do-Minimum traffic (without the project) in the opening year:

- Annual average daily traffic (AADT) >=1,000; or
- Heavy duty vehicle (HDV) AADT >=200; or
- A change in speed band; or
- A change in carriageway alignment by >=5m.

The 'speed band' referred to above refers to a range of categories for which outputs from the traffic model are grouped into to describe their emissions. This process, which is defined in DMRB LA 105 (Highways England, 2019), and associated emission factors (available upon request from Highways England) are however only relevant to Highways England projects. As such, the following criteria (taken from previous Highways England air quality guidance HA 207/07 (Highways England, 2007), were used to identify road links where changes in vehicle speeds have the potential to result in air quality effects:

- Daily average speeds change by 10 km/hour or more; or
- Peak hour speed change by 20 km/hour or more.

Data from the traffic modelling described in Section 4 have been used to define the study area in accordance with the criteria described above, the extent of which is shown Appendix D.

6.3.3 Receptors

6.3.3.1 Human Health

Within the study area, residential properties and other sensitive receptors (such as schools, hospitals and nursing homes) have been considered. Building usage has been determined using the Ordnance Survey Address Base Plus dataset, and calculations made at the nearest façade to the busiest road. A total of 164 human health receptors were included in the air quality assessment (the locations of which are shown in Appendix D), however only results for a subset of these receptors are presented and discussed in this report (i.e. those locations where modelled concentrations were highest and/or where the largest changes in pollutant concentrations were modelled to occur).

6.3.3.2 Compliance Risk

In accordance with DMRB LA 105, a compliance risk assessment was undertaken for the roads identified in the PCM model which are within the ARN. In accordance with DMRB LA 105 (Highways England, 2019), annual mean NO_2 concentrations were modelled at 4m from the roadside and at 2m in height, but not within 25m of a junction, for comparison to PCM model outputs.

6.3.3.3 Designated Sites

Internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity (known as designated habitats) within 200m of the ARN were included in the air quality assessment.

Designated habitats, as defined within DMRB LA 105 (Highways England, 2019), include 'Ramsar' sites, Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs), local wildlife sites (termed Biological Heritage Sites by Lancashire County Council), Nature Improvement Areas (NIAs), ancient woodland and veteran trees.

For each designated habitat which was considered sensitive to nitrogen deposition, transect receptor points at 10m intervals were modelled, starting from the nearest point of the designated habitat to the road, up to a maximum distance of 200m.

A summary of the ecological receptors (Designated Sites) included in the assessment is provided in Table 6.6, the locations of which are shown in Figure 13 of Appendix D.

Table 6.6: Air Quality Ecological Sensitive Receptors included in assessment

Designated Site	Designation
Berry's Farm and Sellerley Farm Ponds, Conder Green	Biological Heritage Site
Forerigg Wood	Biological Heritage Site
Ellel Grange Wood	Biological Heritage Site
Long Bank Wood	Biological Heritage Site
Cocker Cough Wood	Biological Heritage Site
Artle Dale West of SSSI (Crymes Wood, Millwood and Sink Shaft Wood)	Biological Heritage Site / Ancient Woodland
Wyresdale Road Verges	Biological Heritage Site
Newton Beck Valley	Biological Heritage Site
Park Coppice	Biological Heritage Site / Ancient Woodland
Old Park Wood	Biological Heritage Site / Ancient Woodland
Cockshades Wood	Biological Heritage Site / Ancient Woodland
Little Cockshades Wood	Biological Heritage Site / Ancient Woodland
Brunsow (North) Wood	Biological Heritage Site / Ancient Woodland
Lythe Brow Wood	Ancient Woodland

6.3.4 Local Air Quality Assessment

The assessment of the potential air quality effects of the route options was undertaken using the ADMS-Roads software, which has been developed by CERC. It is an atmospheric modelling system that focuses on road traffic as a source of pollutant emissions and is a recognised tool for carrying out air quality impact assessments. The model has been comprehensively validated by both the model developers and independently, and it is used both commercially and by regulatory authorities to assist in decisions related to air quality and traffic management, urban planning and public health in many countries around the world. Version 4.1.1 (Jan 2018) was used for this assessment.

It should be noted that dispersion models provide an estimate of concentrations arising from the emissions entered into the model and historical meteorological data. The estimates produced, while appropriately representing the complex factors involved in atmospheric dispersion, are subject to uncertainty.

Whilst the predictions provided by the models should not be regarded as definitive statements of concentrations that will arise in the future, they are the most reasonable, robust and representative estimates available. The estimates are composed of calculations of the impact of all the modelled emission sources at a single point or location referred to as a receptor.

6.3.4.1 Vehicle Emissions

The ADMS-Roads modelling system takes into account the emissions produced by Light Duty Vehicles (LDV, less than 3.5 tonnes) and HDVs travelling at a certain speed along a section of road, averaged over an hour, and predicts the dispersion of these emissions for a given set of meteorological conditions.

Emission rates for LDVs and HDVs were calculated using Defra's Emission Factors Toolkit (Version 9.0, released May 2019). The resulting hourly emission rates were input into the ADMS-Roads dispersion model taking into account traffic conditions in each of the traffic model periods (see Section 6.3.4.4).

6.3.4.2 Industrial Processes

The Environment Agency is responsible for regulating large polluting industrial Part A1 processes. Part A1 processes include larger industrial processes such as refineries, intensive farming activities, hazardous waste treatment and waste incineration. Local Authorities are responsible for regulating emissions to air, land and water from less polluting Part A2 installations and emissions to air of all smaller Part B installations.

Emissions to air from these processes are likely to be included in monitored data and the background pollutant concentrations used in this assessment.

6.3.4.3 Modelled Scenarios

The local air quality assessment considers the effects of the six route options in the opening year only (as this is the year in which the largest impacts are likely to occur, due to assumed improvements in vehicle emissions over time). The following scenarios have been included in the assessment:

- 2018 Baseline (i.e. existing conditions);
- 2025 Opening Year 'without scheme' referred to as Do-Minimum (DM 2025); and
- 2025 Opening Year 'with scheme' referred to as Do-Something (DS 2025).

6.3.4.4 Traffic Data

Traffic data for the modelling scenarios were taken from the Lancaster Traffic Model (see Section 4.2.1). The base year air quality modelling uses traffic data, air pollution measurements and meteorological measurements from 2018.

Traffic data representing the average conditions occurring in specific time periods were provided for the periods specified in Table 6.7. For each time period, the following traffic data parameters were provided:

- Total traffic flow, defined as vehicles/hour;
- Percentage HDVs; and
- Vehicle speed, in kilometres per hour (kph).

Table 6.7: Traffic Data Parameters used in the Modelling

Traffic Period	Time Period
Annual Average Daily Traffic (AADT)	00:00 – 24:00
Annual Average Weekly Traffic (AAWT) AM Peak (AM)	07:00 – 09:00
AAWT Inter-Peak (IP)	09:00 – 16:00
AAWT PM Peak (PM)	16:00 – 19:00
AAWT Off Peak (OP)	19:00 – 07:00

6.3.4.5 Meteorological Data

The effect of meteorological conditions on dispersion is given complex treatment within the model. The most significant factors in the dispersion of emitted pollutants are wind speed and direction. The nearest meteorological data site to the study area was Blackpool. Data from this site for 2018 (the modelled base year) were therefore used in the modelling, with different surface roughness values used in the modelling for the meteorological site and the dispersion site respectively, to account for differences in dispersion conditions between the two areas.

6.3.4.6 Adjustment for Long Term Trends in NOx and NO_2

In July 2011, Defra published a report (Defra, 2011) examining the long-term air quality trends in NOx and NO_2 concentrations. This identified that ambient air quality concentrations are not decreasing in the future as is predicted using the current established methods of assessment (defined in the LAQM.TG(16), which was issued before the 2011 report). To address this, a Gap Analysis methodology has been developed as set out in DMRB LA 105 (Highways England, 2019) to adjust model predictions to better reflect measured long-term trends of NOx and NO_2. This methodology was applied to this assessment.

6.3.4.7 Calibration and Validation

In order to assess the performance of the air quality model, the results of the base year modelling were compared with available monitoring data. The process of model verification identified that adjustment of the model was required, and this was undertaken following guidance in LAQM.TG(16). The model adjustment factor derived has been applied to the results presented in Section 6.4.5. Details of the derivation of the model adjustment factor can be found in Appendix A.

6.3.4.8 Assumptions and Limitations

The key limitations for this assessment relate to the reliance on modelling for the purposes of predicting significant effects at the location of sensitive receptors as a result of the route options.

The air quality assessment is based on a series of computer models containing forecasting of future conditions. The process relies on the modelling of future traffic flows, which is subject to limitations and uncertainties. The traffic data is used within the quality modelling process to compare future air quality conditions both with and without the Proposed Scheme. The air quality model draws on a number of other trends and parameters that must be projected into the future.

As with any computer model that seeks to predict future conditions, there is uncertainty in the predictions made. Whilst being the best predictions available, elements of impact prediction such as the specific concentration of a given pollutant at a given property, or whether an exceedance of the Air Quality Objectives (AQOs) would or would not occur at a specific location, are not precise and are always subject to a margin of error.

6.3.5 Construction Dust Assessment

The construction phase assessment comprises a qualitative dust risk assessment and assessment of emissions from construction vehicles and associated traffic management measures. However, at this stage of the project, construction traffic data are not yet available.

The dust impacts from the construction phase arise from the activities taking place on construction sites, mainly demolition, earthworks, construction and trackout (dust generated by vehicles travelling on the local road network). A qualitative construction dust risk assessment has been undertaken using guidance in DMRB LA 105 (Highways England, 2019).

Table 6.8 and Table 6.9 (reproduced from DMRB LA 105) were followed to determine whether the project has a high or low construction dust risk. The construction dust risk potential determined was then used to inform the measures required to support the proposed mitigation.

Table 6.8: Construction Dust Risk Potential

Risk	Examples of the Types of Project
Large	Large smart motorway projects, bypass and major motorway junction improvements.
Small	Junction congestion relief project i.e. small junction improvements, signalling changes. Short smart motorway projects.

Table 6.9: Receiving Environment Sensitivity to Construction Dust

Construction Dust Risk Potential	Distance from Construction Activities		
	0- 50m	50 - 100m	100 - 200m
Large	High	High	Low
Small	High	Low	Low

6.3.6 Assessment of Significance

6.3.6.1 Local Air Quality Impacts on Human Health

Predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations were compared to the relevant AQOs for each of the scenarios modelled in this assessment. The relevant AQOs are detailed in Table 6.3. In order to convey the level of impact of the route options, it is necessary to determine its significance. The 'significance' of an environmental impact is a function of the 'sensitivity' of the receptor and the 'scale' of the impact.

The model results were used to assess whether there are any significant effects as a result of the route options. Highways England's approach to evaluating significant air quality effects is set out in DMRB LA 105 (Highways England, 2019).

Highways England's approach to air quality assessment identifies and assesses sensitive receptors near roads where air quality might be affected. Consequently, areas where AQOs are exceeded or are close to being exceeded are considered, such as AQMAs. The model results were used to identify receptors in exceedance of the relevant AQOs in either the Do Minimum (DM) or Do Something (DS) scenarios. These are the only receptors which are considered in the judgement of significance. The change in predicted concentration is then calculated as the difference between DS and DM model results at these receptors.

Where the difference in concentrations are less than or equal to 1 % of the AQO (e.g. less than or equal to 0.4 µg/m³ for annual average NO_2) then the change at these receptors is considered to be imperceptible and can be scoped out of the judgement on significance.

Highways England has developed a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only and are to be used to inform professional judgement on significant effects of the route options. The guideline bands are based on Highways England's considered opinion and are intended to help provide consistency across all Highways England schemes.

A receptor with a predicted change in concentration greater than 'imperceptible' (i.e. greater than a magnitude of 0.4 µg/m³) is assigned to one of six categories (large, medium and small for either worsening or improvement) where there is a predicted AQO exceedance. If any exceedances are predicted, the number of receptors in each category are compared to guideline ranges provided in DMRB LA 105 (Highways England, 2019), as presented in Table 6.10.

Table 6.10: Guideline band for the number of properties informing a judgement of significant air quality effects

Magnitude of change in annual mean NO_2 or PM_{10} concentration (µg/m³)	Total number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

Where the number of receptors falls below, or equal to, the lower value of the range in a given category, it is considered that the route option is likely to have a 'not significant' effect. Where values are equal to or greater than the upper limit of the range for a given category, it has been considered that the potential impact of the route option is likely to cause a 'significant' effect. Where values lie between the guideline ranges for a given category, further consideration based on a balanced judgement of the overall impacts across the whole study area has been undertaken, including consideration of both worsening and improvement.

6.4 Baseline Environment

Baseline conditions have been determined by considering information and data from the following sources:

- Defra background mapping for projected background concentrations in the assessment years (Defra, 2019c);
- Local authority air quality Annual Status Reports (Lancaster City Council, 2018b) and monitoring data (Lancaster City Council, 2019);
- Dispersion modelling results for the base year (2018); and
- PCM model outputs (Defra, 2019d).

6.4.1 Local Air Quality Management (LAQM)

The entirety of the air quality assessment study area is located within the area administered by Lancaster City Council (LCC). The most recent air quality Annual Status Report published by the council (Lancaster City Council, 2018b) has been reviewed and considered as part of the assessment.

LCC have declared three Air Quality Management Areas (AQMA), namely:

- City of Lancaster AQMA, which covers the gyratory system in Lancaster city centre and was declared due to exceedances of annual mean and hourly NO_2 AQOs;
- Carnforth AQMA, which covers the main cross road areas in Carnforth and was declared due to exceedances of the annual mean NO_2 AQO; and
- Galgate AQMA, which covers the main cross road area in Galgate and was declared due to exceedances of the annual mean NO2 AQO.

The locations of two of these AQMAs (the City of Lancaster AQMA and Galgate AQMA) can be seen in Figure 13 of Appendix D, in relation to the air quality study area. The Carnforth AQMA is outside of the study area for the route options.

6.4.2 Local Air Quality Monitoring

LCC undertakes both automatic and non-automatic air quality monitoring, the locations of which are shown in Figure 13 of Appendix D, in relation to the air quality study area.

Two automatic monitoring stations are located within the city of Lancaster, the results at which in recent years are shown in Table 6.11.

Table 6.11: Lancaster City Council Automatic Monitoring Sites (2014-2018)

Site ID / Name	Location (X,Y)	Pollutants monitored	Measured Annual Mean Concentration (µg/m^3)				
			2014	2015	2016	2017	2018
AN1 Cable Street	347684, 461963	NO_2	**42.0**	-	-	39.6	34.0
		PM_{10}	21.1	24.6	-	22.5	22.0
AN2 Dalton Square	347852, 461611	NO_2	36.9	34.9	32.0	32.0	34.0
Note: Measured exceedances of annual mean AQO (40 µg/m^3) shown in **bold** type.							

These results indicate that whilst the annual mean NO_2 AQO was exceeded in 2014 at the Cable Street site, the AQO was achieved between 2015 and 2018, and at the Dalton Square site in all years between 2014 and 2018. Furthermore, measured annual mean PM_{10} concentrations were well within the AQO at the Cable Street site in all years. No exceedances of the hourly mean NO_2 AQO or daily mean PM_{10} AQO were recorded at either site during this period.

LCC also undertakes non-automatic monitoring at 54 locations across the area using NO_2 diffusion tubes. Results from LCC monitoring locations that are within the air quality study area are provided in Table 6.12.

Table 6.12: Lancaster City Council Non-Automatic Monitoring Sites in Study Area (2014-2018)

Site ID / Name	Location (X,Y)	Measured Annual Mean NO_2 Concentration (µg/m^3)				
		2014	2015	2016	2017	2018
LC15	348199, 462361	**43**	38	35	29	27
LC22	347928, 461025	31	27	28	26	25
LC23	347948, 460893	39	35	35	31	27
LC24	347974, 460514	32	33	32	29	25
LC25	348084, 459844	27	24	24	22	21
LC26	347990, 459418	**41**	38	36	32	29

Site ID / Name	Location (X,Y)	Measured Annual Mean NO_2 Concentration (µg/m^3)				
		2014	2015	2016	2017	2018
LC27	347989, 459396	35	31	31	28	26
LC28	348517, 463243	**45**	39	36	28	23
LC29	348527, 463270	-	38	35	27	26
LC30	348511, 463226	-	32	31	24	28
LC31	348114, 462071	-	36	33	30	33
LC33	348045, 462120	-	-	-	35	35
H	347859, 461126	34	32	32	28	27
I	347909, 462015	**42**	37	38	36	33
V	348359, 455352	**45**	**46**	**42**	38	33
Z	348345, 455272	**44**	**43**	**42**	37	33
ZA	348351, 455381	34	30	31	27	26
ZB	348388, 455472	32	27	29	24	24
ZC	348375, 455393	**44**	39	37	34	31
M6	349271, 460208	-	-	-	20	24
Note: Measured exceedances of annual mean AQO (40 µg/m^3) shown in **bold** type.						

The results in Table 6.12 indicate that the annual mean NO_2 AQO has been exceeded at a number of sites in the air quality study area in recent years, namely:

- Site LC15 in 2014, which is located adjacent to the A6 to the northeast of Lancaster;
- Site LC28 in 2014, which is located adjacent to the A683 to the northeast of Lancaster;
- Site LC26 in 2014, which is located adjacent to the A6 to the south of Lancaster;
- Site I in 2014, which is located adjacent to Parliament Street in Lancaster; and
- Site V and site Z between 2014 and 2016 and site ZC in 2014, which are located adjacent to the A6 in Galgate.

The annual mean NO_2 AQO was however achieved at all sites in 2017 and 2018, suggesting that annual mean NO_2 concentrations have reduced in recent years in the air quality study area.

6.4.3 Mapped Background Concentrations

Mapped background annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ for both the base and assessment years were obtained from Defra's Background Maps, which are based and forecasted from monitoring and meteorological data for 2017. As the maps provide data for individual pollutant sectors (e.g. motorway, trunk A-roads, primary A-roads, minor roads and industry), the components relating to modelled road traffic sources have been removed to avoid double counting of road emissions for the prediction of pollutant concentrations. A summary of the minimum and maximum concentrations across the study area is provided in Table 6.13 which indicates that background concentrations for all pollutants within the air quality study area are well within the relevant AQOs, and in some locations are very low reflecting the semi-rural nature of the study area.

Table 6.13: DEFRA Background Concentrations (2018 and 2025)

Pollutant	Mapped Annual Mean Background Concentration (µg/m^3)			
	2018		2025	
	Min.	Max.	Min.	Max.
NO_2	3.1	21.0	2.4	20.3
PM_{10}	6.6	13.0	6.2	12.3
$PM_{2.5}$	4.5	9.0	4.1	8.0

6.4.4 Modelled Base Year Concentrations

Annual Mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at the identified sensitive human health receptors were modelled for the 2018 year, the results for which at selected receptors are summarised in Table 6.14 below (with results provided in full in Appendix D). The results indicate that annual mean NO_2 concentrations at receptors R9 (at the crossroads in Galgate), R24 (adjacent to the M6) and R25 (at the Lune Valley Interchange) exceed the AQO for NO_2 (40 µg/m^3). Modelled NO_2 concentrations at all other receptors are within the AQO, whilst modelled concentrations of PM_{10} and $PM_{2.5}$ are well within the relevant AQOs (i.e. 40 µg/m^3 and 25 µg/m^3 respectively) at all receptors.

Table 6.14: Air Quality Baseline Results

Receptor ID	Location	Modelled 2018 Annual Mean Concentration (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
R1	Bay Horse Lane	20.7	10.6	6.9
R2	Hampson Lane	19.8	11.7	7.4
R3	Stoney Lane	12.4	9.3	6.1
R4	Preston Lancaster Road	25.2	12.8	8.0
R5	Main Road	29.3	13.4	8.4
R6	Conder Green Road	8.5	9.0	5.8
R7	Main Road	37.7	14.1	9.0
R8	Main Road	39.7	14.1	9.0
R9	Stoney Lane	**45.7**	14.8	9.5
R10	Salford Road	14.2	11.4	7.2
R11	Langshaw Lane	12.7	9.1	6.0
R12	Bay Horse Road	7.9	8.5	5.6
R13	Leach House Lane	13.9	11.2	7.1
R14	Leach House Lane	15.1	11.4	7.2
R15	Alexandra Park Drive	7.3	11.4	7.2
R16	Ashton Road	7.0	8.5	5.6
R17	Scotforth Road	8.3	12.0	7.6
R18	Hazelrigg Lane	10.9	9.1	5.9

Receptor ID	Location	Modelled 2018 Annual Mean Concentration (µg/m³)		
		NO_2	PM_{10}	$PM_{2.5}$
R19	Oakwood Gardens	15.4	11.8	7.4
R20	Blea Tarn Road	19.5	11.8	7.5
R21	Ashton Road	7.8	10.2	6.6
R22	Bowerham Road	8.7	13.3	8.7
R23	Alderman Road	12.0	9.7	6.3
R24	Newlands Road	**43.1**	14.5	9.5
R25	Lune Valley Interchange	**41.6**	14.5	9.4
Note: Exceedances of annual mean NO_2 AQO (40 µg/m³) shown in **bold** type.				

6.4.5 Pollution Climate Mapping (PCM) Model Outputs

The Pollution Climate Mapping (PCM) model, provided by Defra, is designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of major air pollutants that impact human health, such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). Modelled roadside concentrations are provided for a 2017 base year, and projected for every year up to 2030, at representative roads throughout the UK. As the most recently available PCM NO_2 projections data were produced in 2019 from a 2017 base year, projections for 2018 are not available. As such, data for 2017 has been used to understand baseline conditions in the air quality study area, which is slightly conservative.

Ten PCM model links are situated within 200m of the route options ARN (as shown in Table 16 of Appendix D). Projected roadside annual mean NO_2 concentrations adjacent to these links are well within the EU Limit Value for NO_2 (40 µg/m³) in both 2017 and 2025, as shown in Table 6.15 below.

Table 6.15: DEFRA Projected Pollution Climate Mapping (PCM) Outputs for NO_2

Census ID	Projected Roadside Annual Mean NO_2 Concentration (µg/m³)	
	2017	2025
77826	31.5	19.6
38472	28.7	18.7
18425	17.7	10.9
18403	30.4	19.6
38292	28.4	18.3
28392	28.0	18.3
16146	29.8	19.2
18036	31.0	21.0
77823	15.1	10.1
46159	23.5	15.3

6.5 Impact of the Schemes on Air Quality

6.5.1 Human Health Impacts

The below sections outline the modelled annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at selected human health receptors for the Opening Year (2025) DM and DS scenarios. The modelled pollutant concentrations at all modelled human health receptors can be found in full in Appendix D.

6.5.1.1 Central 1

The local air quality assessment results for the selected receptors for the Central 1 route option are provided in Table 6.16 and illustrated in Figure 17 of Appendix D.

Table 6.16: Local Air Quality Assessment Results - Central 1

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change
R1	17.1	17.5	0.4	9.9	10.0	0.1	6.2	6.3	0.1
R2	17.1	17.1	0.0	11.1	11.0	-0.1	6.8	6.8	0.0
R3	10.6	10.1	-0.5	8.7	8.7	0.0	5.6	5.5	-0.1
R4	22.3	16.8	-5.5	12.2	11.4	-0.8	7.5	7.0	-0.5
R5	26.0	19.0	-7.0	12.9	11.8	-1.1	7.9	7.2	-0.7
R6	7.1	7.4	0.3	8.5	8.6	0.1	5.3	5.4	0.1
R7	34.4	23.4	-11.0	13.5	12.3	-1.2	8.3	7.6	-0.7
R8	36.1	26.5	-9.6	13.4	12.4	-1.0	8.3	7.7	-0.6
R9	**41.1**	31.6	-9.5	14.1	13.1	-1.0	8.7	8.1	-0.6
R10	12.8	12.2	-0.6	10.9	10.9	0.0	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0
R12	6.9	6.4	-0.5	8.0	7.9	-0.1	5.1	5.1	0.0
R13	11.8	13.0	1.2	10.7	10.9	0.2	6.6	6.7	0.1
R14	12.6	12.5	-0.1	10.8	10.8	0.0	6.7	6.7	0.0
R15	11.1	12.9	1.8	10.9	11.2	0.3	6.7	6.9	0.2
R16	5.8	5.8	0.0	7.9	7.9	0.0	5.1	5.1	0.0
R17	14.7	13.7	-1.0	11.3	11.2	-0.1	7.0	6.9	-0.1
R18	9.3	9.6	0.3	8.5	8.6	0.1	5.4	5.5	0.1
R19	14.0	12.8	-1.2	11.4	11.1	-0.3	7.1	6.9	-0.2
R20	17.3	18.5	1.2	11.3	11.5	0.2	7.0	7.1	0.1
R21	12.2	11.9	-0.3	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	23.9	1.0	12.6	12.9	0.3	8.0	8.1	0.1
R23	11.6	13.3	1.7	9.5	9.8	0.3	6.0	6.1	0.1

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change
R24	37.3	38.2	0.9	13.5	13.6	0.1	8.5	8.6	0.1
R25	36.7	36.5	-0.2	13.6	13.7	0.1	8.5	8.5	0.0

Note: Exceedances of annual mean AQO (40 µg/m³) shown in **bold** type.

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m³) in the DM scenario at receptor R9 (41.1 µg/m³). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for Central 1 suggest however, that a large reduction in NO_2 concentrations (9.5 µg/m³) will occur at this receptor, thus achieving compliance with the AQO (31.6 µg/m³).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the Central 1 route option.

As a large decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.1.2 Central 2: A588

The local air quality assessment results for the selected receptors for the Central 2: A588 option are provided in Table 6.17 and illustrated in Figure 18 of Appendix D.

Table 6.17: Local Air Quality Assessment Results - Central 2 (A558)

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change
R1	17.1	17.5	0.4	9.9	10.0	0.1	6.2	6.3	0.1
R2	17.1	17.1	0.0	11.1	11.0	-0.1	6.8	6.8	0.0
R3	10.6	10.1	-0.5	8.7	8.7	0.0	5.6	5.5	-0.1
R4	22.3	17.1	-5.2	12.2	11.4	-0.8	7.5	7.0	-0.5
R5	26.0	19.3	-6.7	12.9	11.8	-1.1	7.9	7.3	-0.6
R6	7.1	6.9	-0.2	8.5	8.5	0.0	5.3	5.3	0.0
R7	34.4	23.7	-10.7	13.5	12.3	-1.2	8.3	7.6	-0.7
R8	36.1	25.7	-10.4	13.4	12.4	-1.0	8.3	7.6	-0.7
R9	**41.1**	29.9	-11.2	14.1	12.9	-1.2	8.7	8.0	-0.7
R10	12.8	11.1	-1.7	10.9	10.7	-0.2	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0
R12	6.9	6.4	-0.5	8.0	7.9	-0.1	5.1	5.1	0.0

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change	DM 2025	DS 2025	Change
R13	11.8	13.9	2.1	10.7	11.0	0.3	6.6	6.8	0.2
R14	12.6	12.6	0.0	10.8	10.8	0.0	6.7	6.7	0.0
R15	11.1	12.9	1.8	10.9	11.2	0.3	6.7	6.9	0.2
R16	5.8	5.9	0.1	7.9	8.0	0.1	5.1	5.1	0.0
R17	14.7	13.8	-0.90	11.3	11.2	-0.1	7.0	6.9	-0.1
R18	9.3	9.6	0.3	8.5	8.6	0.1	5.4	5.5	0.1
R19	14.0	12.8	-1.2	11.4	11.1	-0.3	7.1	6.9	-0.2
R20	17.3	18.5	1.2	11.3	11.4	0.1	7.0	7.1	0.1
R21	12.2	11.9	-0.3	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	23.9	1.0	12.6	12.8	0.2	8.0	8.1	0.1
R23	11.6	13.1	1.5	9.5	9.7	0.2	6.0	6.1	0.1
R24	37.3	38.2	0.9	13.5	13.6	0.1	8.5	8.6	0.1
R25	36.7	36.6	-0.1	13.6	13.7	0.1	8.5	8.5	0.0
Note: Exceedances of annual mean AQO (40 µg/m³) shown in **bold** type.									

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m³) in the DM scenario at receptor R9 (41.1 µg/m³). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for Central 2: A588 suggest however, that a large reduction in NO_2 concentrations (11.2 µg/m³) will occur at this receptor, thus achieving compliance with the AQO (29.9 µg/m³).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the Central 2: A588 route option.

As a large decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.1.3 West 1

The local air quality assessment results for the selected receptors for the West 1 route option are provided in Table 6.18 and demonstrated in Table 19 of Appendix D.

Table 6.18: Local Air Quality Assessment Results - West 1

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R1	17.1	17.8	0.7	9.9	10.0	0.1	6.2	6.3	0.1
R2	17.1	17.1	0.0	11.1	11.1	0.0	6.8	6.8	0.0

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R3	10.6	10.5	-0.1	8.7	8.7	0.0	5.6	5.6	0.0
R4	22.3	20.3	-2.0	12.2	12.0	-0.2	7.5	7.3	-0.2
R5	26.0	23.5	-2.5	12.9	12.5	-0.4	7.9	7.6	-0.3
R6	7.1	7.4	0.3	8.5	8.6	0.1	5.3	5.4	0.1
R7	34.4	29.9	-4.5	13.5	13.0	-0.5	8.3	8.1	-0.2
R8	36.1	31.9	-4.2	13.4	13.0	-0.4	8.3	8.1	-0.2
R9	**41.1**	37.0	-4.1	14.1	13.7	-0.4	8.7	8.5	-0.2
R10	12.8	12.1	-0.7	10.9	10.8	-0.1	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0
R12	6.9	6.6	-0.3	8.0	7.9	-0.1	5.1	5.1	0.0
R13	11.8	12.0	0.2	10.7	10.7	0.0	6.6	6.6	0.0
R14	12.6	12.2	-0.4	10.8	10.8	0.0	6.7	6.6	-0.1
R15	11.1	11.5	0.4	10.9	11.0	0.1	6.7	6.8	0.1
R16	5.8	5.8	0.0	7.9	7.9	0.0	5.1	5.1	0.0
R17	14.7	13.5	-1.2	11.3	11.1	-0.2	7.0	6.9	-0.1
R18	9.3	9.2	-0.1	8.5	8.5	0.0	5.4	5.4	0.0
R19	14.0	12.6	-1.4	11.4	11.1	-0.3	7.1	6.9	-0.2
R20	17.3	16.8	-0.5	11.3	11.2	-0.1	7.0	7.0	0.0
R21	12.2	11.9	-0.3	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	22.6	-0.3	12.6	12.5	-0.1	8.0	8.0	0.0
R23	11.6	16.4	4.8	9.5	10.4	0.9	6.0	6.5	0.5
R24	37.3	37.3	0.0	13.5	13.5	0.0	8.5	8.5	0.0
R25	36.7	36.2	-0.5	13.6	13.6	0.0	8.5	8.5	0.0
Note: Exceedances of annual mean AQO (40 µg/m³) shown in **bold** type.									

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m³) in the DM scenario at receptor R9 (41.1 µg/m³). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for West 1 suggest however, that a large reduction in NO_2 concentrations (4.1 µg/m³) will occur at this receptor, thus achieving compliance with the AQO (37.0 µg/m³).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the West 1 route option.

As a large decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.1.4 West 2

The local air quality assessment results for the selected receptors for the West 2 option are provided in Table 6.19 and illustrated in Table 20 of Appendix D.

Table 6.19: Local Air Quality Assessment Results - West 2

Receptor ID	Modelled Annual Mean Concentration (μg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R1	17.1	16.8	-0.3	9.9	9.9	0.0	6.2	6.2	0.0
R2	17.1	17.2	0.1	11.1	11.1	0.0	6.8	6.8	0.0
R3	10.6	10.8	0.2	8.7	8.8	0.1	5.6	5.6	0.0
R4	22.3	22.6	0.3	12.2	11.9	-0.3	7.5	7.3	-0.2
R5	26.0	26.2	0.2	12.9	12.4	-0.5	7.9	7.6	-0.3
R6	7.1	7.3	0.2	8.5	8.5	0.0	5.3	5.3	0.0
R7	34.4	29.7	-4.7	13.5	13.0	-0.5	8.3	8.0	-0.3
R8	36.1	31.2	-4.9	13.4	13.0	-0.4	8.3	8.0	-0.3
R9	**41.1**	37.2	-3.9	14.1	13.7	-0.4	8.7	8.5	-0.2
R10	12.8	12.1	-0.7	10.9	10.8	-0.1	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0
R12	6.9	6.9	0.0	8.0	8.0	0.0	5.1	5.2	0.1
R13	11.8	13.1	1.3	10.7	10.9	0.2	6.6	6.7	0.1
R14	12.6	12.6	0.0	10.8	10.8	0.0	6.7	6.7	0.0
R15	11.1	11.4	0.3	10.9	10.9	0.0	6.7	6.7	0.0
R16	5.8	5.8	0.0	7.9	7.9	0.0	5.1	5.1	0.0
R17	14.7	14.0	-0.7	11.3	11.2	-0.1	7.0	6.9	-0.1
R18	9.3	9.2	-0.1	8.5	8.5	0.0	5.4	5.4	0.0
R19	14.0	13.1	-0.9	11.4	11.2	-0.2	7.1	6.9	-0.2
R20	17.3	17.3	0.0	11.3	11.2	-0.1	7.0	7.0	0.0
R21	12.2	12.1	-0.1	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	22.8	-0.1	12.6	12.6	0.0	8.0	8.0	0.0
R23	11.6	13.9	2.3	9.5	9.9	0.4	6.0	6.2	0.2
R24	37.3	37.2	-0.1	13.5	13.5	0.0	8.5	8.5	0.0
R25	36.7	36.6	-0.1	13.6	13.7	0.1	8.5	8.5	0.0
Note: Exceedances of annual mean AQO (40 μg/m³) shown in **bold** type.									

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m^3) in the DM scenario at receptor R9 (41.1 µg/m^3). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for West 2 suggest however, that a medium (bordering on large) reduction in NO_2 concentrations (3.9 µg/m^3) will occur at this receptor, thus achieving compliance with the AQO (37.2 µg/m^3).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the West 2 route option.

As a medium (bordering on large) decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.1.5 East 1

The local air quality assessment results for the selected receptors for the East 1 route option are provided in Table 6.20 and demonstrated in Table 21 of Appendix D.

Table 6.20: Local Air Quality Assessment Results - East 1

Receptor ID	Modelled Annual Mean Concentration (µg/m^3)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R1	17.1	17.7	0.6	9.9	10.0	0.1	6.2	6.3	0.1
R2	17.1	16.9	-0.2	11.1	11.0	-0.1	6.8	6.8	0.0
R3	10.6	10.5	-0.1	8.7	8.8	0.1	5.6	5.6	0.0
R4	22.3	17.3	-5.0	12.2	11.4	-0.8	7.5	7.0	-0.5
R5	26.0	19.6	-6.4	12.9	11.8	-1.1	7.9	7.3	-0.6
R6	7.1	7.3	0.2	8.5	8.6	0.1	5.3	5.4	0.1
R7	34.4	24.2	-10.2	13.5	12.3	-1.2	8.3	7.6	-0.7
R8	36.1	27.2	-8.9	13.4	12.5	-0.9	8.3	7.7	-0.6
R9	**41.1**	32.6	-8.6	14.1	13.2	-0.9	8.7	8.1	-0.6
R10	12.8	12.1	-0.7	10.9	10.8	-0.1	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0
R12	6.9	6.4	-0.5	8.0	7.9	-0.1	5.1	5.1	0.0
R13	11.8	12.8	1.0	10.7	10.8	0.1	6.6	6.7	0.1
R14	12.6	12.0	-0.6	10.8	10.7	-0.1	6.7	6.6	-0.1
R15	11.1	12.4	1.3	10.9	11.1	0.2	6.7	6.9	0.2
R16	5.8	5.8	0.0	7.9	7.9	0.0	5.1	5.1	0.0
R17	14.7	12.9	-1.8	11.3	11.0	-0.3	7.0	6.8	-0.2
R18	9.3	9.9	0.6	8.5	8.7	0.2	5.4	5.5	0.1
R19	14.0	12.4	-1.6	11.4	11.0	-0.4	7.1	6.8	-0.3
R20	17.3	19.6	2.3	11.3	11.6	0.3	7.0	7.2	0.2

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R21	12.2	11.9	-0.3	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	24.4	1.5	12.6	13.0	0.4	8.0	8.2	0.2
R23	11.6	13.2	1.6	9.5	9.8	0.3	6.0	6.1	0.1
R24	37.3	38.2	0.9	13.5	13.6	0.1	8.5	8.6	0.1
R25	36.7	36.5	-0.2	13.6	13.6	0.0	8.5	8.5	0.0
Note: Exceedances of annual mean AQO (40 µg/m³) shown in **bold** type.									

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m³) in the DM scenario at receptor R9 (41.1 µg/m³). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for East 1 suggest however, that a large reduction in NO_2 concentrations (8.6 µg/m³) will occur at this receptor, thus achieving compliance with the AQO (32.6 µg/m³).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the East 1 route option.

As a large decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.1.6 East 2

The local air quality assessment results for the selected receptors for the East 2 route option are provided in Table 6.21 and illustrated in Table 22 of Appendix D.

Table 6.21: Local Air Quality Assessment Results - East 2

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R1	17.1	17.9	0.8	9.9	10.0	0.1	6.2	6.3	0.1
R2	17.1	16.9	-0.1	11.1	11.0	-0.1	6.8	6.8	0.0
R3	10.6	10.5	-0.1	8.7	8.7	0.0	5.6	5.6	0.0
R4	22.3	17.8	-4.4	12.2	11.5	-0.7	7.5	7.1	-0.4
R5	26.0	20.3	-5.7	12.9	11.9	-1.0	7.9	7.3	-0.6
R6	7.1	7.3	0.2	8.5	8.5	0.0	5.3	5.4	0.1
R7	34.4	25.2	-9.2	13.5	12.5	-1.0	8.3	7.7	-0.6
R8	36.1	28.0	-8.1	13.4	12.6	-0.8	8.3	7.8	-0.5
R9	**41.1**	33.5	-7.6	14.1	13.3	-0.8	8.7	8.2	-0.5
R10	12.8	12.1	-0.7	10.9	10.8	-0.1	6.8	6.7	-0.1
R11	10.7	10.7	0.0	8.5	8.5	0.0	5.5	5.5	0.0

Receptor ID	Modelled Annual Mean Concentration (µg/m³)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM2025	DS2025	Change	DM2025	DS2025	Change	DM2025	DS2025	Change
R12	6.9	6.5	-0.4	8.0	7.9	-0.1	5.1	5.1	0.0
R13	11.8	13.0	1.2	10.7	10.8	0.1	6.6	6.7	0.1
R14	12.6	12.2	-0.4	10.8	10.8	0.0	6.7	6.6	-0.1
R15	11.1	12.4	1.3	10.9	11.1	0.2	6.7	6.9	0.2
R16	5.8	5.8	0.0	7.9	7.9	0.0	5.1	5.1	0.0
R17	14.7	13.3	-1.4	11.3	11.1	-0.2	7.0	6.8	-0.2
R18	9.3	9.8	0.5	8.5	8.6	0.1	5.4	5.5	0.1
R19	14.0	12.6	-1.4	11.4	11.1	-0.3	7.1	6.9	-0.2
R20	17.3	19.1	1.8	11.3	11.5	0.2	7.0	7.2	0.2
R21	12.2	11.9	-0.3	9.8	9.7	-0.1	6.2	6.1	-0.1
R22	22.9	24.2	1.3	12.6	12.9	0.3	8.0	8.2	0.2
R23	11.6	13.2	1.6	9.5	9.8	0.3	6.0	6.1	0.1
R24	37.3	38.2	0.9	13.5	13.6	0.1	8.5	8.6	0.1
R25	36.7	36.6	-0.1	13.6	13.7	0.1	8.5	8.5	0.0
Note: Exceedances of annual mean AQO (40 µg/m³) shown in **bold** type.									

The results indicate that annual mean NO_2 concentrations are likely to exceed the respective AQO (40 µg/m³) in the DM scenario at receptor R9 (41.1 µg/m³). This receptor is located at the crossroads in Galgate, within the Galgate AQMA. The results in the DS scenario for East 2 suggest however, that a large reduction in NO_2 concentrations (7.6 µg/m³) will occur at this receptor, thus achieving compliance with the AQO (33.5 µg/m³).

Annual mean NO_2 concentrations at all other receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, are modelled to be below the relevant AQOs in both the DM and DS scenarios for the East 2 route option.

As a large decrease in annual mean NO_2 concentrations is modelled to occur at a receptor where the AQO is exceeded, this is considered to represent a significant beneficial impact in accordance with the criteria described in Table 6.10.

6.5.2 Construction Dust Impacts

The approximate number of sensitive receptors within 200m of potential construction activities (in 0-50m, 50-100m and 100-200m distance bands in line with DRMB LA 105 (Highways England, 2019) guidance), is provided in Table 6.22.

Table 6.22: Construction Dust Impacts Risk Potential Receptor Count Bands

Design option	0-50m	50-100m	100-200m
Central 1	32	106	290
Central 2	32	103	283
East 1	32	103	285
East 2	33	103	279
West 1	3	18	124
West 2	5	18	130

Based upon the criteria within DMRB LA 105 (see Table 6.9), and a 'Large' construction dust risk potential (see Table 6.8), properties within 100m of proposed construction activities for any of the route options would be of 'High sensitivity' to construction dust, and those further than 100m would be of 'Low' sensitivity to construction dust. As such, measures to mitigate potential construction dust effects for 'High Sensitivity' receptors would be required, as detailed in Appendix D.

6.5.3 Designated Sites

DMRB LA 105 (Highways England, 2019) indicates that the assessment of potential impacts on Designated Sites requires the estimation of changes in nitrogen deposition, but states that ultimately the competent expert for biodiversity shall conclude whether the estimated changes in nitrogen deposition are likely to trigger a significant effect. DMRB LA 105 (Highways England, 2019) also indicates however that if the change in nitrogen deposition as a result of a Proposed Scheme is less than 1% of the site relevant lower critical load, then impacts can be considered not significant.

It should be noted that at this stage, discussions with ecologists have not taken place to fully clarify which of the Designated Sites within 200m of the ARN include species sensitive to nitrogen or which site relevant critical loads should be used. However, in order to provide an indication of whether each option has the potential to impact nitrogen deposition within a Designated Site, the change in nitrogen deposition within each site has been estimated at the closest point within each site to the ARN and compared to the lowest possible critical load (i.e. 5 kgN/ha/yr). Where the change in nitrogen deposition is estimated to be >1% of the lowest possible critical load (i.e. >0.05 kgN/ha/yr), this has been used to indicate where changes in nitrogen deposition have the potential to affect a Designated Site. Likewise, where changes in nitrogen deposition are estimated to be less than this amount (i.e. <0.05 kgN/ha/yr), then it has been assumed that any resulting impacts are unlikely to be significant. It should be noted that this is a simplistic approach and that further work should be undertaken in conjunction with an ecologist and using the outputs of this assessment to more fully understand potential impacts on Designated Sites and their ultimate significance.

A summary of the results of this assessment for each of the route options for the Designated Sites detailed in Table 6.6 is provided in Table 6.23.

Table 6.23: Summary of Nitrogen Deposition Assessment for Designated Sites

Designated Site	Central 1	Central 2	East 1	East 2	West 1	West 2
Berry's Farm and Sellerley Farm Ponds, Conder Green	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	**Potentially Affected**	**Potentially Affected**
Foreigg Wood	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected

Designated Site	Central 1	Central 2	East 1	East 2	West 1	West 2
Ellel Grange Wood	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected
Long Bank Wood	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	Unlikely to be affected	Unlikely to be affected
Cocker Cough Wood	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected
Artle Dale	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected
Wyresdale Road Verges	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	Unlikely to be affected	Unlikely to be affected
Newton Beck Valley	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected
Park Coppice	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**	**Potentially Affected**
Old Park Wood	Unlikely to be affected	**Potentially Affected**	Unlikely to be affected	Unlikely to be affected	**Potentially Affected**	**Potentially Affected**
Cockshades Wood	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected
Little Cockshades Wood	Unlikely to be affected	Unlikely to be affected	**Potentially Affected**	**Potentially Affected**	Unlikely to be affected	Unlikely to be affected
Brunsow (North) Wood)	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	**Potentially Affected**
Lythe Brow Wood Woods	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected	Unlikely to be affected

The nitrogen deposition assessment results indicate that all route options have the potential to affect Designated Sites and therefore that further assessment should be undertaken to understand the significance (or not) of these impacts and if and how this might affect the selection of the preferred option.

6.5.4 Compliance Risk Assessment

Roadside annual mean NO_2 concentrations were predicted adjacent to all PCM links within 200m of the ARN. The relevant PCM links (Defra, 2019d) are presented in Table 6.15 and shown in Figure 16 of Appendix D.

No PCM links were modelled to have roadside concentrations in exceedance of the annual mean NO_2 EU Limit Value in either 2018 or 2025. The highest concentration in the opening year (2025), for any of these PCM links for any option, was 29.6 $\mu g/m^3$, which is well within the EU Limit Value of 40 $\mu g/m^3$. As such, the impact of the route options on national compliance with the EU Limit Value is concluded to be not significant.

6.6 Conclusions

6.6.1 Construction

The route options have the potential to give rise to construction phase air quality impacts, including those associated with construction dust and construction traffic emissions. No construction traffic data were available at this stage in the project, however it is considered unlikely that construction traffic would result in a significant effect on air quality given its short-term nature.

Following DMRB LA 105 (Highways England, 2019) guidance, the level of sensitivity to construction dust has been determined for sensitive receptors within 200m of each route option. These levels provide a basis for mitigation measures, which should be included within a CEMP going forwards. With the suitable implementation of mitigation measures, the impact of construction activities would be reduced to not significant.

6.6.2 Operation

Detailed air dispersion modelling has been undertaken for each of the route options, taking into account both human health, compliance risk and ecological receptors within 200m of the affected road network. The assessment included verification and adjustment with comparison against local authority monitoring data, taking into account Defra mapped background concentrations, to provide representative predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ at human health receptors, roadside NO_2 concentrations adjacent to PCM model links and nitrogen deposition rates at ecological receptors.

The assessment indicates there would be an exceedance of the NO_2 AQO at one modelled human health receptor in the opening year Do-Minimum scenario. This receptor, which is located within the Galgate AQMA, is however modelled to experience a medium to large beneficial reduction in NO_2 concentrations in all DS options, resulting in the AQO being achieved at this receptor. NO_2 concentrations at all other human health receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, were modelled be within the relevant AQOs. In accordance with DMRB LA 105 (Highways England, 2019), this indicates that the air quality impacts of the route options – for all design options – can be considered beneficial. Furthermore, the results of the compliance risk assessment indicate that the route options is unlikely to have a significant effect on national compliance with the annual mean NO_2 EU Limit Value.

For ecological receptors, an initial, high level assessment of nitrogen deposition rates indicates that some of the identified Designated Sites have the potential to be affected by the various route options. However, further assessment is required (in conjunction with ecologists) in order to more fully understand these impacts and assess their significance.

6.7 References

Air Quality Standards (England) Regulations 2010.

Air Quality (England) (Amendment) 2000 / 2002 Regulations.

ClientEarth et al (2018) https://www.judiciary.uk/wp-content/uploads/2018/02/clientearth-no3-final-judgmentdocx.pdf. July 2018.

Defra (2011). Trends in NOx and NO_2 emissions and ambient measurements in the UK. July 2011.

Defra (2015). Air quality in the UK: Plan to Reduce Nitrogen Dioxide Emissions. December 2015.

Defra (2017). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2017.

Defra (2018). Local Air Quality Management. Technical Guidance LAQM.TG(16). April 2018.

Defra (2019a). Clean Air Strategy 2019. January 2019.

Defra (2019b). Air Quality: National Air Pollution Control Programme. March 2019.

Defra (2019c). Background Air Quality Maps. https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017. May 2019.

Defra (2019d). 2019 NO_2 projections data (2017 reference year). https://uk-air.defra.gov.uk/library/no2ten/2019-no2-pm-projections-from-2017-data

Defra & DfT (2017). UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations. July 2017.

Environment Act 1995, HMSO.

Environment Protection Act 1990, HMSO.

European Commission (2008). European Union (EU) Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFÉ), May 2008.

Highways Agency (2007). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 Air Quality, HA207/07. Highways Agency, Scottish Executive, The National Assembly for Wales and The Department of Regional Development Northern Ireland.

Highways England (2019). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 LA 105 Air Quality. Highways England, Transport Scotland, Welsh Government and The Department for Infrastructure.

IAQM (2016). Institute of Air Quality Management. Guidance on the assessment of dust from demolition and construction Version 1.1. June 2016.

Lancaster City Council (2014). A Local Plan for Lancaster District (2011-2031). Development Management Development Plan Document (DPD). December 2014.

Lancaster City Council (2018a). A Local Plan for Lancaster District (2011-2031). Low Emission and Air Quality Planning Advisory Note. November 2018.

Lancaster City Council (2018b). 2018 Air Quality Annual Status Report (ASR) for Lancaster City Council. October 2018.

Lancaster City Council (2019). 2018 NO_2 Diffusion Tube Results.

Ministry of Housing, Communities and Local Government (2019). National Planning Policy Framework. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf. February 2019.

7. Conclusions

A comparative assessment of the performance of each of the six route options including the following topics:

- Traffic Impact
- Noise Impact
- Air Quality Impact

A policy review to understand the fit of the each of the six route options with relevant national and local policy was also undertaken.

Our assessment has demonstrated that:

- From the traffic modelling point of view, the Central 1 route option is the one that shows more potential to reduce traffic flow and alleviate congestion on the A6 through Galgate. The main disadvantage of Central 1 is that the junctions in the new infrastructure are showing to operate over capacity. A feasible design that provides enough capacity needs to be considered if the route option is taken forward to subsequent stages. All other route options achieve some reduction in flows along the A6 through Galgate however, these are not consistent for all directions of travel.

- The Noise analysis shows that for the short-term daytime period, West 2 is the most preferable option from a noise perspective, as it results in the least number of adverse impacts of minor magnitude and provides a substantial number of beneficial impacts of minor magnitude or more. In the long term, all route options are considered comparable in terms of preference from a noise point of view. All route options would be regarded as adverse owing to the larger numbers of adverse impacts of minor magnitude or more compared to the beneficial impacts of minor magnitude or more. There is not a large variation between the route options in the long-term night-time, with Central 2 route option predicted to experience the greatest number of long-term night time adverse impacts of minor magnitude or more and Central 1 predicted to experience the least number of long-term night time adverse impacts of minor magnitude or more.
- The Air Quality assessment indicates there would be an exceedance of the NO_2 AQO at one modelled human health receptor in the opening year Do-Minimum scenario. This receptor, which is located within the Galgate AQMA, is however modelled to experience a medium to large beneficial reduction in NO_2 concentrations in all DS route options, resulting in the AQO being achieved at this receptor. NO_2 concentrations at all other human health receptors, and for PM_{10} and $PM_{2.5}$ at all receptors, were modelled be within the relevant AQOs. In accordance with DMRB LA 105 (Highways England, 2019), this indicates that the air quality impacts of the route options can be considered beneficial. Furthermore, the results of the compliance risk assessment indicate that the route options are unlikely to have a significant effect on national compliance with the annual mean NO_2 EU Limit Value.

- The West 2 and Central 2route options have been found not to be a good fit with relation to the Green Spaces policy, DM25 Green Space Infrastructure in the DPD as they weave through ancient woodland - Old Park Wood and Park Coppice. The West 1 and East 1 route options also cut across the canal, potentially creating a conflict with this policy. All of the route options have been found to potentially affect existing housing and will have to be integrated in the reconfiguration plans for the M6 J33. Similarly, there is an Agri-business Centre planned in the vicinity of the M6 J33 and some of the route option alignments are in close proximity and potentially interfere with the proposed site. If this was the case, these route options might not be a good fit with the Agri-business and Future Employment policies.

Appendix A. Traffic Modelling

Central 1, 2025, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme Central 1 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	794	524	574	25%	2%	15%
		South of M6 J33	2	4164	4301	700	566	723	635	575	723	-9%	2%	0%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	877	633	845	663	403	468	-24%	-36%	-45%
		M6 J33 & Stoney Lane	2	4002	3368	714	689	948	346	388	419	-51%	-44%	-56%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	706	448	522	-21%	-20%	-31%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	397	417	576	-39%	-30%	-36%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	695	442	519	-16%	-19%	-26%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	370	409	565	-32%	-25%	-23%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	669	454	466	28%	-10%	-24%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	287	351	494	-35%	-31%	-27%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	581	641	581	-17%	-21%	-30%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	983	526	336	-18%	-32%	-36%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	783	671	601	-3%	-11%	-19%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	548	551	534	-16%	-17%	-17%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3328	3147	3129	1%	2%	6%
		J33 & J34	2	7032	7026	3268	3475	3336	3452	3529	3497	6%	2%	5%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	56	13	33	16	13	5	-72%	2%	-84%
		A6 & Bay Horse Road	2	3377	3371	158	13	44	39	12	6	-75%	-6%	-87%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	18	6	3	-92%	-70%	-91%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	10	3	12	-75%	-88%	-88%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	6	6	25	12	7	7	119%	22%	-71%
		Chapel Lane & Bay Horse Road	2	4307	4007	34	6	3	31	7	4	-7%	27%	58%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	244	139	212	856%	149%	68%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	359	229	205	1%	316%	73%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	98	62	103	173%	55%	-18%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	153	74	117	-43%	51%	-15%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	38	21	18	-78%	1%	-52%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	22	14	35	-24%	-53%	-65%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	177	92	108	9%	141%	154%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	221	163	104	93%	336%	22%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	506	345	548	-16%	-10%	-10%
		Barnton Road & A6	2	4294	4015	603	429	594	603	426	521	0%	-1%	-12%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	6	12	7	-91%	-57%	-65%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	14	7	13	-64%	-60%	-67%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	50	0%	0%	1%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	32	42	0%	2%	0%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	72	60	55	56%	17%	61%
		A588 & Highland Brow	2	4241	4004	45	35	45	109	51	135	141%	44%	201%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	274	133	118	-12%	-4%	-24%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	101	146	201	-5%	1%	-21%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	287	132	130	-9%	-10%	-19%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	100	145	198	-21%	-5%	-13%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	671	315	307	26%	25%	21%
		Ashford Road & A6	2	4129	4152	306	249	430	374	314	514	22%	26%	20%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Central 1, 2040, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme Central 1 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	708	590	520	34%	7%	37%
		South of M6 J33	2	4164	4301	640	531	596	380	572	679	-41%	8%	14%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	906	905	963	779	505	445	-14%	-44%	-54%
		M6 J33 & Stoney Lane	2	4002	3368	760	803	716	216	296	515	-72%	-63%	-28%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	820	594	343	-1%	-7%	-38%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	248	397	700	-65%	-37%	-1%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	786	590	629	-1%	-6%	22%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	164	384	670	-66%	-25%	20%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	980	791	457	78%	36%	-30%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	484	692	728	9%	66%	49%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	724	976	923	47%	-1%	-10%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1199	854	689	-1%	27%	174%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	907	889	831	36%	8%	0%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	611	649	667	23%	45%	69%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	4054	3849	3780	8%	10%	12%
		J33 & J34	2	7032	7026	3553	4077	3977	3734	4219	4231	5%	3%	6%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	75	11	6	18	10	4	-76%	-3%	-21%
		A6 & Bay Horse Road	2	3377	3371	197	14	221	45	12	10	-77%	-14%	-95%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	279	7	33	-21%	-81%	-84%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	249	39	92	53%	-72%	-65%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	5	6	112	15	8	49	198%	44%	-56%
		Chapel Lane & Bay Horse Road	2	4307	4007	269	10	10	188	13	157	-30%	36%	1450%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	444	303	454	104%	57%	25%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	754	446	357	17%	49%	10%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	182	106	118	15%	2%	-61%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	328	150	226	-15%	2%	-15%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	225	28	57	-25%	-16%	-67%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	214	49	208	7%	-63%	-6%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	423	218	387	13%	71%	62%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	576	338	331	21%	17%	18%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	694	488	645	-1%	-7%	-4%
		Barnton Road & A6	2	4294	4015	852	701	943	824	679	853	-3%	-3%	-10%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	80	13	14	-7%	-69%	-76%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	129	14	56	82%	-58%	-33%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	66	43	39	-47%	5%	-7%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	96	29	45	-5%	1%	-15%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	196	186	165	-3%	67%	139%
		A588 & Highland Brow	2	4241	4004	104	141	267	170	209	306	63%	49%	15%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	376	310	422	30%	17%	13%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	314	299	336	15%	40%	76%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	817	389	432	-16%	-33%	-9%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	347	409	720	-30%	-37%	-30%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	811	430	431	-16%	-34%	-14%
		Ashford Road & A6	2	4129	4152	617	701	947	459	444	743	-26%	-37%	-21%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Central 2, 2025, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme Central 1 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	794	524	574	25%	2%	15%
		South of M6 J33	2	4164	4301	700	566	723	635	575	723	-9%	2%	0%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	877	633	845	663	403	468	-24%	-36%	-45%
		M6 J33 & Stoney Lane	2	4002	3368	714	689	948	346	388	419	-51%	-44%	-56%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	706	448	522	-21%	-20%	-31%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	397	417	576	-39%	-30%	-36%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	695	442	519	-16%	-19%	-26%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	370	409	565	-32%	-25%	-23%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	669	454	466	28%	-10%	-24%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	287	351	494	-35%	-31%	-27%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	581	641	581	-17%	-21%	-30%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	983	526	336	-18%	-32%	-36%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	783	671	601	-3%	-11%	-19%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	548	551	534	-16%	-17%	-17%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3328	3147	3129	1%	2%	6%
		J33 & J34	2	7032	7026	3268	3475	3336	3452	3529	3497	6%	2%	5%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	56	13	33	16	13	5	-72%	2%	-84%
		A6 & Bay Horse Road	2	3377	3371	158	13	44	39	12	6	-75%	-6%	-87%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	18	6	3	-92%	-70%	-91%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	10	3	12	-75%	-88%	-88%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	6	6	25	12	7	7	119%	22%	-71%
		Chapel Lane & Bay Horse Road	2	4307	4007	34	6	3	31	7	4	-7%	27%	58%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	244	139	212	856%	149%	68%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	359	229	205	1%	316%	73%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	98	62	103	173%	55%	-18%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	153	74	117	-43%	51%	-15%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	38	21	18	-78%	1%	-52%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	22	14	35	-24%	-53%	-65%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	177	92	108	9%	141%	154%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	221	163	104	93%	336%	22%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	506	345	548	-16%	-10%	-10%
		Barnton Road & A6	2	4294	4015	603	429	594	603	426	521	0%	-1%	-12%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	6	12	7	-91%	-57%	-65%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	14	7	13	-64%	-60%	-67%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	50	0%	0%	1%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	32	42	0%	2%	0%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	72	60	55	56%	17%	61%
		A588 & Highland Brow	2	4241	4004	45	35	45	109	51	135	141%	44%	201%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	274	133	118	-12%	-4%	-24%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	101	146	201	-5%	1%	-21%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	287	132	130	-9%	-10%	-19%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	100	145	198	-21%	-5%	-13%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	671	315	307	26%	25%	21%
		Ashford Road & A6	2	4129	4152	306	249	430	374	314	514	22%	26%	20%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Central 2, 2040, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme Central 2 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	702	582	577	33%	5%	52%
		South of M6 J33	2	4164	4301	640	531	596	530	611	709	-17%	15%	19%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	906	905	963	768	522	686	-15%	-42%	-29%
		M6 J33 & Stoney Lane	2	4002	3368	760	803	716	419	378	602	-45%	-53%	-16%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	817	546	615	-1%	-14%	12%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	365	403	717	-48%	-36%	2%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	785	545	698	-1%	-13%	35%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	311	396	581	-36%	-23%	4%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	811	783	844	47%	35%	30%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	383	659	533	-14%	58%	9%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	629	973	1008	28%	-1%	-1%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1153	820	392	-5%	22%	56%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	827	902	837	24%	10%	1%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	486	644	426	-2%	44%	8%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	4113	3868	3800	9%	10%	12%
		J33 & J34	2	7032	7026	3553	4077	3977	3803	4230	4258	7%	4%	7%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	75	11	6	15	11	4	-80%	2%	-21%
		A6 & Bay Horse Road	2	3377	3371	197	14	221	28	12	7	-86%	-14%	-97%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	239	7	21	-33%	-81%	-90%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	110	10	94	-32%	-93%	-64%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	5	6	112	32	9	25	520%	56%	-78%
		Chapel Lane & Bay Horse Road	2	4307	4007	269	10	10	89	12	72	-67%	31%	616%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	377	289	346	73%	50%	-4%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	570	421	304	-11%	41%	-6%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	159	105	128	0%	2%	-57%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	271	135	179	-30%	-8%	-33%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	210	28	41	-30%	-16%	-76%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	75	19	122	-63%	-85%	-45%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	428	203	247	14%	59%	3%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	373	297	236	-21%	3%	-16%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	692	478	645	-2%	-9%	-4%
		Barnton Road & A6	2	4294	4015	852	701	943	767	669	872	-10%	-5%	-7%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	65	13	14	-24%	-69%	-77%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	85	14	56	19%	-58%	-32%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	45	43	43	-64%	5%	2%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	96	30	39	-5%	2%	-26%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	139	31	40	-31%	-72%	-42%
		A588 & Highland Brow	2	4241	4004	104	141	267	71	51	207	-32%	-64%	-23%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	340	212	292	18%	-20%	-22%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	245	184	202	-10%	-14%	5%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	820	398	427	-16%	-32%	-10%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	683	471	974	37%	-28%	-5%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	868	410	438	-9%	-38%	-13%
		Ashford Road & A6	2	4129	4152	617	701	947	679	466	957	10%	-34%	1%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

East 1, 2025, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme East 1 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	831	532	581	30%	4%	17%
		South of M6 J33	2	4164	4301	700	566	723	685	576	745	-2%	2%	3%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	877	633	845	744	474	663	-15%	-25%	-22%
		M6 J33 & Stoney Lane	2	4002	3368	714	689	948	299	321	355	-58%	-53%	-63%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	819	512	710	-8%	-8%	-6%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	363	350	519	-45%	-41%	-43%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	809	506	705	-3%	-7%	1%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	327	337	474	-40%	-38%	-36%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	589	444	416	13%	-12%	-32%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	188	270	395	-57%	-47%	-42%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	509	636	540	-27%	-22%	-35%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	894	442	239	-26%	-42%	-54%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	754	660	589	-7%	-13%	-21%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	487	476	449	-25%	-28%	-30%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3328	3153	3128	1%	2%	6%
		J33 & J34	2	7032	7026	3268	3475	3336	3453	3512	3491	6%	1%	5%
9	Stoney Lane	A6 & Bay Horse Road	1	4007	4307	6	6	25	11	7	7	93%	22%	-71%
		A6 & Bay Horse Road	2	4307	4007	34	6	3	31	7	4	-7%	28%	67%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	16	4	2	-93%	-78%	-95%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	5	3	9	-87%	-88%	-91%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4303	6029	172	21	37	35	21	16	-80%	1%	-56%
		Chapel Lane & Bay Horse Road	2	6029	4303	29	29	99	21	14	34	-29%	-53%	-66%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	333	144	262	1207%	158%	107%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	484	335	312	37%	508%	164%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	131	62	116	267%	53%	-8%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	156	89	129	-42%	83%	-6%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	35	21	16	-80%	1%	-56%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	21	14	34	-29%	-53%	-66%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	230	97	147	42%	155%	244%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	342	254	202	198%	579%	137%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	509	354	548	-16%	-8%	-10%
		Barnton Road & A6	2	4294	4015	603	429	594	718	510	612	19%	19%	3%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	6	10	6	-91%	-63%	-66%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	11	7	11	-71%	-60%	-71%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	48	0%	0%	-2%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	32	42	0%	2%	0%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	65	55	44	40%	7%	30%
		A588 & Highland Brow	2	4241	4004	45	35	45	109	51	135	141%	44%	202%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	270	132	120	-13%	-5%	-23%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	99	145	199	-6%	0%	-22%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	283	132	131	-10%	-10%	-18%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	98	145	196	-22%	-5%	-14%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	664	314	309	25%	24%	21%
		Ashford Road & A6	2	4129	4152	306	249	430	359	313	510	17%	26%	19%

All values expressed in PCU's. All values are two-way link flows.

*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

East 1, 2040, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme East 1 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	930	599	616	76%	8%	62%
		South of M6 J33	2	4164	4301	640	531	596	640	608	743	0%	15%	25%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	906	905	963	767	570	610	-15%	-37%	-37%
		M6 J33 & Stoney Lane	2	4002	3368	760	803	716	274	269	412	-64%	-66%	-42%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	818	659	579	-1%	3%	5%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	286	374	594	-59%	-41%	-16%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	764	654	839	-4%	4%	62%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	258	356	568	-47%	-31%	1%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	986	781	452	79%	34%	-30%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	466	567	631	5%	36%	29%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	684	976	771	39%	-1%	-25%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1229	736	578	1%	9%	130%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	880	880	700	32%	7%	-16%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	620	559	612	25%	25%	55%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	4150	3856	3916	10%	10%	16%
		J33 & J34	2	7032	7026	3553	4077	3977	3971	4222	4293	12%	4%	8%
9	Stoney Lane	A6 & Bay Horse Road	1	4007	4307	5	6	112	27	8	52	438%	45%	-54%
		A6 & Bay Horse Road	2	4307	4007	269	10	10	83	12	122	-69%	23%	1104%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	114	5	4	-68%	-87%	-98%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	44	5	22	-73%	-97%	-92%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4303	6029	299	33	173	121	28	33	-60%	-17%	-81%
		Chapel Lane & Bay Horse Road	2	6029	4303	200	131	221	69	19	143	-66%	-86%	-35%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	512	318	566	135%	65%	56%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	793	622	550	24%	108%	70%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	215	109	137	35%	5%	-54%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	283	190	253	-27%	29%	-5%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	121	28	33	-60%	-17%	-81%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	69	19	143	-66%	-86%	-35%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	406	229	454	8%	79%	89%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	585	443	433	23%	54%	54%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	690	497	673	-2%	-6%	0%
		Barnton Road & A6	2	4294	4015	852	701	943	820	744	889	-4%	6%	-6%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	31	11	10	-64%	-73%	-83%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	45	9	29	-37%	-71%	-65%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	51	43	39	-59%	5%	-7%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	96	30	49	-4%	4%	-8%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	228	183	179	13%	65%	159%
		A588 & Highland Brow	2	4241	4004	104	141	267	176	212	329	69%	51%	23%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	366	307	418	27%	15%	12%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	314	281	370	15%	31%	93%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	801	381	372	-18%	-34%	-22%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	305	394	662	-39%	-40%	-35%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	797	426	400	-17%	-35%	-20%
		Ashford Road & A6	2	4129	4152	617	701	947	429	432	710	-31%	-38%	-25%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

East 2, 2025, modelled flow by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme East 2 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	825	530	580	29%	3%	17%
		South of M6 J33	2	4164	4301	700	566	723	732	576	797	4%	2%	10%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	877	633	845	781	511	718	-11%	-19%	-15%
		M6 J33 & Stoney Lane	2	4002	3368	714	689	948	333	354	358	-53%	-49%	-62%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	890	545	763	0%	-2%	1%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	383	384	510	-42%	-36%	-44%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	874	536	750	5%	-2%	7%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	344	370	465	-37%	-32%	-37%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	614	477	449	18%	-6%	-27%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	213	302	406	-52%	-41%	-40%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	535	670	569	-24%	-18%	-32%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	905	468	248	-25%	-39%	-52%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	749	679	597	-7%	-10%	-20%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	485	486	452	-26%	-27%	-29%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3335	3159	3135	2%	2%	6%
		J33 & J34	2	7032	7026	3268	3475	3336	3465	3526	3501	6%	1%	5%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	56	13	33	18	14	15	-68%	5%	-55%
		A6 & Bay Horse Road	2	3377	3371	158	13	44	85	13	8	-46%	2%	-81%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	17	4	3	-92%	-78%	-91%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	7	3	25	-82%	-89%	-75%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	6	6	25	11	7	7	89%	22%	-71%
		Chapel Lane & Bay Horse Road	2	4307	4007	34	6	3	31	7	4	-7%	27%	42%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	286	101	223	1020%	81%	77%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	462	293	279	31%	433%	136%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	119	53	104	232%	32%	-17%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	164	85	116	-39%	74%	-16%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	36	21	18	-79%	1%	-52%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	22	14	48	-24%	-53%	-51%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	196	63	118	21%	65%	177%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	313	216	193	174%	480%	127%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	509	336	545	-16%	-13%	-11%
		Barnton Road & A6	2	4294	4015	603	429	594	691	488	606	15%	14%	2%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	6	10	7	-91%	-63%	-64%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	11	7	13	-70%	-62%	-67%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	50	0%	-1%	1%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	32	42	0%	2%	1%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	57	55	44	23%	7%	30%
		A588 & Highland Brow	2	4241	4004	45	35	45	72	51	123	59%	44%	174%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	277	133	120	-11%	-4%	-23%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	94	145	200	-11%	1%	-21%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	289	136	132	-8%	-7%	-18%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	94	145	197	-26%	-5%	-14%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	669	314	309	26%	24%	21%
		Ashford Road & A6	2	4129	4152	306	249	430	351	313	511	15%	26%	19%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

East 2, 2040, modelled flow by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme East 2 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	897	594	597	70%	7%	57%
		South of M6 J33	2	4164	4301	640	531	596	701	647	791	10%	22%	33%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	906	905	963	778	610	668	-14%	-33%	-31%
		M6 J33 & Stoney Lane	2	4002	3368	760	803	716	291	318	378	-62%	-60%	-47%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	842	694	586	2%	9%	7%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	299	412	547	-57%	-35%	-22%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	775	686	854	-2%	10%	65%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	253	394	522	-48%	-23%	-7%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	965	814	434	75%	40%	-33%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	457	591	644	3%	42%	32%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	696	987	788	41%	0%	-23%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1249	756	586	3%	12%	133%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	865	902	704	29%	10%	-15%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	644	595	625	30%	33%	58%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	4154	3862	3917	10%	10%	16%
		J33 & J34	2	7032	7026	3553	4077	3977	3976	4223	4321	12%	4%	9%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	75	11	6	18	11	4	-76%	1%	-20%
		A6 & Bay Horse Road	2	3377	3371	197	14	221	63	14	9	-68%	0%	-96%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	123	6	9	-65%	-85%	-96%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	42	5	29	-74%	-96%	-89%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	5	6	112	18	8	44	248%	40%	-60%
		Chapel Lane & Bay Horse Road	2	4307	4007	269	10	10	69	11	124	-74%	17%	1125%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	512	276	558	135%	43%	54%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	814	583	536	27%	95%	66%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	203	100	128	28%	-3%	-57%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	285	179	248	-26%	21%	-7%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	114	28	33	-62%	-16%	-81%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	54	20	157	-73%	-85%	-29%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	414	196	453	10%	54%	89%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	588	416	433	24%	44%	54%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	699	470	676	-1%	-11%	1%
		Barnton Road & A6	2	4294	4015	852	701	943	812	707	881	-5%	1%	-6%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	37	12	11	-57%	-72%	-82%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	42	9	24	-40%	-72%	-71%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	51	43	42	-60%	4%	1%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	96	32	49	-4%	9%	-8%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	225	178	176	12%	60%	154%
		A588 & Highland Brow	2	4241	4004	104	141	267	173	207	317	66%	47%	19%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	363	310	460	26%	17%	23%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	305	276	355	12%	29%	85%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	810	385	401	-17%	-34%	-16%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	298	400	647	-40%	-39%	-37%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	844	429	408	-12%	-35%	-19%
		Ashford Road & A6	2	4129	4152	617	701	947	423	435	693	-31%	-38%	-27%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

West 1, 2025, modelled flow by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme West 1 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	756	526	568	19%	3%	14%
		South of M6 J33	2	4164	4301	700	566	723	728	592	790	4%	4%	9%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	877	633	845	826	486	711	-6%	-23%	-16%
		M6 J33 & Stoney Lane	2	4002	3368	714	689	948	552	572	839	-23%	-17%	-12%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	913	449	656	3%	-19%	-13%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	526	510	864	-20%	-14%	-5%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	850	437	604	2%	-20%	-13%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	471	464	679	-14%	-15%	-8%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	446	387	426	-15%	-24%	-30%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	342	421	625	-23%	-18%	-8%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	377	592	592	-46%	-27%	-29%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	997	571	266	-17%	-26%	-49%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	507	585	522	-37%	-22%	-30%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	473	504	399	-27%	-24%	-38%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3277	3091	2923	0%	0%	-1%
		J33 & J34	2	7032	7026	3268	3475	3336	3319	3475	3329	2%	0%	0%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	56	13	33	33	13	47	-42%	-3%	40%
		A6 & Bay Horse Road	2	3377	3371	158	13	44	143	13	8	-9%	2%	-83%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	72	10	17	-66%	-50%	-50%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	26	8	42	-34%	-73%	-58%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	6	6	25	6	6	10	14%	3%	-60%
		Chapel Lane & Bay Horse Road	2	4307	4007	34	6	3	30	6	3	-10%	4%	26%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	60	60	122	135%	7%	-4%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	251	64	88	-29%	16%	-26%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	59	49	125	64%	22%	-1%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	212	52	98	-21%	6%	-28%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	57	19	20	-67%	-9%	-45%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	17	15	46	-41%	-50%	-53%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	60	31	21	-63%	-19%	-50%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	58	28	40	-49%	-24%	-53%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	536	363	614	-11%	-6%	0%
		Barnton Road & A6	2	4294	4015	603	429	594	600	422	573	-1%	-2%	-4%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	43	19	18	-36%	-30%	-3%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	36	11	34	-5%	-38%	-13%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	50	0%	0%	0%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	31	42	0%	0%	0%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	53	53	43	16%	3%	28%
		A588 & Highland Brow	2	4241	4004	45	35	45	49	37	76	8%	5%	70%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	283	134	120	-9%	-3%	-23%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	97	139	215	-8%	-3%	-15%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	278	133	120	-12%	-9%	-25%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	96	139	198	-23%	-9%	-14%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	953	440	496	79%	74%	95%
		Ashford Road & A6	2	4129	4152	306	249	430	523	424	743	71%	70%	73%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

West 1, 2040, modelled flow by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme West 1 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	708	549	505	34%	-1%	33%
		South of M6 J33	2	4164	4301	640	531	596	606	574	629	-5%	8%	5%
2	A6	M6 J33 & Stoney Lane	1	3368	4002	906	905	963	845	713	939	-7%	-21%	-2%
		M6 J33 & Stoney Lane	2	4002	3368	760	803	716	702	804	941	-8%	0%	31%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	812	650	854	-2%	2%	56%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	639	763	896	-9%	21%	27%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	757	639	805	-5%	2%	56%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	496	704	729	3%	37%	30%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	937	824	934	70%	42%	44%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	493	713	601	11%	71%	23%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	733	1004	1019	49%	2%	0%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1248	895	605	3%	33%	140%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	903	929	840	35%	13%	1%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	654	698	663	32%	56%	68%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	4040	3706	3610	7%	6%	7%
		J33 & J34	2	7032	7026	3553	4077	3977	3796	4159	4170	7%	2%	5%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	75	11	6	28	13	4	-63%	25%	-31%
		A6 & Bay Horse Road	2	3377	3371	197	14	221	120	13	73	-39%	-2%	-67%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	338	45	113	-5%	14%	-45%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	164	103	212	1%	-25%	-19%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	5	6	112	10	7	48	88%	20%	-57%
		Chapel Lane & Bay Horse Road	2	4307	4007	269	10	10	133	9	3	-50%	-9%	-73%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	304	252	396	40%	30%	9%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	713	343	462	11%	15%	43%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	190	130	282	20%	25%	-6%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	360	198	277	-6%	35%	4%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	269	41	81	-10%	23%	-53%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	172	97	167	-14%	-26%	-25%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	392	165	201	4%	29%	-16%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	534	245	357	13%	-15%	27%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	710	513	698	1%	-3%	4%
		Barnton Road & A6	2	4294	4015	852	701	943	809	631	830	-5%	-10%	-12%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	99	40	59	16%	-6%	0%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	80	31	85	13%	-5%	3%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	76	42	47	-40%	2%	11%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	100	30	53	-1%	1%	-1%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	178	171	159	-11%	54%	129%
		A588 & Highland Brow	2	4241	4004	104	141	267	119	200	212	14%	43%	-21%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	321	325	351	11%	22%	-6%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	259	284	357	-5%	33%	86%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	835	412	387	-14%	-29%	-18%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	314	393	635	-37%	-40%	-38%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	856	457	398	-11%	-30%	-21%
		Ashford Road & A6	2	4129	4152	617	701	947	438	436	724	-29%	-38%	-24%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

West 2, 2025, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2025)			With scheme West 2 (2025)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	638	513	498	602	496	407	-6%	-3%	-18%
		South of M6 J33	2	4164	4301	700	566	723	706	566	733	1%	0%	1%
2	A6	M6 J33 & Stoney Lane	1	3368	4166	877	633	845	730	680	925	-17%	7%	9%
		M6 J33 & Stoney Lane	2	4166	3368	714	689	948	690	600	635	-3%	-13%	-33%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	890	557	754	721	561	566	-19%	1%	-25%
		Stoney Lane & Chapel Lane	2	4006	4002	656	595	905	648	624	785	-1%	5%	-13%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	831	545	698	684	550	550	-18%	1%	-21%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	548	545	736	595	578	611	9%	6%	-17%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	523	506	613	449	471	430	-14%	-7%	-30%
		Hazelrigg Lane & Burrow Road	2	4130	4159	442	511	679	409	488	627	-7%	-4%	-8%
6	A6	Burrow Road & Ashford Road	1	4012	4149	701	816	836	412	684	683	-41%	-16%	-18%
		Burrow Road & Ashford Road	2	4149	4012	1204	769	521	1123	641	398	-7%	-17%	-24%
7	A6	Ashford Road & Ashton Road	1	4269	1084	807	754	745	626	686	677	-23%	-9%	-9%
		Ashford Road & Ashton Road	2	1084	4269	652	662	640	618	589	521	-5%	-11%	-19%
8	M6	J33 & J34	1	7010	7031	3281	3084	2950	3310	3092	2949	1%	0%	0%
		J33 & J34	2	7032	7026	3268	3475	3336	3190	3476	3293	-2%	0%	-1%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	56	13	33	84	14	117	49%	5%	252%
		A6 & Bay Horse Road	2	3377	3371	158	13	44	172	17	104	9%	34%	136%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	211	20	34	264	34	78	25%	71%	129%
		Stoney Lane & Procter Moss Road	2	6040	6050	39	29	100	30	30	44	-23%	2%	-56%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	6	6	25	4	6	4	-23%	3%	-83%
		Chapel Lane & Bay Horse Road	2	4307	4007	34	6	3	63	6	4	89%	3%	42%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	26	56	126	20	46	95	-23%	-17%	-25%
		A6 & Procter Moss Road	2	6029	3351	354	55	118	374	59	124	6%	7%	5%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	36	40	126	33	35	102	-9%	-14%	-19%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	269	49	138	290	53	134	8%	9%	-3%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	172	21	37	222	26	49	29%	27%	33%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	29	29	99	20	30	47	-32%	2%	-52%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	162	38	43	209	39	46	29%	3%	7%
		Hazelrigg Lane & Barnton Road	2	1160	6029	115	37	85	103	37	42	-10%	-1%	-51%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	605	386	612	605	364	590	0%	-6%	-4%
		Barnton Road & A6	2	4294	4015	603	429	594	626	417	580	4%	-3%	-2%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	67	28	19	67	36	51	0%	30%	167%
		Procter Moss Road & Wyresdale Road	2	6039	6040	38	19	39	38	18	35	0%	-1%	-11%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	60	45	50	60	45	50	0%	0%	0%
		Bay Horse Road & Little Fell Lane	2	4304	6028	90	31	42	90	31	42	0%	0%	0%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	46	51	34	59	46	39	29%	-11%	15%
		A588 & Highland Brow	2	4241	4004	45	35	45	40	36	86	-11%	3%	92%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	310	139	156	297	142	193	-4%	2%	24%
		Birch Avenue & Tarnwater Lane	2	9028	4005	106	144	253	106	143	199	1%	-1%	-21%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	316	146	160	304	150	152	-4%	2%	-5%
		Tarnwater Lane & Ashford Road	2	4183	4244	126	153	228	107	142	197	-15%	-7%	-14%
22	Ashton Road	Ashford Road & A6	1	4152	4129	533	252	255	704	335	323	32%	33%	27%
		Ashford Road & A6	2	4129	4152	306	249	430	372	332	611	21%	34%	42%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Jacobs

West 2, 2040, modelled flows by direction

	Road name	Between	Dir	A node	B node	Without scheme (2040)			With scheme West 2 (2040)			Change (%)		
						AM	IP	PM	AM	IP	PM	AM	IP	PM
1	A6	South of M6 J33	1	4301	4164	527	553	380	439	480	359	-17%	-13%	-6%
		South of M6 J33	2	4164	4301	640	531	596	614	526	575	-4%	-1%	-4%
2	A6	M6 J33 & Stoney Lane	1	3368	4166	760	803	716	908	893	896	19%	11%	25%
		M6 J33 & Stoney Lane	2	4166	3368	906	905	963	758	712	949	-16%	-21%	-1%
3	A6	Stoney Lane & Chapel Lane	1	4002	4006	829	638	549	581	519	564	-30%	-19%	3%
		Stoney Lane & Chapel Lane	2	4006	4002	702	630	704	669	662	940	-5%	5%	34%
4	A6	Chapel Lane & Hazelrigg Lane	1	4006	4159	794	626	517	576	509	558	-27%	-19%	8%
		Chapel Lane & Hazelrigg Lane	2	4159	4006	484	513	560	464	605	760	-4%	18%	36%
5	A6	Hazelrigg Lane & Burrow Road	1	4159	4130	552	581	650	762	792	710	38%	36%	9%
		Hazelrigg Lane & Burrow Road	2	4130	4159	444	417	488	584	720	659	31%	73%	35%
6	A6	Burrow Road & Ashford Road	1	4012	4149	493	984	1023	665	985	960	35%	0%	-6%
		Burrow Road & Ashford Road	2	4149	4012	1217	673	252	1250	907	664	3%	35%	164%
7	A6	Ashford Road & Ashton Road	1	4269	1084	668	822	830	865	915	820	29%	11%	-1%
		Ashford Road & Ashton Road	2	1084	4269	496	447	395	649	688	647	31%	54%	64%
8	M6	J33 & J34	1	7010	7031	3769	3501	3382	3995	3661	3591	6%	5%	6%
		J33 & J34	2	7032	7026	3553	4077	3977	3604	4090	3982	1%	0%	0%
9	Stoney Lane	A6 & Bay Horse Road	1	3371	3377	75	11	6	97	47	187	29%	341%	3232%
		A6 & Bay Horse Road	2	3377	3371	197	14	221	179	67	167	-9%	392%	-24%
10	Bay Horse Road	Stoney Lane & Procter Moss Road	1	6050	6040	354	40	206	414	107	236	17%	169%	15%
		Stoney Lane & Procter Moss Road	2	6040	6050	162	138	262	172	132	229	6%	-4%	-13%
11	Langshaw Lane	Chapel Lane & Bay Horse Road	1	4007	4307	5	6	112	6	7	39	13%	18%	-65%
		Chapel Lane & Bay Horse Road	2	4307	4007	269	10	10	307	9	49	14%	-9%	382%
12	Hazelrigg Lane	A6 & Procter Moss Road	1	3351	6029	218	193	362	256	233	359	18%	21%	-1%
		A6 & Procter Moss Road	2	6029	3351	642	299	323	784	366	500	22%	22%	55%
13	Little Fell Lane	Blea Tarn Rd & Wyresdale Road	1	6029	6028	159	104	300	173	124	284	9%	19%	-5%
		Blea Tarn Rd & Wyresdale Road	2	6028	6029	385	147	267	310	234	336	-20%	59%	26%
14	Procter Moss Road	Bay Horse Road & Hazelrigg Lane	1	4303	6029	299	33	173	363	88	199	22%	164%	15%
		Bay Horse Road & Hazelrigg Lane	2	6029	4303	200	131	221	121	119	172	-39%	-9%	-22%
15	Blea Tarn Road	Hazelrigg Lane & Barnton Road	1	6029	1160	376	128	240	448	201	279	19%	57%	16%
		Hazelrigg Lane & Barnton Road	2	1160	6029	474	288	282	598	254	340	26%	-12%	21%
16	Bowerham Road	Barnton Road & A6	1	4015	4294	704	527	671	717	545	676	2%	3%	1%
		Barnton Road & A6	2	4294	4015	852	701	943	860	660	864	1%	-6%	-8%
17	Bay Horse Road	Procter Moss Road & Wyresdale Road	1	6040	6039	85	42	59	80	54	61	-6%	29%	3%
		Procter Moss Road & Wyresdale Road	2	6039	6040	71	32	82	108	37	99	52%	15%	20%
18	Wyresdale Road	Bay Horse Road & Little Fell Lane	1	6028	4304	126	41	42	182	41	58	45%	0%	38%
		Bay Horse Road & Little Fell Lane	2	4304	6028	101	29	53	100	30	48	-1%	1%	-10%
19	Birch Avenue	A588 & Highland Brow	1	4004	4241	201	111	69	179	173	177	-11%	56%	155%
		A588 & Highland Brow	2	4241	4004	104	141	267	166	179	242	60%	28%	-9%
20	A588	Birch Avenue & Tarnwater Lane	1	4005	9028	289	265	373	424	313	427	47%	18%	14%
		Birch Avenue & Tarnwater Lane	2	9028	4005	273	214	192	254	278	372	-7%	30%	94%
21	A588	Tarnwater Lane & Ashford Road	1	4244	4183	974	582	474	852	424	362	-12%	-27%	-24%
		Tarnwater Lane & Ashford Road	2	4183	4244	498	654	1025	307	411	663	-38%	-37%	-35%
22	Ashton Road	Ashford Road & A6	1	4152	4129	959	657	501	853	461	398	-11%	-30%	-21%
		Ashford Road & A6	2	4129	4152	617	701	947	429	447	747	-31%	-36%	-21%

All values expressed in PCU's. All values are two-way link flows.
*** The percentage change is less than 1% and is reported as 0%, as the nearest whole number.**

Appendix B. Construction Noise

The construction noise levels were predicted in accordance with BS 5228-1 Annex F (BSI, 2014) and sound emission levels, associated with the construction plant and equipment, have been sourced from BS 5228-1 Annex C (BSI, 2014), from manufactures data, or from measurements. The table below lists the typical construction activities and machinery used in the calculation of the construction noise.

To convert the hourly construction noise levels to the assessment periods, defined to be 07:00 to 19:00 for daytime and 23:00 to 07:00 for night-time, it has been considered that the hours of operation of a typical daytime shift will last for 10 hours over the total 12 hours of the assessment period whereas during the night-time shift operation will last for 6 hours over the 8 hours assessment period.

The construction calculations are a generic representation of the potential noise levels at different distance bands from the activities. Thus, the calculations have not taken into account the actual topography or existing screening from obstacles such as embankments or other buildings located close to the works. The calculations have conservatively assumed the ground between the works and sensitive receptors to be 50% soft ground

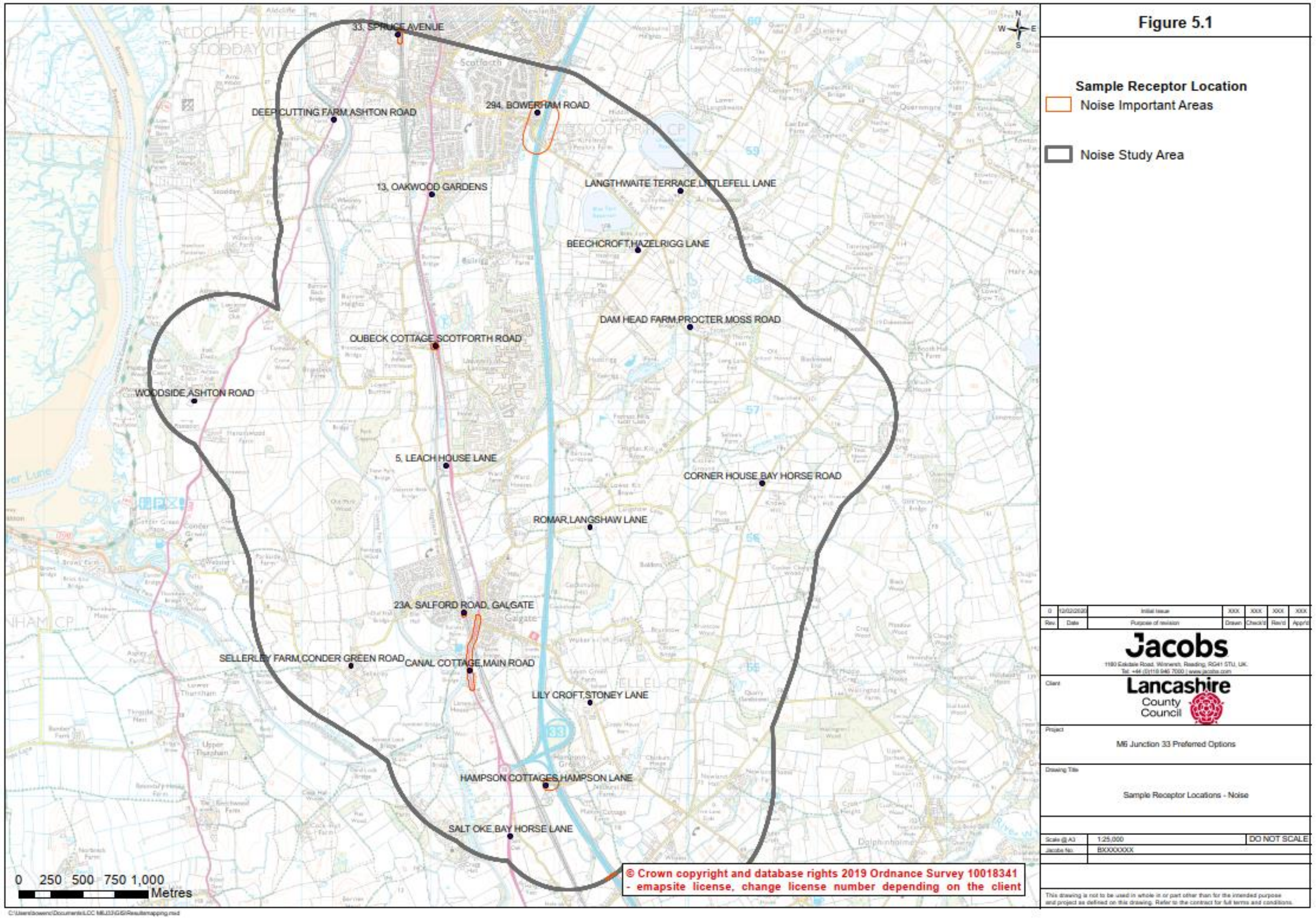
Typical construction road activities and machinery used in the calculations for construction noise

Phase	Annex C BS5228-1		Activity	Equipment	Quantity	% On time [1]	Multiple L_w at 10 m (dB) [2]
	Table	Ref. No.					
Highway works							
Site & Vegetation Clearance	C.2.	16	Ground Excavation/earthworks	Tracked excavator	1	90%	103.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	2	90%	111.0
	D.2.	14	Site Clearance	Chain Saw	1	40%	114.0
	D.2.	14	Site Clearance	Brush-cutter	1	40%	114.0
Road and embankments earthworks	C.2.	16	Ground Excavation/earthworks	Tracked excavator	1	90%	103.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	2	50%	111.0
	C.5.	13	Spreading Chipping/Fill	Dozer	1	90%	110.0
	C.5.	20	Rolling and Compaction	Vibratory roller	1	50%	103.0
Construction of new road	C.5.	19	Rolling and Compaction	Road roller	2	50%	111.0
	C.5.	29	Rolling and Compaction	Vibratory compacter (asphalt)	1	50%	110.0
	C.5.	33	Paving	Asphalt paver (+ tipper lorry)	2	50%	106.0
	C.5.	7	Road Planing	Road planer	1	50%	110.0
Central reserve paving works	C.4.	72	Cutting concrete blocks/ paving	Hand-held circular saw (petrol-cutting concrete blocks)	1	40%	107.0
	C.4.	18	Mixing Concrete	Cement mixer truck	1	40%	103.0
	C.4.	34	Concrete Other	Poker vibrator	1	50%	97.0
	C.4.	6	Distribution of Materials	Dumper	1	90%	107.0
	C.4.	96	Miscellaneous	Directional drill (generator)	1	40%	105.0
	C.4.	69	Core Drilling Concrete	Core drill (electric)	1	40%	113.0
Drainage works	C.5.	18	Earthworks	Tracked excavator	2	90%	111.0

Phase	Annex C BS5228-1		Activity	Equipment	Quantity	% On time [1]	Multiple L_w at 10 m (dB) [2]
	Table	Ref. No.					
Highway works							
	C.3.	30	Craneage for piling	Wheeled mobile crane	1	90%	98.0
	C.5.	35	Trenching	Tracked excavator	1	90%	102.0
Signage Works	C.3.	1	Pre-cast concrete piling - hydraulic hammer	Hydraulic hammer rig	1	40%	117.0
	C.3.	30	Craneage for piling	Wheeled mobile crane	1	90%	98.0
	C.3.	34	Welding/cutting steel piles	Gas cutter (cutting top of pile)	1	90%	96.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	2	90%	111.0
	C.4.	32	Pumping Concrete	Concrete mixer truck + truck mounted concrete pump + boom arm	1	40%	106.0
Road Marking Works	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	2	90%	111.0
Structures works							
Earthworks: excavation & Piling Mat	C.2.	16	Ground Excavation/earthworks	Tracked excavator	1	90%	103.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	1	90%	108.0
	C.4.	45	Lifting	Mobile telescopic crane	1	50%	110.0
	C.5.	13	Spreading Chipping/Fill	Dozer 68 kW 11 t	1	90%	110.0
	C.5.	20	Rolling and Compaction	Vibratory roller 98 kW 8.9 t	1	40%	103.0
Piles installation (rotatory piling)	C.3.	20	Rotary bored piling - cast in situ	Mini tracked excavator	1	90%	96.0
	C.3.	21	Continuous flight auger piling - cast in situ	Crawler mounted rig	1	50%	107.0
	C.3.	30	Craneage for piling	Wheeled mobile crane	1	90%	98.0
	C.3.	31	Welding/cutting steel piles	Hand-held welder (welding piles)	1	20%	101.0

Phase	Annex C BS5228-1		Activity	Equipment	Quantity	% On time [1]	Multiple L_w at 10 m (dB) [2]
	Table	Ref. No.					
Highway works							
	C.3.	32	Welding/cutting steel piles	Generator for Welding	1	20%	101.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	1	50%	108.0
Concreting: abutments bases, stems and central reserve	C.4.	21	Mixing Concrete	Large lorry concrete mixer	1	40%	105.0
	C.4.	28	Pumping Concrete	Concrete mixer truck (discharging) & pump (pumping)	1	40%	103.0
	C.4.	77	Power for Site Cabins	Diesel generator	1	90%	88.0
Steel deck beams installation	C.4.	21	Lifting	Wheeled mobile telescopic crane	1	90%	106.0
	C.4.	28	Lifting	Lifting platform	2	50%	98.0
	C.4.	77	Lorry Movements on Access Road	Lorry	1	90%	111.0
	C.4.	21	Power for Site Cabins	Diesel generator	1	90%	88.0
	C.4.	95	Miscellaneous	Handheld cordless Nail Gun	1	40%	101.0
Surfacing works	C.5.	7	Road Planing	Road Planer	1	40%	110.0
			Shot-blasting	Shot-blast Nozzle	1	10%	115.0
			Removal of Material	Scabbler	1	40%	97.0
	C.5.	5	Breaking Road Surface	Compressor for hand-held pneumatic breaker	1	40%	93.0
	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	1	90%	108.0
	C.4.	77	Power for Site Cabins	Diesel generator	1	90%	88.0
Spray Waterproofing	C.2.	34	Distribution of Materials	Lorry (4-axle wagon)	1	90%	108.0

Appendix C. : Noise Figures



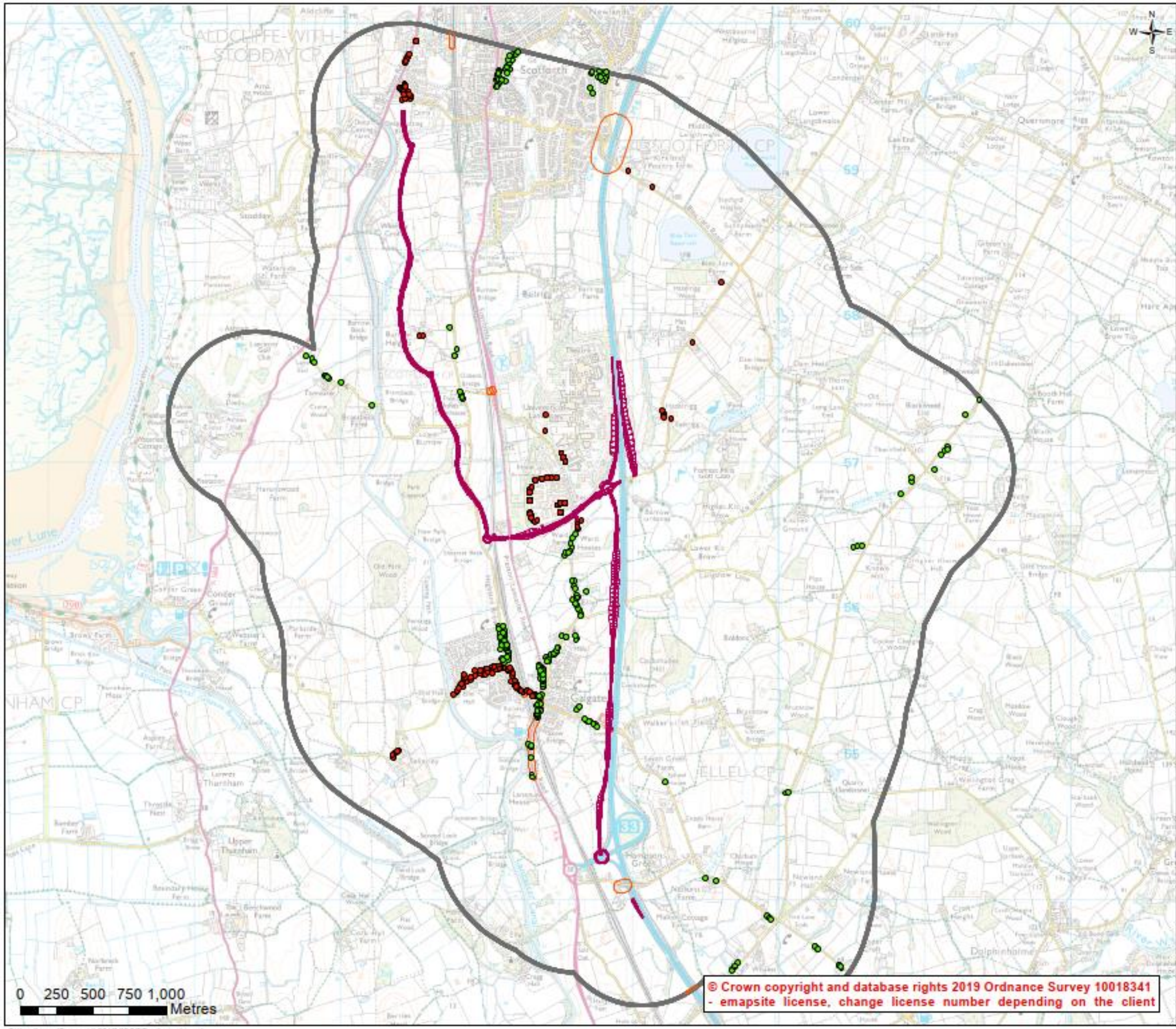


Figure 5.2

Potential Significant Effect Location

- Adverse (703)
- Beneficial (299)

Noise Important Areas

Noise Study Area

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	12/02/2020	Initial Issue	XXX	XXX	XXX	XXX

Jacobs

1180 Eskdale Road, Winnersh, Reading, RG41 5TU, UK.
Tel: +44 (0)118 946 7000 | www.jacobs.com

Client: Lancashire County Council

Project: M6 Junction 33 Preferred Options

Drawing Title: Central 1 - Potential Short Term Significant Effects for Day and Night time Periods

Scale @ A3	1:25,000	DO NOT SCALE
Jacobs No.	BXXXXXXX	

C:\Users\bowers\Documents\LCC M6J33\GIS\Resultsmapping.mxd

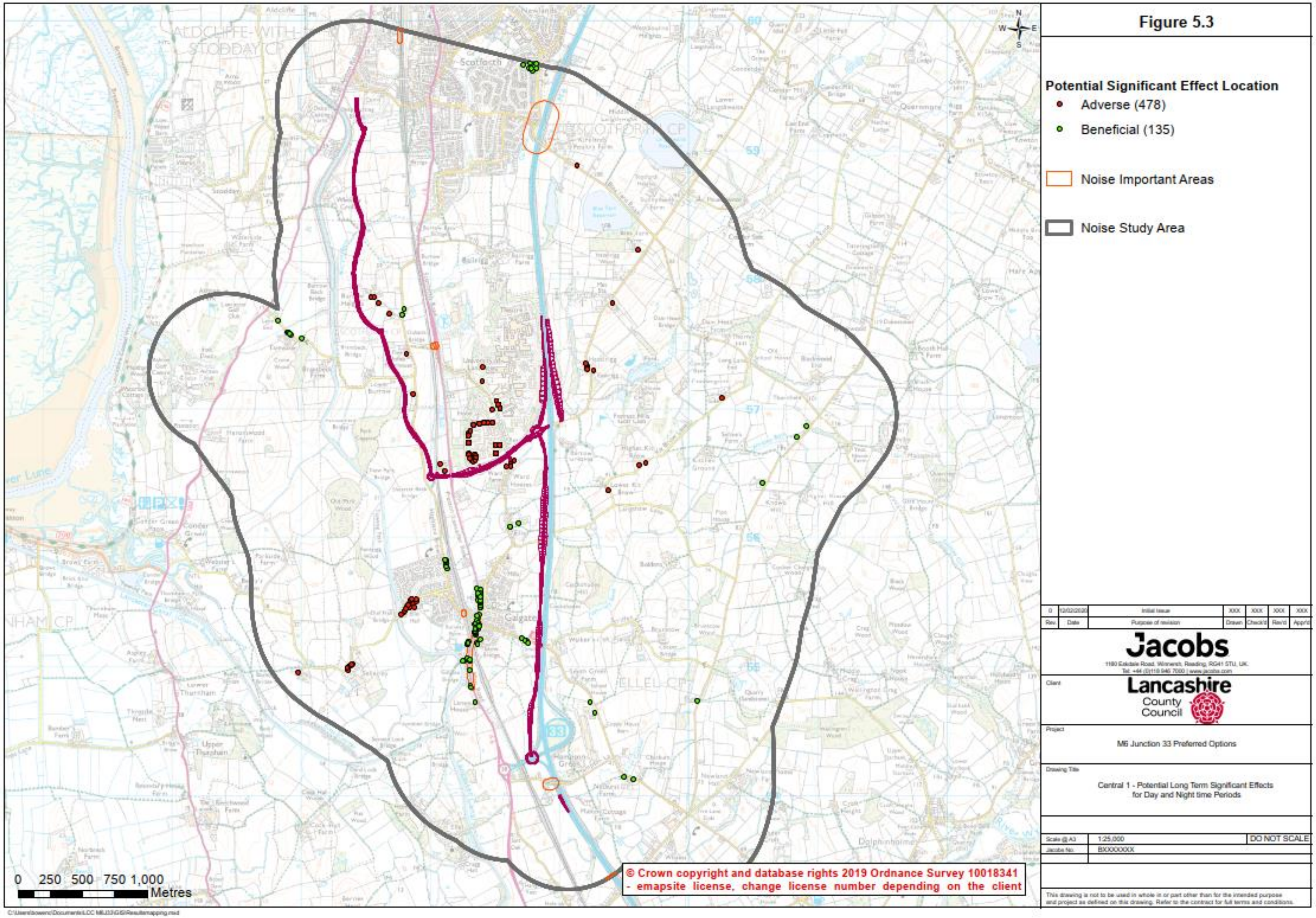


Figure 5.3
Potential Significant Effect Location
Adverse (478)
Beneficial (135)
Noise Important Areas
Noise Study Area
0 | 12/02/2020 | Initial issue | XXX | XXX | XXX | XXX
Rev. | Date | Purpose of revision | Drawn | Check'd | Rev'd | Appr'd
Jacobs
1180 Eskdale Road, Winnersh, Reading, RG41 5TU, UK.
Tel: +44 (0)118 946 7000 | www.jacobs.com
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
Central 1 - Potential Long Term Significant Effects for Day and Night time Periods
Scale @ A3 | 1:25,000 | DO NOT SCALE
Jacobs No. | BXXXXXXX
This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
0 250 500 750 1,000
Metres
Scotforth
Galgate
ELLEL CP
33

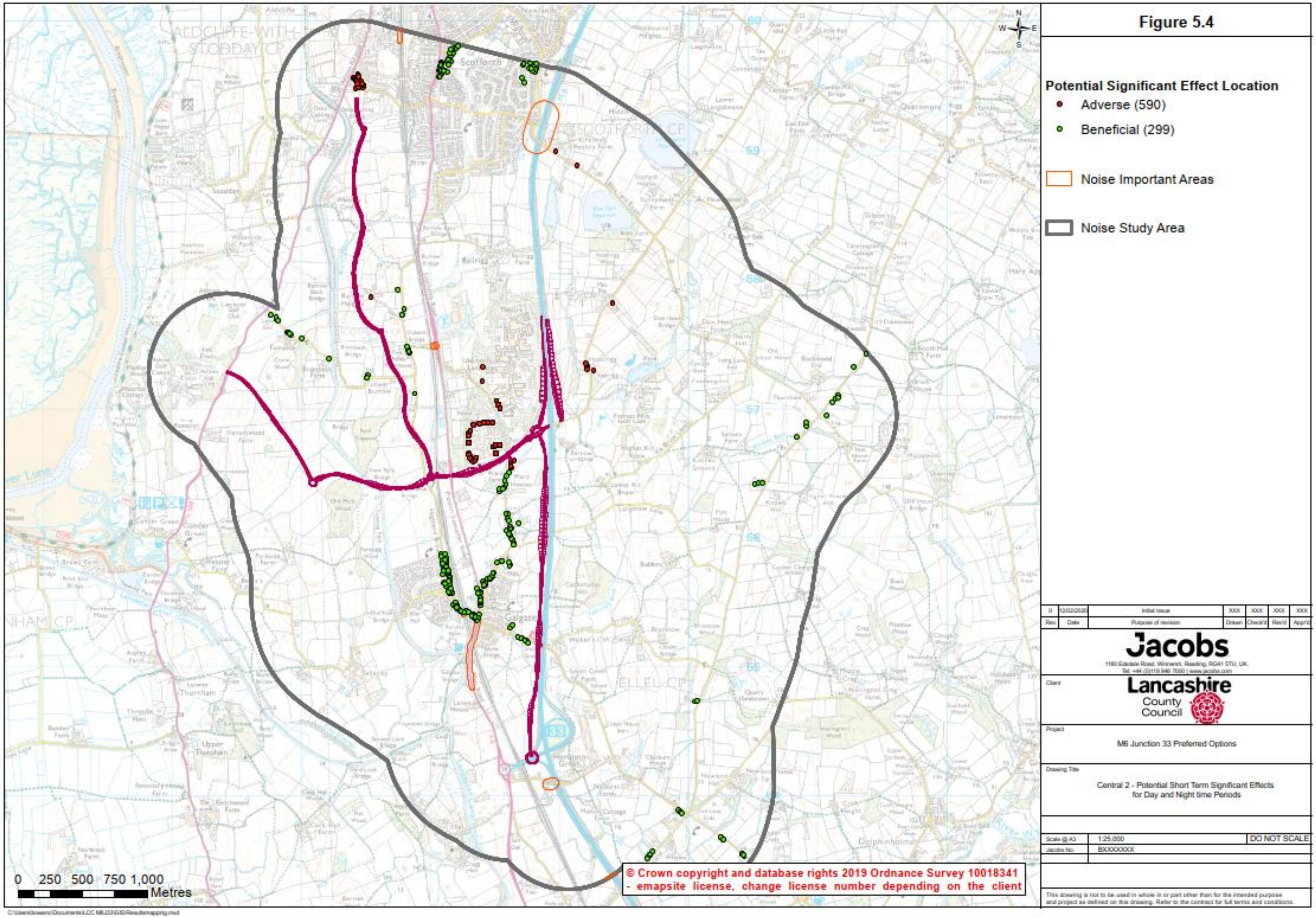


Figure 5.4
Potential Significant Effect Location
Adverse (590)
Beneficial (299)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
Jacobs
Lancashire County Council
M6 Junction 33 Preferred Options
Central 2 - Potential Short Term Significant Effects for Day and Night time Periods
1:25,000
DO NOT SCALE

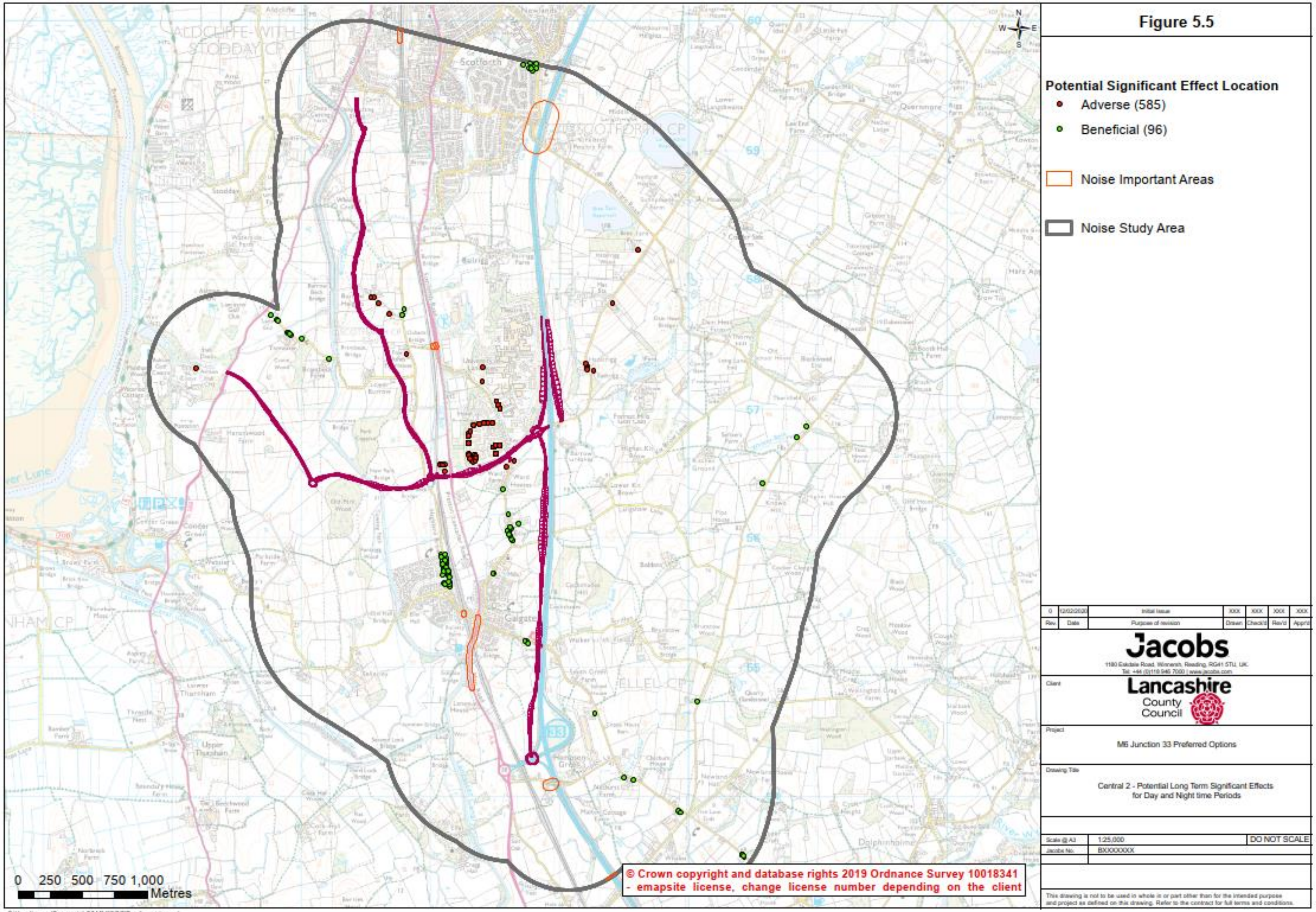


Figure 5.5
Potential Significant Effect Location
Adverse (585)
Beneficial (96)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
0 | 12/02/2020 | Initial Issue | XXX | XXX | XXX | XXX
Rev. | Date | Purpose of revision | Drawn | Check'd | Rev'd | Appr'd
Jacobs
1180 Eskdale Road, Winnersh, Reading, RG41 5TU, UK
Tel: +44 (0)118 946 7000 | www.jacobs.com
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
Central 2 - Potential Long Term Significant Effects for Day and Night time Periods
Scale @ A3
1:25,000
DO NOT SCALE
Jacobs No.
BXXXXXXX
This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

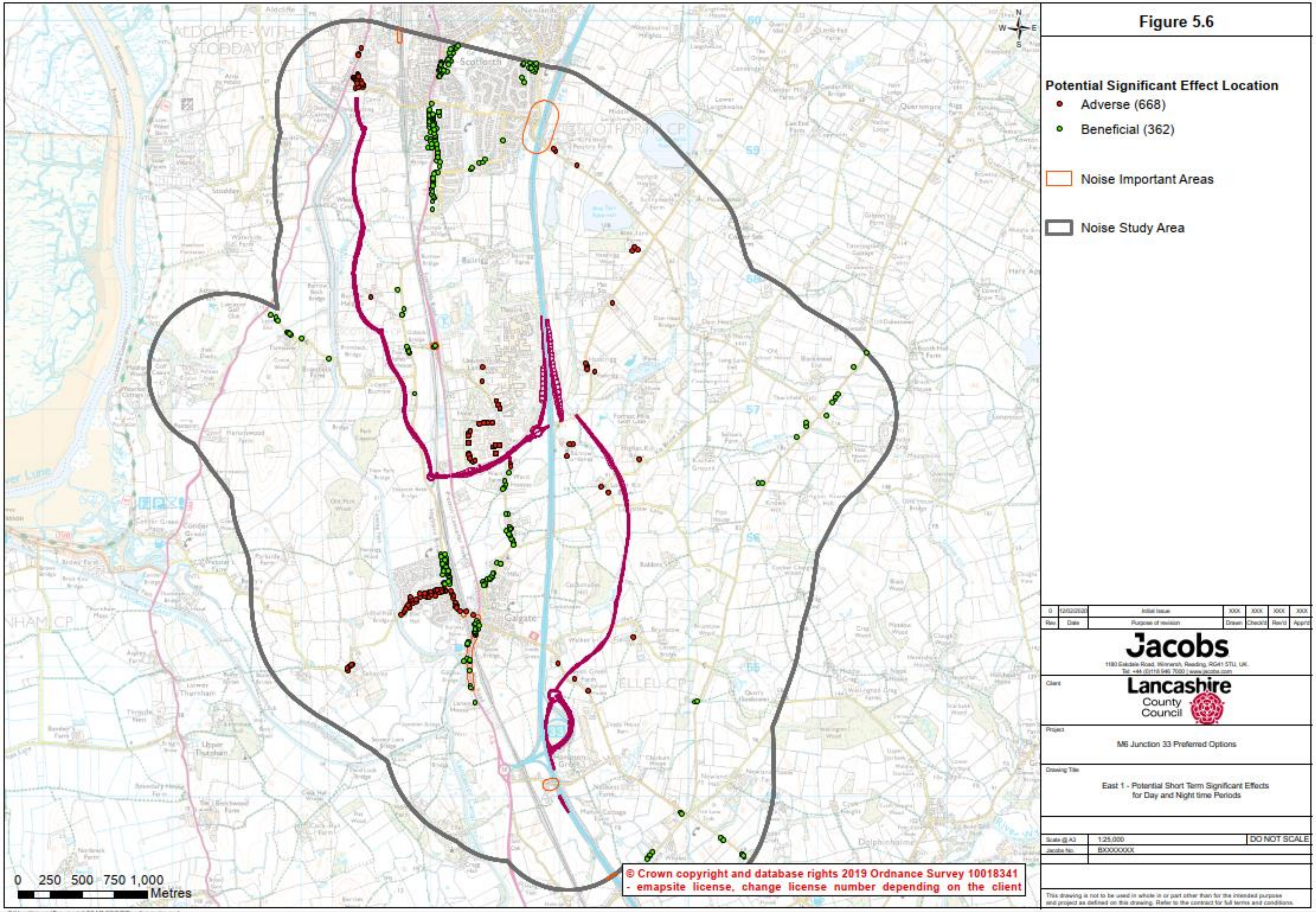


Figure 5.6
Potential Significant Effect Location
Adverse (668)
Beneficial (362)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
0 | 12/02/2020 | Initial Issue | XXX | XXX | XXX | XXX
Rev. | Date | Purpose of revision | Drawn | Check'd | Rev'd | Appr'd
Jacobs
1180 Eskdale Road, Winnersh, Reading, RG41 5TU, UK.
Tel: +44 (0)118 946 7000 | www.jacobs.com
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
East 1 - Potential Short Term Significant Effects for Day and Night time Periods
Scale @ A3 | 1:25,000 | DO NOT SCALE
Jacobs No. | BXXXXXXX
This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

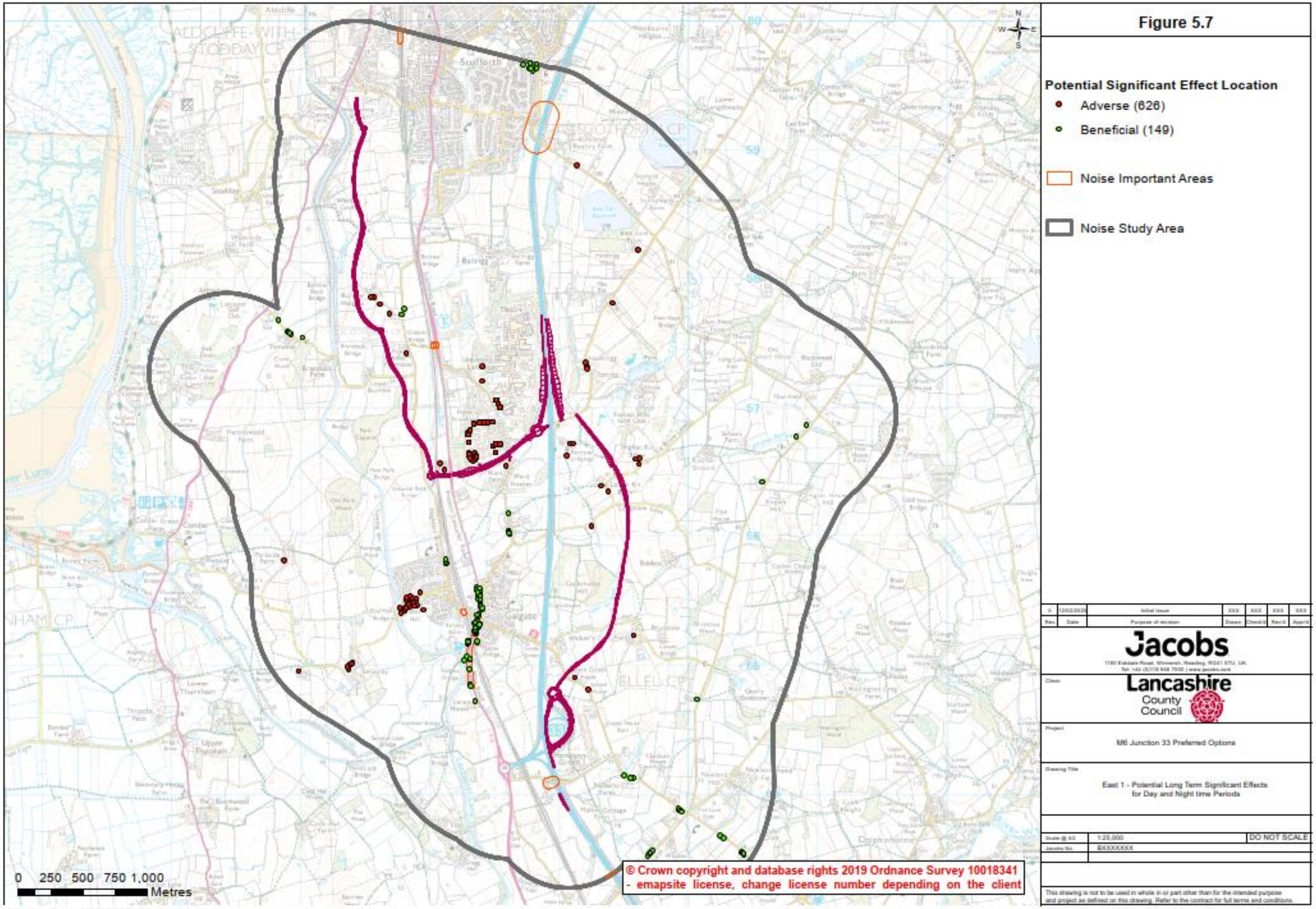


Figure 5.7
Potential Significant Effect Location
Adverse (626)
Beneficial (149)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
Initial issue
Rev Date Purpose of revision Drawn Check'd Rev'd App'd
Client
Project
M6 Junction 33 Preferred Options
Drawing Title
East 1 - Potential Long Term Significant Effects for Day and Night time Periods
1:25,000
DO NOT SCALE
This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

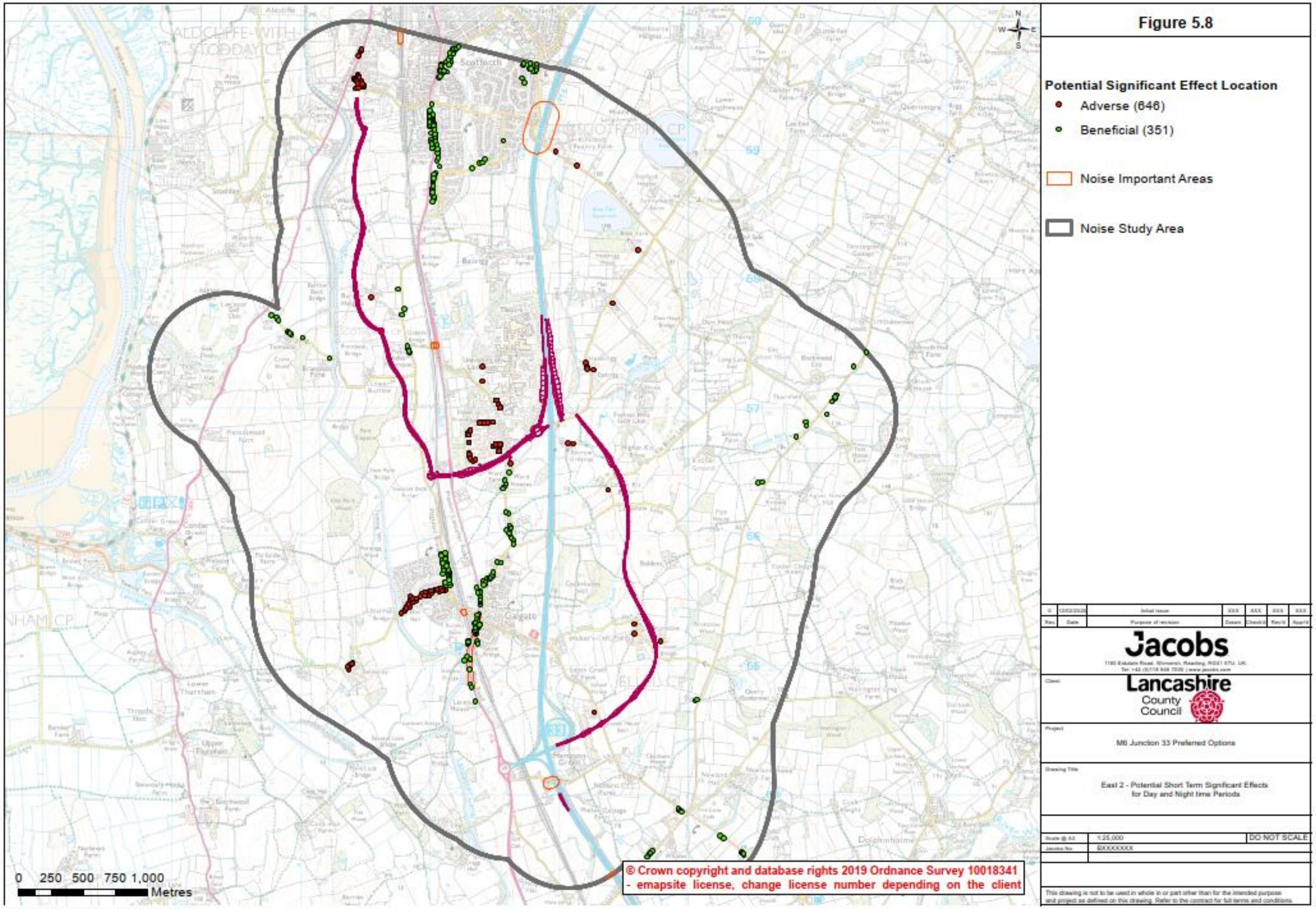


Figure 5.8
Potential Significant Effect Location
Adverse (646)
Beneficial (351)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341
- emapsite license, change license number depending on the client
Initial issue
Rev
Date
Purpose of revision
Drawn
Check'd
Rev'd
App'd
Jacobs
Client
Lancashire
County
Council
Project
M6 Junction 33 Preferred Options
Drawing Title
East 2 - Potential Short Term Significant Effects
for Day and Night time Periods
1:25,000
DO NOT SCALE
This drawing is not to be used in whole in or part other than for the intended purpose
and project as defined on this drawing. Refer to the contract for full terms and conditions.

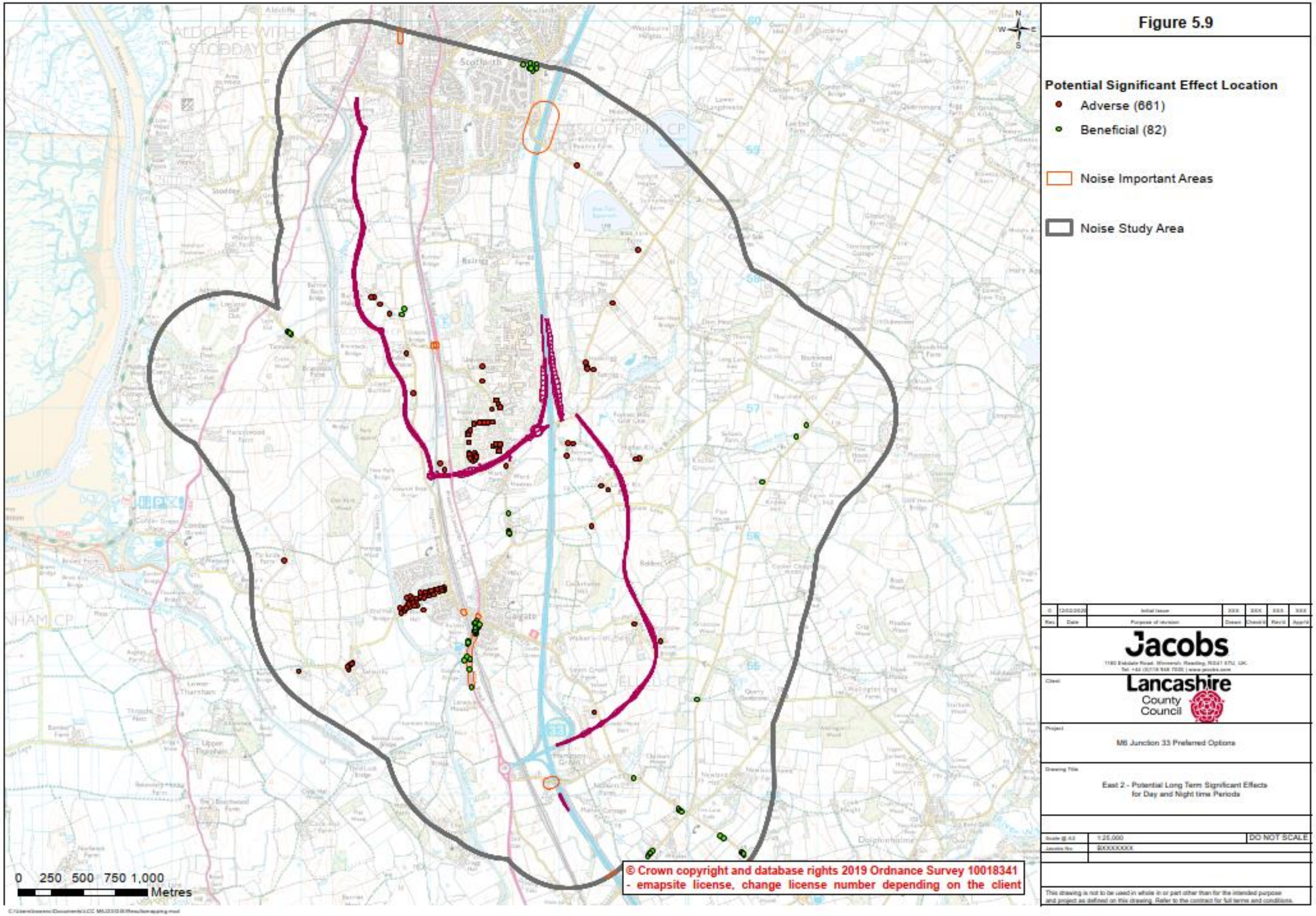


Figure 5.9
Potential Significant Effect Location
Adverse (661)
Beneficial (82)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
Initial Issue
Rev
Date
Purpose of revision
Drawn
Check'd
Rev'd
Appr'd
Jacobs
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
East 2 - Potential Long Term Significant Effects for Day and Night time Periods
1:25,000
DO NOT SCALE
This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

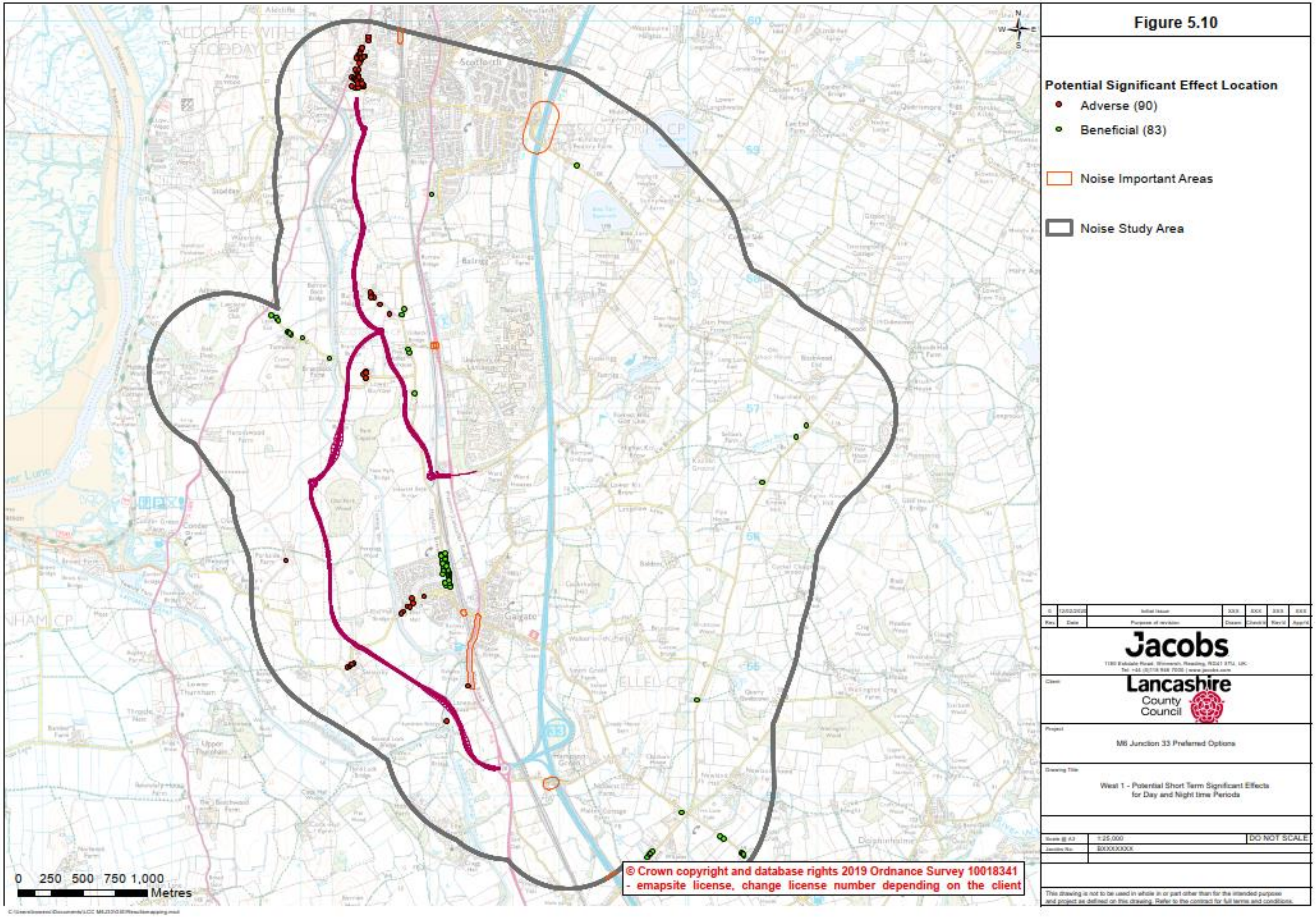


Figure 5.10
Potential Significant Effect Location
Adverse (90)
Beneficial (83)
Noise Important Areas
Noise Study Area
Initial Issue
Rev.
Date
Purpose of revision
Drawn
Check'd
Rev'd
App'd
Client
Project
M6 Junction 33 Preferred Options
Drawing Title
West 1 - Potential Short Term Significant Effects for Day and Night time Periods
Scale @ A3
1:25,000
DO NOT SCALE
Jacobs No.
This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
0 250 500 750 1,000
Metres

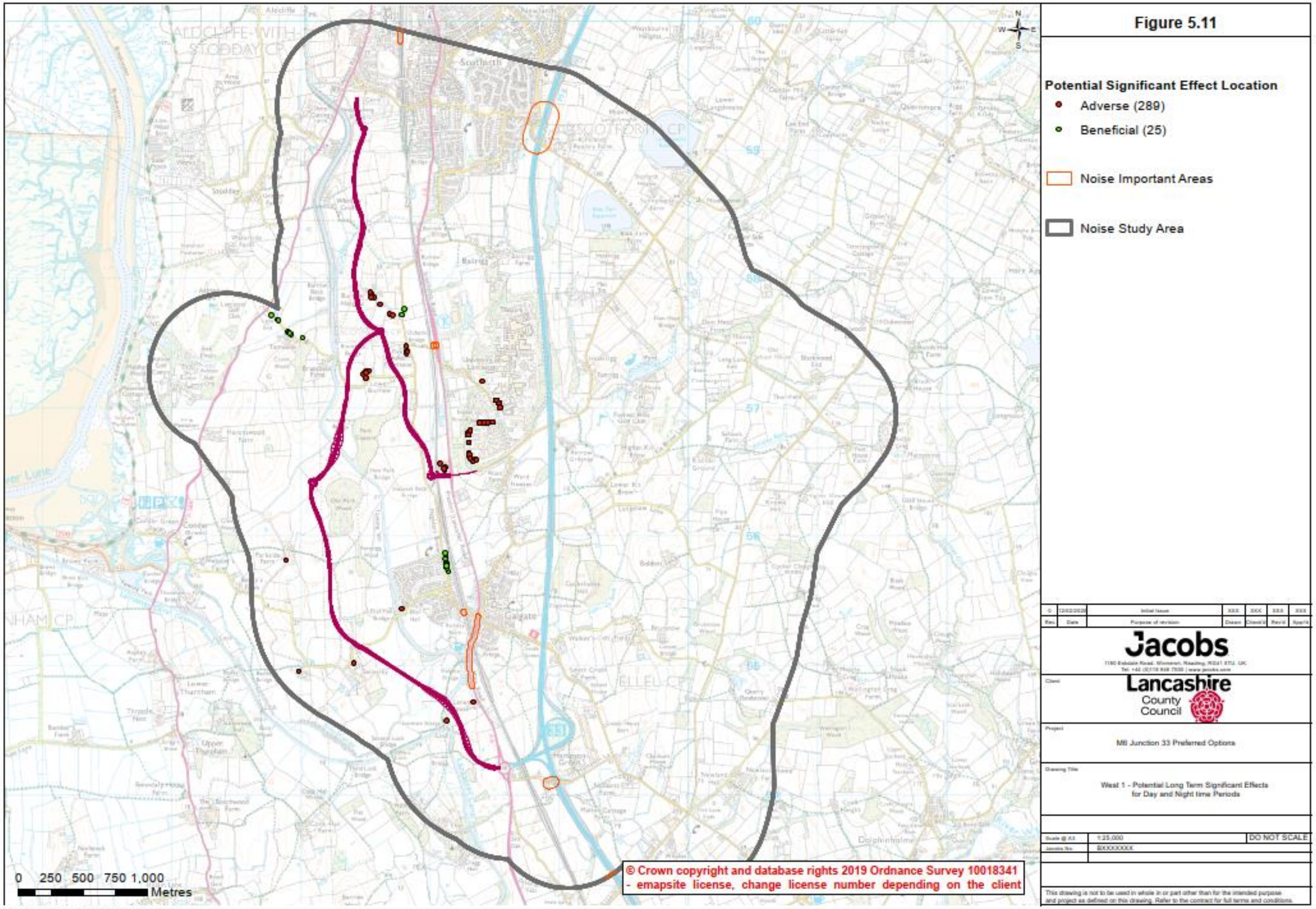


Figure 5.11
Potential Significant Effect Location
Adverse (289)
Beneficial (25)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
Initial Issue
Rev
Date
Purpose of revision
Drawn
Check'd
Rev'd
App'd
Jacobs
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
West 1 - Potential Long Term Significant Effects for Day and Night time Periods
1:25,000
DO NOT SCALE
This drawing is not to be used in whole in or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

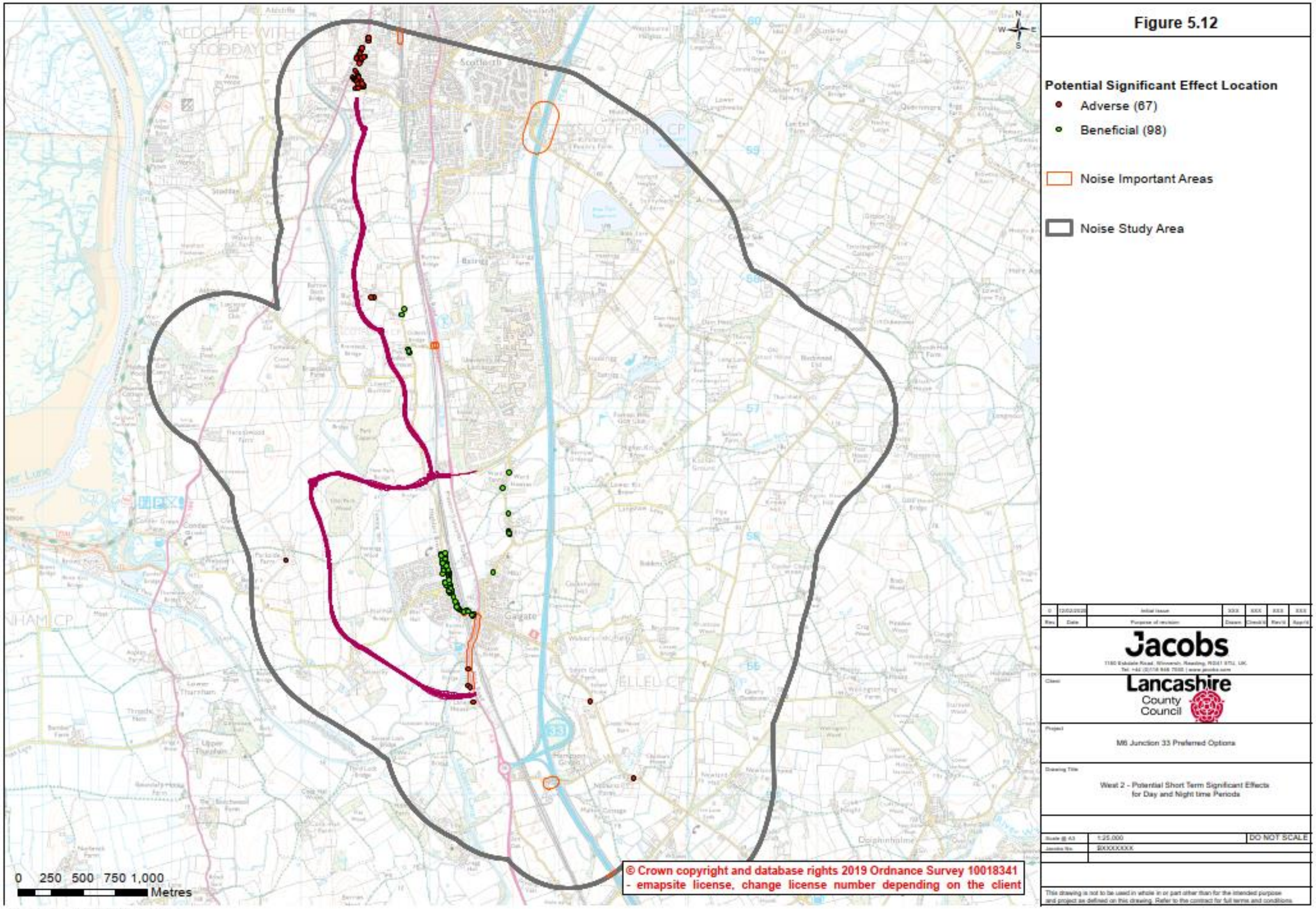


Figure 5.12
Potential Significant Effect Location
Adverse (67)
Beneficial (98)
Noise Important Areas
Noise Study Area
Rev
Date
Purpose of revision
Drawn
Check'd
Rev'd
Appr'd
Initial issue
Jacobs
Client
Lancashire County Council
Project
M6 Junction 33 Preferred Options
Drawing Title
West 2 - Potential Short Term Significant Effects
for Day and Night time Periods
1:25,000
DO NOT SCALE
This drawing is not to be used in whole in or part other than for the intended purpose
and project as defined on this drawing. Refer to the contract for full terms and conditions.
© Crown copyright and database rights 2019 Ordnance Survey 10018341
- emapsite license, change license number depending on the client
0 250 500 750 1,000
Metres
Scotforth
Galgate
ELLEL CP
SCOTFORTH CP
ALDCLIFFE-WITH-STODDAY CP

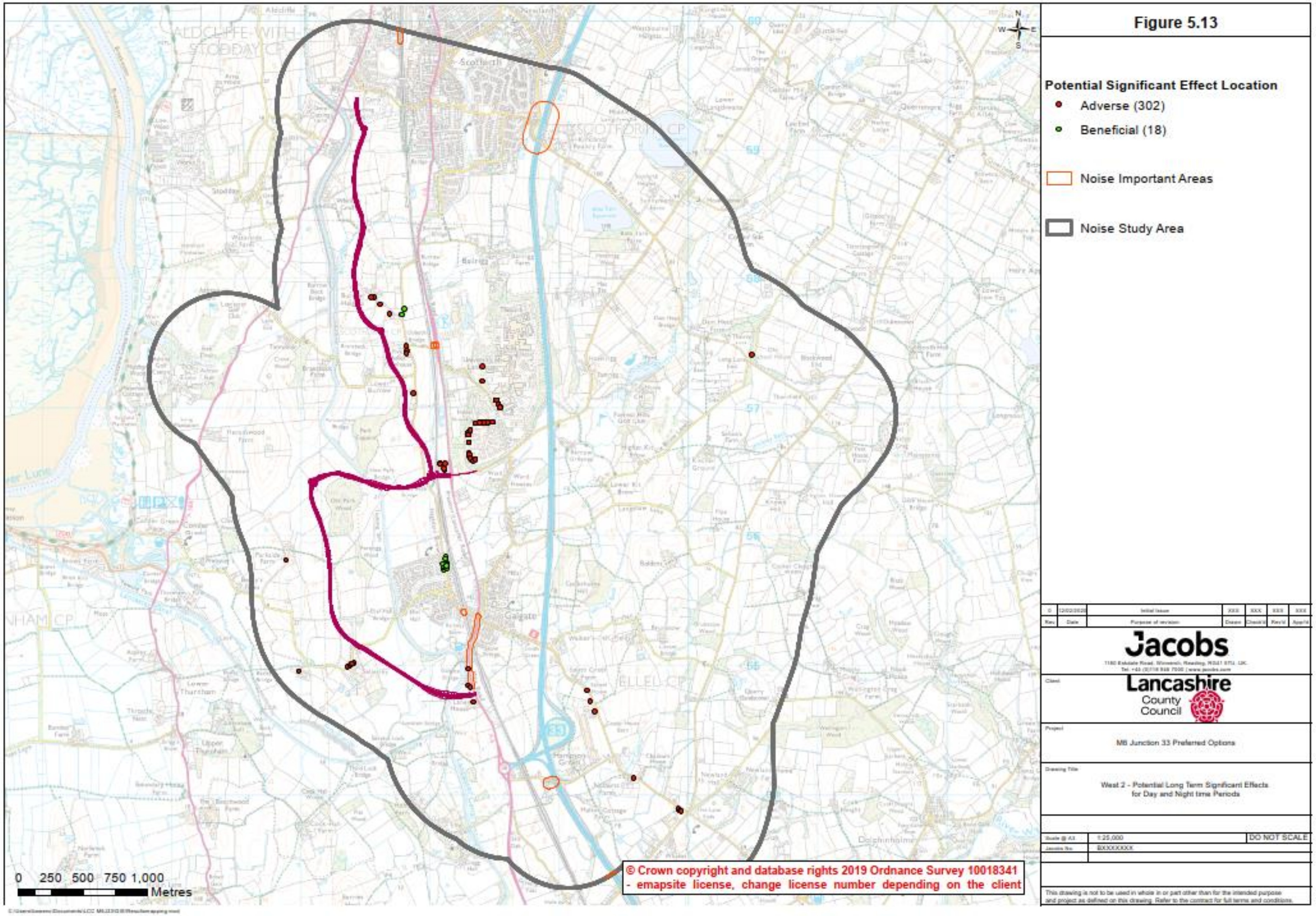
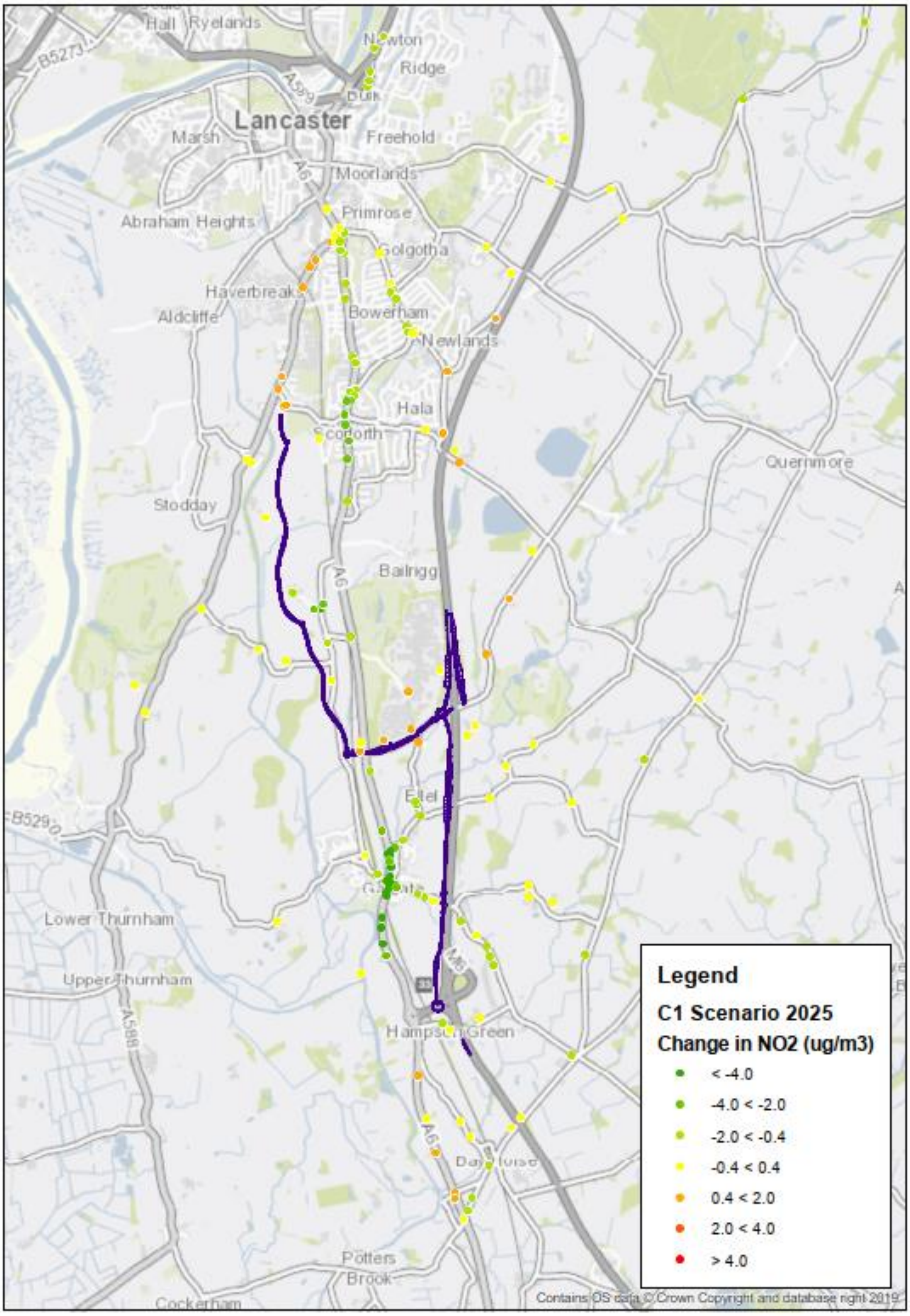
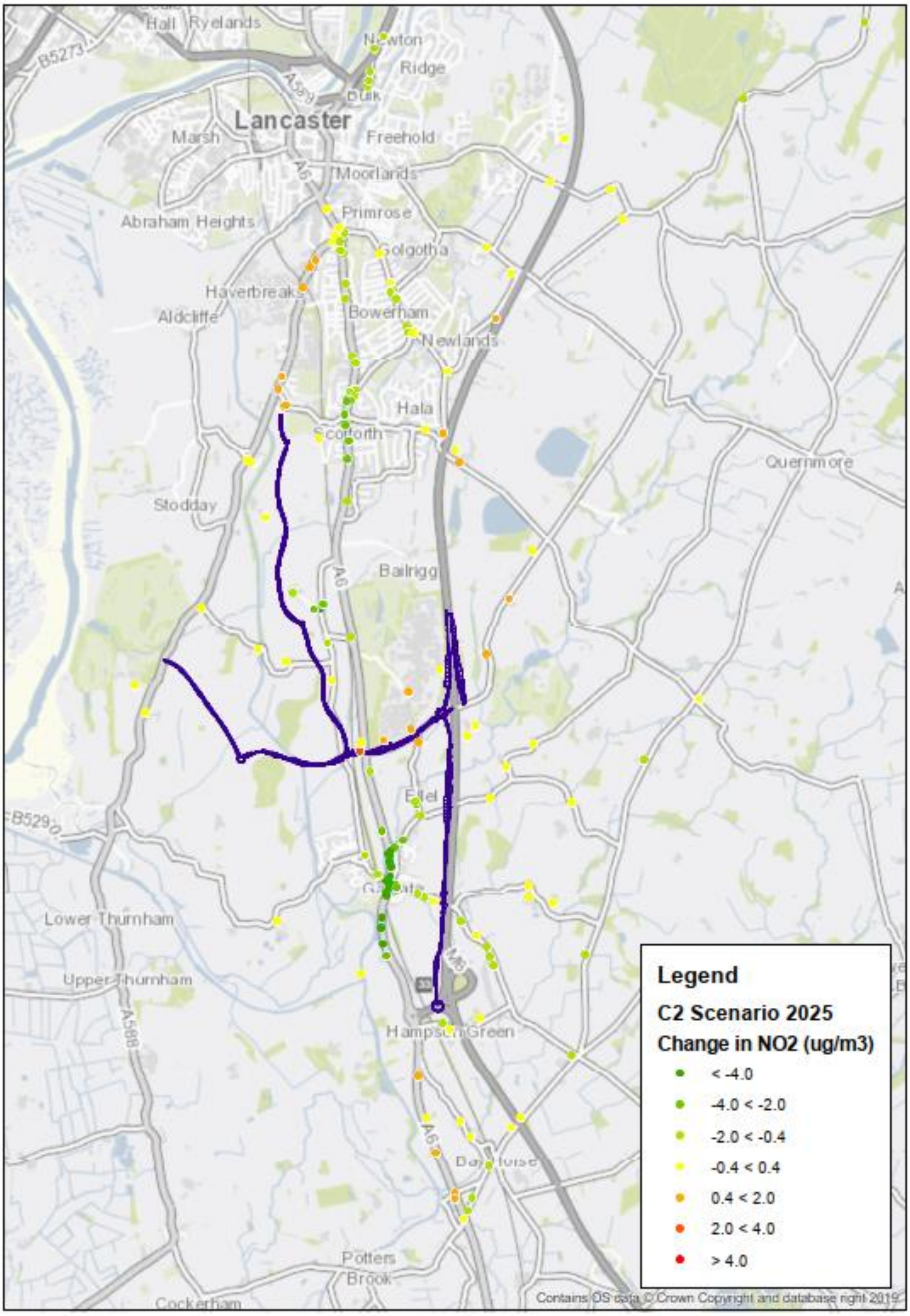
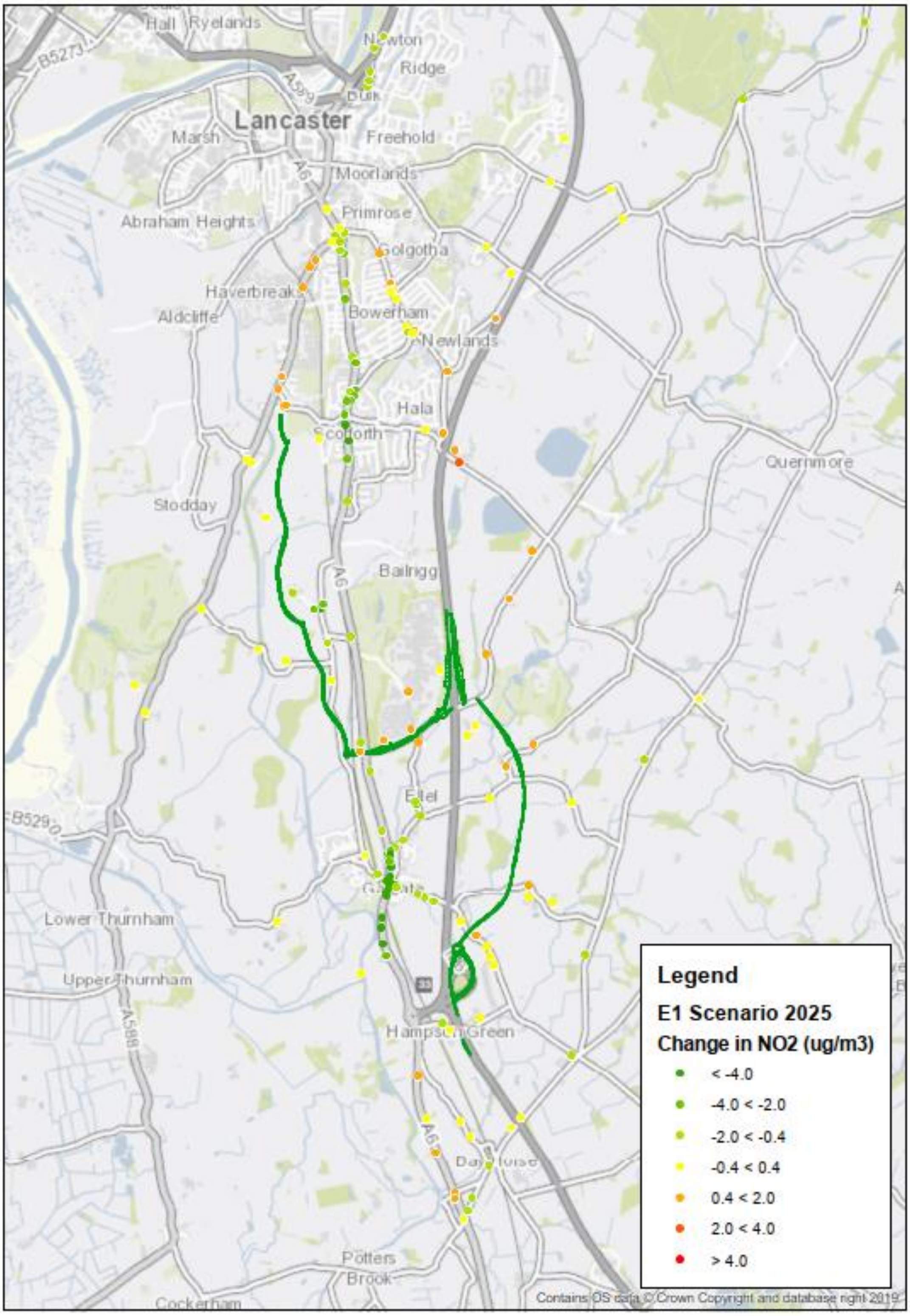


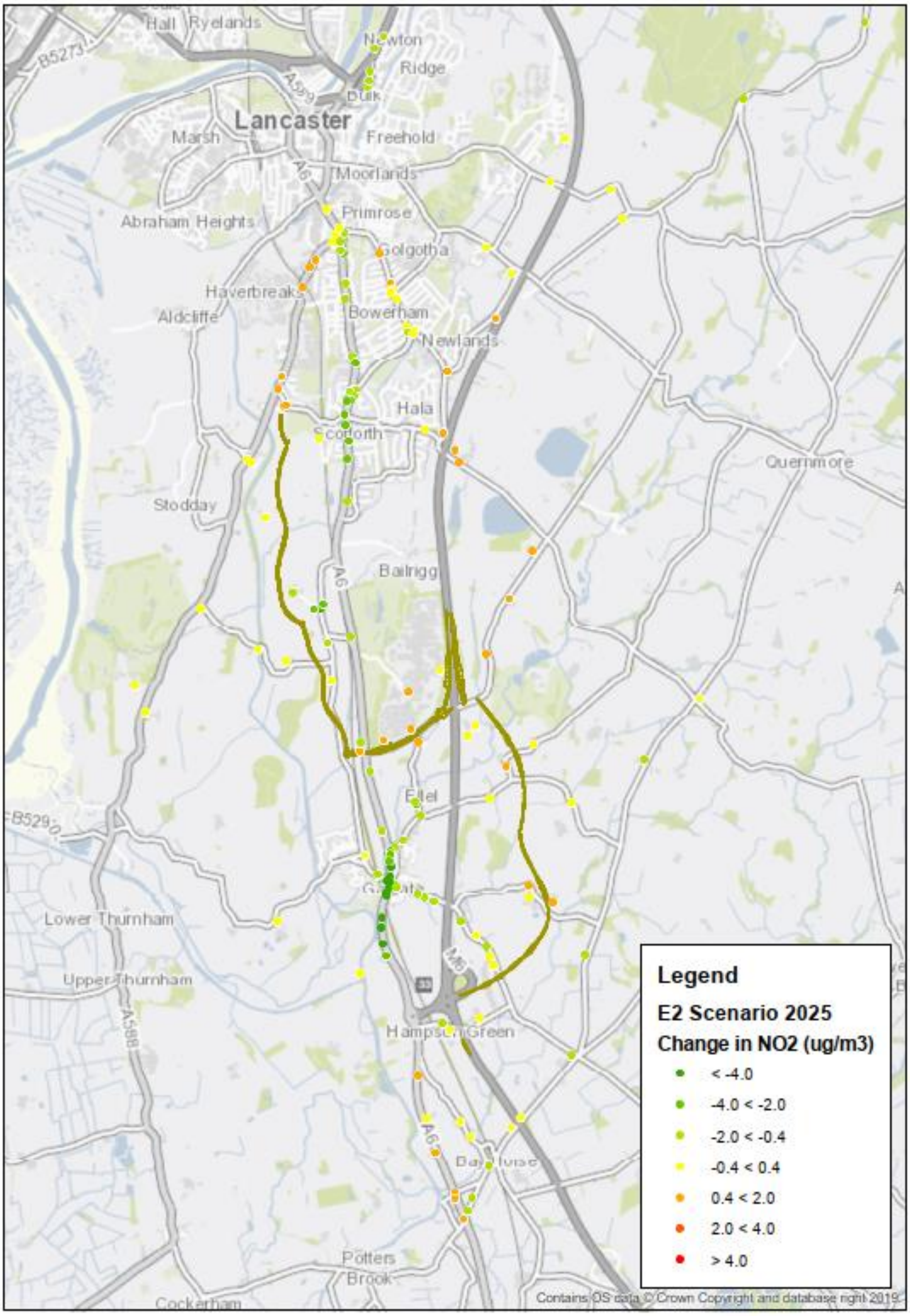
Figure 5.13
Potential Significant Effect Location
Adverse (302)
Beneficial (18)
Noise Important Areas
Noise Study Area
0 250 500 750 1,000
Metres
© Crown copyright and database rights 2019 Ordnance Survey 10018341 - emapsite license, change license number depending on the client
Jacobs
Lancashire County Council
M6 Junction 33 Preferred Options
West 2 - Potential Long Term Significant Effects for Day and Night time Periods
1:25,000
DO NOT SCALE
Galgate
Scotforth
ELLEL CP

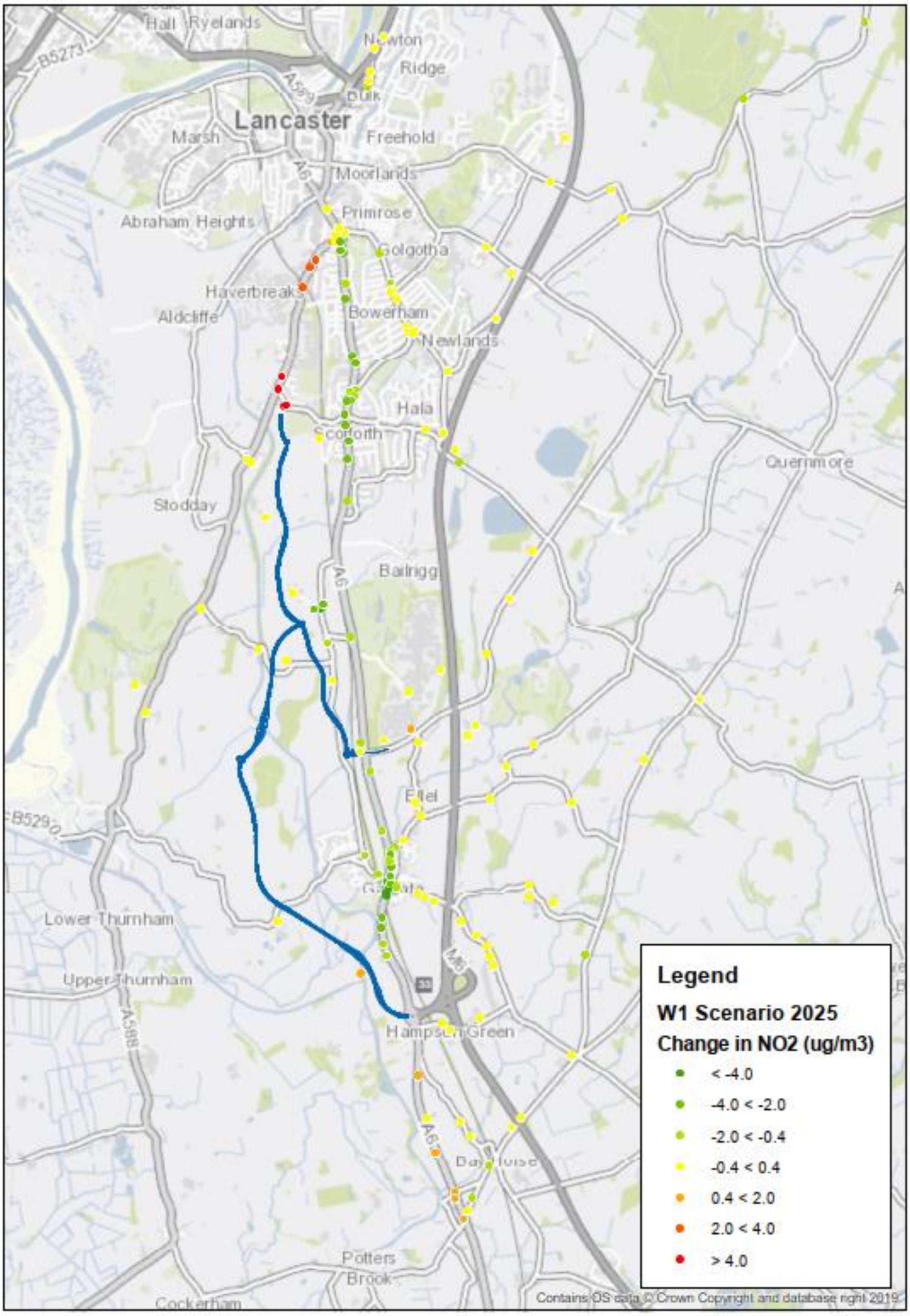
Appendix D. : Air Quality Figures



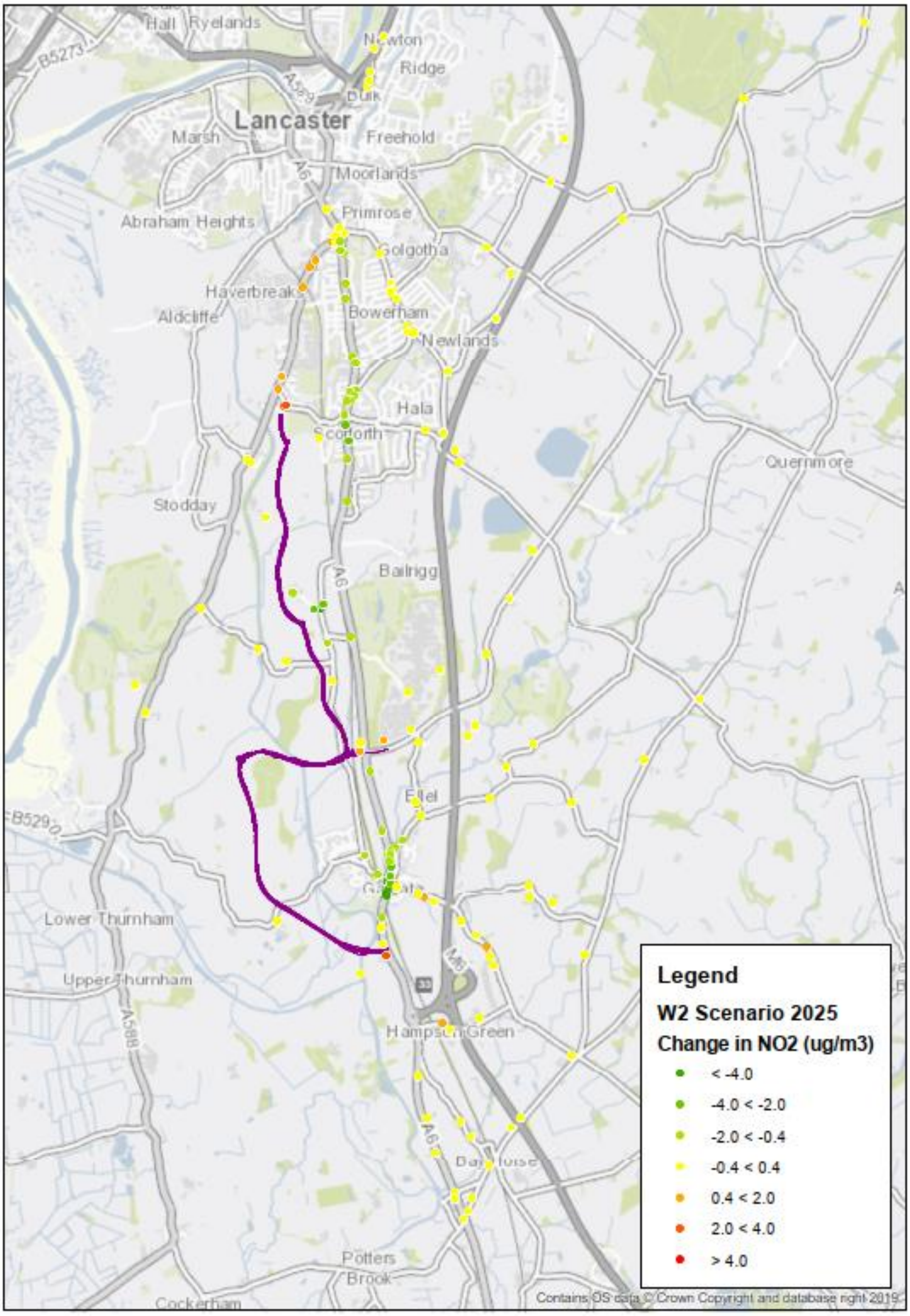

Legend
C2 Scenario 2025
Change in NO2 (ug/m3)
< -4.0
-4.0 < -2.0
-2.0 < -0.4
-0.4 < 0.4
0.4 < 2.0
2.0 < 4.0
> 4.0
Lancaster
Scotforth
Bailrigg
Galgate
Ellel
Hampson Green
Quernmore
Stodday
Aldcliffe
Lower Thurnham
Upper Thurnham
Contains OS data © Crown Copyright and database right 2019


Legend
E1 Scenario 2025
Change in NO2 (ug/m3)
< -4.0
-4.0 < -2.0
-2.0 < -0.4
-0.4 < 0.4
0.4 < 2.0
2.0 < 4.0
> 4.0
Lancaster
Contains OS data © Crown Copyright and database right 2019


Legend
E2 Scenario 2025
Change in NO2 (ug/m3)
< -4.0
-4.0 < -2.0
-2.0 < -0.4
-0.4 < 0.4
0.4 < 2.0
2.0 < 4.0
> 4.0
Lancaster
Contains OS data © Crown Copyright and database right 2019



Lancaster
Ryelands
Newton
Ridge
Marsh
Freehold
Moorlands
Abraham Heights
Primrose
Golgotha
Haverbreaks
Aldcliffe
Bowerham
Newlands
Hala
Scotforth
Quernmore
Stodday
Bailrigg
Ellel
Lower Thurnham
Upper Thurnham
Hampson Green
Potters Brook
Cockerham
A6
A588
B5290
B5273
M6
33
Legend
W1 Scenario 2025
Change in NO2 (ug/m3)
< -4.0
-4.0 < -2.0
-2.0 < -0.4
-0.4 < 0.4
0.4 < 2.0
2.0 < 4.0
> 4.0
Contains OS data © Crown Copyright and database right 2019


Lancaster
Hall
Ryelands
Newton
Ridge
Bulk
Marsh
Freehold
Moorlands
Abraham Heights
Primrose
Golgotha
Haverbreaks
Aldcliffe
Bowerham
Newlands
Hala
Scotforth
Quernmore
Stodday
Bailrigg
Ellel
B5290
Lower Thurnham
Upper Thurnham
A588
Hampson Green
Potters Brook
Cockerham
A6
M6
A589
B5273
Legend
W2 Scenario 2025
Change in NO2 (ug/m3)
< -4.0
-4.0 < -2.0
-2.0 < -0.4
-0.4 < 0.4
0.4 < 2.0
2.0 < 4.0
> 4.0
Contains OS data © Crown Copyright and database right 2019

Appendix E. Saturn Coding Options

****** Central 1 option coding****

**Arm Amended

```
 4266   4   1   0   0
    4257   1   32  180 1730  1 1   0  0 0 1980  1 1
    9013*  1   58  245   0  0 0  640G 1 1  640G 1 1
          58   25 1680        1.03   33
    4018   1   32  142 -770G 1 1 -640G 1 1 -640G 1 1
    4267   1   32  150 1980  1 1  760X 1 1   0  0 0
 9013   3   5   10 2250          16
    4266*  1   58  245 1100  1 1 1100  1 1
          58   25 1680        1.03   33
    9022   1   48  100 1100  1 1 1100  1 1
                                                33
    9012*  1   58  660 1100  1 1 1100  1 1
          58   25 1680        1.03   33
 9022   1   0   0   0      1
    9013   1   48  100
 9012   2   5   10 2250          16
    9013*  1   58  660 1100  1 1
          58   25 1680        1.03   33
    9014*  1   58  990 1100  1 1
          58   25 1680        1.03   33
 9014   3   5   10 2250          16
    9012*  1   48  990 1100  1 1 1100  1 1
                          33
    9019   1   48  100 1100  1 1 1100  1 1
    9015*  1   48  765 1100  1 1 1100  1 1
```

```
                    33
9019   1   0   0   0       1
   9014   1   48  100
**East1
9004   3   1   0   0
   9030   0
   7011*   3  113 2055   0  0 0 6360  1 3
       113   81 6990        2.80    3
   9002   1   96  200 1930M 1 1    0  0 0
9005   3   1   0   0
   9031*   4  113  110 1930  1 1 6360  2 4
       113   81 9320        2.80    2
   9003   0
   7047   0
9030   2   1   0   0
   9004*   4  113  200 6360Q 1 4
       113   81 9320        2.80    2
   7010   0
9031   2   1   0   0
   7026*   3  113 1851 6360  1 3
       113   81 6990        2.80    3
   9005   0
7010   2   1   0   0
   7031   0
   9030*   3  113 2116 6360  1 3
       113   81 6990        2.80    3
7011   2   1   0   0
   9004   0
```

7014* 3 113 176 6360 1 3

113 81 6990 2.80 3

7026 2 1 0 0

7032* 3 113 3211 6360 1 3

113 81 6990 2.80 3

9031 0

7047 2 1 0 0

7027 0

9005* 3 113 2021 8480 1 3

113 81 6990 2.80 3

7028 3 1

7027* 3 113 366 6360 1 3

3

81 7013 1 96 337 1930M 1 1

7029 0

* Copied from R for central

4169 4 1

4166 2 48 103 1250G 1 1 2500G 1 2

9009 0

4167 0

4165 2 48 48 1880 1 1 3900 1 2

4067 3 1

4037 0

4227 1 32 110 1980 1 1

4070 1 32 78 1870G 1 1

9009 4 1

9010 0 0 0

9008 0 0 0

9007 2 48 60 1880 1 1 2020 2 2

4169* 2 58 119 1250G 1 1 1250G 2 2

26

9007 3 1

9009 0 0 0

9006 2 48 60 1880 1 1 2020 2 2

4167 0 0 0

9008 4 1

9010 2 64 80 1250G 1 1 1250G 2 2

7013 0 0 0

9006 0 0 0

9009 2 48 60 1880 1 1 2020 2 2

9006 3 1

9008 2 48 60 3900 1 2

7012 2 96 265 2500G 1 2

9007 0 0 0

7012 3 1

9006 0

7014 0

7033* 4 113 194 1930 1 1 6360 2 4

2

9010 3 1

9001* 1 85 2530 2100 1 1

14

9008 0 0 0

9009 1 64 80 2100 1 1

7013 2 1

7028 0

9008 2 96 426 3970 1 2

4167 4 1

4169 2 48 94 1880 1 1 3900 1 2

9007* 2 58 112 1250G 1 1 2500G 1 2

26

4164 0

4001 0

7014 2 1

7011 0

7012* 3 113 339 6360 1 3

3

7027 2 1

7047* 3 113 236 6360 1 3

3

7028 0

** Remove spine

4165 3 1

4169 0

4001 2 48 66 1880 1 1 3900 1 2

4166 0

** Zone connectors removed

4257 3 1 0 0

4258 1 48 100 770G 1 1 640G 1 1

4255 1 32 376 1980 1 1 760X 1 1

4266 1 32 180 1730 1 1 1980 1 1

3355 2 1

4246* 1 67 405 1980 1 1

39

4245* 1 67 447 1980 1 1

39

9015 2 1 0 0

9014* 1 58 765 1980 1 1

58 25 1680 1.03 33

9017* 1 58 430 1980 1 1

58 25 1680 1.03 33

**Speed change

9017 2 5 10 2250 16

9015* 1 58 430 1100 1 1 1100 1 1

58 25 1680 1.03 33

4159* 1 58 170 1100 1 1 1100 1 1

65 25 1680 2.63 31

* 9018 1 48 100 1100 1 1 1100 1 1

* 1505 1 48 100 1100 1 1 1100 1 1

4159 4 3 2 0 60 60

167 4006* 2 82 889 1730 1 1 1980 1 1 1800X 2 2

82 53 1328 2.04 16

9017* 2 58 170 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

160 4130* 2 82 855 1730 1 1 1980 2 2 1800X 2 2

82 53 1328 2.04 16

47 1165* 2 48 230 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

25 5 12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006

4130 9017

25 5 12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017

1165 4130

1165 4 5 10 2310 16

4008* 1 48 249 1100 1 1 1100 1 1 1100 1 1

31

3353 1 48 100 1100 1 1 1100 1 1 1100 1 1

4159* 1 48 230 1100 1 1 1100 1 1 1100 1 1

31

1166 1 32 69 1100 1 1 1100 1 1 1100 1 1

4008 3 1

1165* 1 48 249 1980 1 1 760X 1 1

31

9011* 1 82 210 1730 1 1 1980 1 1

31

3375* 1 32 200 770G 1 1 640G 1 1

39

9011 4 1 0 0

4008* 1 54 210 1730 1 1 1980 1 1 760X 1 1

65 25 1680 2.63 31

9025 1 48 100 770G 1 1 640G 1 1 640G 1 1

9001* 1 54 55 1730 1 1 1980 1 1 760X 1 1

65 25 1680 2.63 31

9024 1 48 100 770G 1 1 640G 1 1 640G 1 1

9001 3 5 10 2250 16

9002* 1 82 55 1200 1 1 1200 1 1

31

9010* 1 85 2530 1200 1 1 1200 1 1

14

9011* 1 82 55 1200 1 1 1200 1 1

31

9002 3 5 10 2250 16

9004 0

9003* 1 54 135 1200 1 1 1200 1 1

65 25 1680 2.63 31

9001* 1 54 55 1200 1 1 1200 1 1

65 25 1680 2.63 31

9003 3 1

9005 2 98 200 1250G 1 1 1250G 2 2

3351* 1 82 723 1980 1 1

21

9002* 1 82 135 1980 1 1

31

3351 3 1

3352 1 48 100 770G 1 1 640G 1 1

6029* 1 82 1023 1980 1 1 760X 1 1

21

9003* 1 82 723 1730 1 1 1980 1 1

21

****** Central 2 option coding****

**Arm Amended

```
4266   4   1   0   0
    4257   1   32  180 1730  1 1   0  0 0 1980  1 1
    9013*  1   58  245   0  0 0  640G 1 1  640G 1 1
          58   25 1680         1.03   33
    4018   1   32  142 -770G 1 1 -640G 1 1 -640G 1 1
    4267   1   32  150 1980  1 1  760X 1 1   0  0 0
9013   3   5   10 2250          16
    4266*  1   58  245 1100  1 1 1100  1 1
          58   25 1680         1.03   33
    9022   1   48  100 1100  1 1 1100  1 1
                                                      33
    9012*  1   58  660 1100  1 1 1100  1 1
          58   25 1680         1.03   33
9022   1   0   0   0       1
    9013   1   48  100
9012   2   5   10 2250          16
    9013*  1   58  660 1100  1 1
          58   25 1680         1.03   33
    9014*  1   58  990 1100  1 1
          58   25 1680         1.03   33
9014   3   5   10 2250          16
    9012*  1   48  990 1100  1 1 1100  1 1
                              33
    9019   1   48  100 1100  1 1 1100  1 1
    9015*  1   48  765 1100  1 1 1100  1 1
                              33
```

9019 1 0 0 0 1

9014 1 48 100

**East1

9004 3 1 0 0

9030 0

7011* 3 113 2055 0 0 0 6360 1 3

113 81 6990 2.80 3

9002 1 96 200 1930M 1 1 0 0 0

9005 3 1 0 0

9031* 4 113 110 1930 1 1 6360 2 4

113 81 9320 2.80 2

9003 0

7047 0

9030 2 1 0 0

9004* 4 113 200 6360Q 1 4

113 81 9320 2.80 2

7010 0

9031 2 1 0 0

7026* 3 113 1851 6360 1 3

113 81 6990 2.80 3

9005 0

7010 2 1 0 0

7031 0

9030* 3 113 2116 6360 1 3

113 81 6990 2.80 3

7011 2 1 0 0

9004 0

7014* 3 113 176 6360 1 3

113 81 6990 2.80 3

7026 2 1 0 0

7032* 3 113 3211 6360 1 3

113 81 6990 2.80 3

9031 0

7047 2 1 0 0

7027 0

9005* 3 113 2021 8480 1 3

113 81 6990 2.80 3

7028 3 1

7027* 3 113 366 6360 1 3

3

81 7013 1 96 337 1930M 1 1

7029 0

* Copied from R for central

4169 4 1

4166 2 48 103 1250G 1 1 2500G 1 2

9009 0

4167 0

4165 2 48 48 1880 1 1 3900 1 2

4067 3 1

4037 0

4227 1 32 110 1980 1 1

4070 1 32 78 1870G 1 1

9009 4 1

9010 0 0 0

9008 0 0 0

9007 2 48 60 1880 1 1 2020 2 2

4169* 2 58 119 1250G 1 1 1250G 2 2

26

9007 3 1

9009 0 0 0

9006 2 48 60 1880 1 1 2020 2 2

4167 0 0 0

9008 4 1

9010 2 64 80 1250G 1 1 1250G 2 2

7013 0 0 0

9006 0 0 0

9009 2 48 60 1880 1 1 2020 2 2

9006 3 1

9008 2 48 60 3900 1 2

7012 2 96 265 2500G 1 2

9007 0 0 0

7012 3 1

9006 0

7014 0

7033* 4 113 194 1930 1 1 6360 2 4

2

9010 3 1

9001* 1 85 2530 2100 1 1

14

9008 0 0 0

9009 1 64 80 2100 1 1

7013 2 1

7028 0

9008 2 96 426 3970 1 2

4167 4 1

4169 2 48 94 1880 1 1 3900 1 2

9007* 2 58 112 1250G 1 1 2500G 1 2

26

4164 0

4001 0

7014 2 1

7011 0

7012* 3 113 339 6360 1 3

3

7027 2 1

7047* 3 113 236 6360 1 3

3

7028 0

** Remove spine

4165 3 1

4169 0

4001 2 48 66 1880 1 1 3900 1 2

4166 0

** Zone connectors removed

4257 3 1 0 0

4258 1 48 100 770G 1 1 640G 1 1

4255 1 32 376 1980 1 1 760X 1 1

4266 1 32 180 1730 1 1 1980 1 1

3355 2 1

4246* 1 67 405 1980 1 1

39

4245* 1 67 447 1980 1 1

```
                    39
 9015   2   1   0   0
    9014*  1   58  765 1980  1 1
          58   25 1680         1.03   33
    9017*  1   58  430 1980  1 1
          58   25 1680         1.03   33
**Speed change
 4159   4   3   2   0   60   60
  167 4006*   2   82  889 1730  1 1 1980  1 1 1800X 2 2
          82   53 1328         2.04   16
    9017*  2   58  170 1730  1 1 1980  2 2 1800X 2 2
          65   25 1680         2.63   31
  160 4130*   2   82  855 1730  1 1 1980  2 2 1800X 2 2
          82   53 1328         2.04   16
   47 1165*   2   48  230 1730  1 1 1980  2 2 1800X 2 2
          65   25 1680         2.63   31
          25    5   12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006
                    4130 9017
          25    5   12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017
                    1165 4130
 1165   4   5   10 2310           16
    4008*  1   48  249 1100  1 1 1100  1 1 1100  1 1
                    31
    3353   1   48  100 1100  1 1 1100  1 1 1100  1 1
    4159*  1   48  230 1100  1 1 1100  1 1 1100  1 1
                    31
    1166   1   32   69 1100  1 1 1100  1 1 1100  1 1
 4008   3   1
```

```
   1165*  1  48  249 1980  1 1  760X 1 1
                      31
   9011*  1  82  210 1730  1 1 1980  1 1
                      31
   3375*  1  32  200  770G 1 1  640G 1 1
                      39
9011   4   1   0   0
   4008*  1  54  210 1730  1 1 1980  1 1  760X 1 1
       65  25 1680       2.63  31
   9025   1  48  100  770G 1 1  640G 1 1  640G 1 1
   9001*  1  54   55 1730  1 1 1980  1 1  760X 1 1
       65  25 1680       2.63  31
   9024   1  48  100  770G 1 1  640G 1 1  640G 1 1
9001   3   5  10 2250         16
   9002*  1  82   55 1200  1 1 1200  1 1
                      31
   9010*  1  85 2530 1200  1 1 1200  1 1
                      14
   9011*  1  82   55 1200  1 1 1200  1 1
                      31
9002   3   5  10 2250         16
   9004   0
   9003*  1  54  135 1200  1 1 1200  1 1
       65  25 1680       2.63  31
   9001*  1  54   55 1200  1 1 1200  1 1
       65  25 1680       2.63  31
9003   3   1
   9005   2  98  200 1250G 1 1 1250G 2 2
```

3351* 1 82 723 1980 1 1

21

9002* 1 82 135 1980 1 1

31

3351 3 1

3352 1 48 100 770G 1 1 640G 1 1

6029* 1 82 1023 1980 1 1 760X 1 1

21

9003* 1 82 723 1730 1 1 1980 1 1

21

* Adding A588

9028 3 5 10 2250 16

1003* 1 54 544 1100 1 1 1100 1 1

19

9029 1 48 100 1100 1 1 1100 1 1

4005* 1 54 1112 1100 1 1 1100 1 1

19

4244 3 1

4183* 1 54 1405 1730 1 1 1980 1 1

19

4245* 1 48 1506 770G 1 1 640G 1 1

21

1003* 1 54 568 1980 1 1 760X 1 1

19

9017 3 5 10 2250 16

9015* 1 58 430 1100 1 1 1100 1 1

58 25 1680 1.03 33

4159* 1 58 170 1100 1 1 1100 1 1

65 25 1680 2.63 31

1505* 1 65 938 1100 1 1 1100 1 1

31

1003 3 1

4244* 1 54 568 1730 1 1 1980 1 1

19

1505* 1 82 1082 770G 1 1 690G 1 1

31

9028* 1 54 544 1980 1 1 760X 1 1

19

1505 2 5 10 2250 16

9017* 1 75 938 1100 1 1 1100 1 1

31

1003* 1 75 1082 1100 1 1 1100 1 1

31

East 1 coding scheme

```
*New Node
 1001   3   5   0   0
    3351*  1  48  623 1200  1 1 1200  1 1
                               21
    1002*  1  54 2441 1200  1 1 1200  1 1
                               14
    9003*  1  54  100 1200  1 1 1200  1 1
                               31
 7027   2   1   0   0
    7047*  3  113  236 6360  1 3
         113  81 6990       2.80   3
    7028   0
 1002   3   5   0   0
    1001*  1  54 2441 1600  1 1 1600  1 1
                               14
    7013   2  96  150 1985  1 1 1985  2 2
*    7013   2  96  150 1686  1 1 1686  2 2
*                               14
    7028   0
 7013   2   1
*    7028   0
*    7027   2  96  421 3970  1 2
    7015   2  96  400 3970  1 2
    1002   2  96  150 3970  1 2
 7015   4   1
    7014   0
  152 7013   2  96  400      3970  1 2
```

```
    7012   1  96  235 1930M 1 1
    4168*  2  80   91 1930  1 1 3970  1 2
                              12
 3355   2   1
    4246*  1  67  405 1980  1 1
                              39
    4245*  1  67  447 1980  1 1
                              39
***New
 4266   4   1   0   0
    4257   1  32  180 1730  1 1   0  0 0 1980  1 1
    9013*  1  58  245   0  0 0  640G 1 1  640G 1 1
        58   25 1680         1.03   33
    4018   1  32  142 -770G 1 1 -640G 1 1 -640G 1 1
    4267   1  32  150 1980  1 1  760X 1 1   0  0 0
 9013   3   5   10 2250           16
    4266*  1  58  245 1100  1 1 1100  1 1
        58   25 1680         1.03   33
    9022   1  48  100 1100  1 1 1100  1 1
*                                                   33
    9012*  1  58  660 1100  1 1 1100  1 1
        58   25 1680         1.03   33
 9022   1   0   0   0       1
    9013   1  48  100
 9012   2   5   10 2250           16
    9013*  1  58  660 1100  1 1
        58   25 1680         1.03   33
    9014*  1  58  990 1100  1 1
```

58 25 1680 1.03 33

9014 3 5 10 2250 16

9012* 1 48 990 1100 1 1 1100 1 1

33

9019 1 48 100 1100 1 1 1100 1 1

9015* 1 48 765 1100 1 1 1100 1 1

33

9019 1 0 0 0 1

9014 1 48 100

9004 3 1 0 0

9030 0

7011* 3 113 2055 0 0 0 6360 1 3

113 81 6990 2.80 3

9002 1 96 200 1930M 1 1 0 0 0

9005 3 1 0 0

9031* 4 113 110 1930 1 1 6360 2 4

113 81 9320 2.80 2

9003 0

7047 0

9030 2 1 0 0

9004* 4 113 200 6360Q 1 4

113 81 9320 2.80 2

7010 0

9031 2 1 0 0

7026* 3 113 1851 6360 1 3

113 81 6990 2.80 3

9005 0

7010 2 1 0 0

7031 0

9030* 3 113 2116 6360 1 3

113 81 6990 2.80 3

7011 2 1 0 0

9004 0

7014* 3 113 176 6360 1 3

113 81 6990 2.80 3

7026 2 1 0 0

7032* 3 113 3211 6360 1 3

113 81 6990 2.80 3

9031 0

7047 2 1 0 0

7027 0

9005* 3 113 2021 8480 1 3

113 81 6990 2.80 3

7028 3 1

7027* 3 113 366 6360 1 3

3

81 1002 1 96 548 1930M 1 1

7029 0

9015 2 1 0 0

9014* 1 58 765 1980 1 1

58 25 1680 1.03 33

9017* 1 58 430 1980 1 1

58 25 1680 1.03 33

**Speed change

9017 2 5 10 2250 16

9015* 1 58 430 1100 1 1 1100 1 1

58 25 1680 1.03 33

4159* 1 58 170 1100 1 1 1100 1 1

65 25 1680 2.63 31

* 9018 1 48 100 1100 1 1 1100 1 1

* 1505 1 48 100 1100 1 1 1100 1 1

4159 4 3 2 0 60 60

167 4006* 2 82 889 1730 1 1 1980 1 1 1800X 2 2

82 53 1328 2.04 16

9017* 2 58 170 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

160 4130* 2 82 855 1730 1 1 1980 2 2 1800X 2 2

82 53 1328 2.04 16

47 1165* 2 48 230 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

25 5 12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006

4130 9017

25 5 12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017

1165 4130

1165 4 5 10 2310 16

4008* 1 48 249 1100 1 1 1100 1 1 1100 1 1

31

3353 1 48 100 1100 1 1 1100 1 1 1100 1 1

4159* 1 48 230 1100 1 1 1100 1 1 1100 1 1

31

1166 1 32 69 1100 1 1 1100 1 1 1100 1 1

4008 3 1

1165* 1 48 249 1980 1 1 760X 1 1

31

```
   9011*  1  82  210 1730  1 1 1980  1 1
                        31
   3375*  1  32  200  770G 1 1  640G 1 1
                        39
9011   4   1   0   0
   4008*  1  54  210 1730  1 1 1980  1 1  760X 1 1
       65  25 1680        2.63  31
   9025   1  48  100  770G 1 1  640G 1 1  640G 1 1
   9001*  1  54   55 1730  1 1 1980  1 1  760X 1 1
       65  25 1680        2.63  31
   9024   1  48  100  770G 1 1  640G 1 1  640G 1 1
9001   2   5  10 2250          16
   9002*  1  82   55 1200  1 1 1200  1 1
                        31
*   9010*  1  85 2530 1200  1 1 1200  1 1
*                        14
   9011*  1  82   55 1200  1 1 1200  1 1
                        31
9002   3   5  10 2250          16
   9004   0
   9003*  1  54  135 1200  1 1 1200  1 1
       65  25 1680        2.63  31
   9001*  1  54   55 1200  1 1 1200  1 1
       65  25 1680        2.63  31
9003   3   1
   9005   2  98  200 1250G 1 1 1250G 2 2
   1001*  1  82  100 1980  1 1
                        31
```

```
    9002*   1   82  135         1980  1 1
                                31
3351   3    1
    3352    1   48  100  770G 1 1  640G 1 1
    6029*   1   82 1023 1980  1 1  760X 1 1
                                21
    1001*   1   82  623 1730  1 1 1980  1 1
                                21
4257   3    1    0    0
    4258    1   48  100  770G 1 1  640G 1 1
    4255    1   32  376 1980  1 1  760X 1 1
    4266    1   32  180 1730  1 1 1980  1 1
```

****East 2 Scheme coding**

*New Node

3355 2 1

4246* 1 67 405 1980 1 1

39

4245* 1 67 447 1980 1 1

39

***New

4266 4 1 0 0

4257 1 32 180 1730 1 1 0 0 0 1980 1 1

9013* 1 58 245 0 0 0 640G 1 1 640G 1 1

58 25 1680 1.03 33

4018 1 32 142 -770G 1 1 -640G 1 1 -640G 1 1

4267 1 32 150 1980 1 1 760X 1 1 0 0 0

9013 3 5 10 2250 16

4266* 1 58 245 1100 1 1 1100 1 1

58 25 1680 1.03 33

9022 1 48 100 1100 1 1 1100 1 1

* 33

9012* 1 58 660 1100 1 1 1100 1 1

58 25 1680 1.03 33

9022 1 0 0 0 1

9013 1 48 100

9012 2 5 10 2250 16

9013* 1 58 660 1100 1 1

58 25 1680 1.03 33

9014* 1 58 990 1100 1 1

58 25 1680 1.03 33

9014 3 5 10 2250 16

9012* 1 48 990 1100 1 1 1100 1 1

33

9019 1 48 100 1100 1 1 1100 1 1

9015* 1 48 765 1100 1 1 1100 1 1

33

9019 1 0 0 0 1

9014 1 48 100

9004 3 1 0 0

9030 0

7011* 3 113 2055 0 0 0 6360 1 3

113 81 6990 2.80 3

9002 1 96 200 1930M 1 1 0 0 0

9005 3 1 0 0

9031* 4 113 110 1930 1 1 6360 2 4

113 81 9320 2.80 2

9003 0

7047 0

9030 2 1 0 0

9004* 4 113 200 6360Q 1 4

113 81 9320 2.80 2

7010 0

9031 2 1 0 0

7026* 3 113 1851 6360 1 3

113 81 6990 2.80 3

9005 0

7010 2 1 0 0

7031 0

```
    9030*   3  113 2116 6360  1 3
         113   81 6990          2.80    3
 7011    2    1    0    0
    9004    0
    7014*   3  113  176 6360  1 3
         113   81 6990          2.80    3
 7026    2    1    0    0
    7032*   3  113 3211 6360  1 3
         113   81 6990          2.80    3
    9031    0
 7047    2    1    0    0
    7027    0
    9005*   3  113 2021 8480  1 3
         113   81 6990          2.80    3
 9015    2    1    0    0
    9014*   1   58  765 1980  1 1
          58   25 1680          1.03   33
    9017*   1   58  430 1980  1 1
          58   25 1680          1.03   33
**Speed change
 9017    2    5   10 2250           16
    9015*   1   58  430 1100  1 1 1100  1 1
          58   25 1680          1.03   33
    4159*   1   58  170 1100  1 1 1100  1 1
          65   25 1680          2.63   31
*     9018    1   48  100 1100  1 1 1100  1 1
*     1505    1   48  100 1100  1 1 1100  1 1
 4159    4    3    2    0   60   60
```

167 4006* 2 82 889 1730 1 1 1980 1 1 1800X 2 2

82 53 1328 2.04 16

9017* 2 58 170 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

160 4130* 2 82 855 1730 1 1 1980 2 2 1800X 2 2

82 53 1328 2.04 16

47 1165* 2 48 230 1730 1 1 1980 2 2 1800X 2 2

65 25 1680 2.63 31

25 5 12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006

4130 9017

25 5 12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017

1165 4130

1165 4 5 10 2310 16

4008* 1 48 249 1100 1 1 1100 1 1 1100 1 1

31

3353 1 48 100 1100 1 1 1100 1 1 1100 1 1

4159* 1 48 230 1100 1 1 1100 1 1 1100 1 1

31

1166 1 32 69 1100 1 1 1100 1 1 1100 1 1

4008 3 1

1165* 1 48 249 1980 1 1 760X 1 1

31

9011* 1 82 210 1730 1 1 1980 1 1

31

3375* 1 32 200 770G 1 1 640G 1 1

39

9011 4 1 0 0

4008* 1 54 210 1730 1 1 1980 1 1 760X 1 1

```
        65   25 1680        2.63   31
    9025   1   48  100  770G 1 1  640G 1 1  640G 1 1
    9001*  1   54   55 1730  1 1 1980  1 1  760X 1 1
        65   25 1680        2.63   31
    9024   1   48  100  770G 1 1  640G 1 1  640G 1 1
 9001   2    5   10 2250          16
    9002*  1   82   55 1200  1 1 1200  1 1
                              31
*     9010*  1   85 2530 1200  1 1 1200  1 1
*                               14
    9011*  1   82   55 1200  1 1 1200  1 1
                              31
 9002   3    5   10 2250          16
    9004   0
    9003*  1   54  135 1200  1 1 1200  1 1
        65   25 1680        2.63   31
    9001*  1   54   55 1200  1 1 1200  1 1
        65   25 1680        2.63   31
 9003   3    1
    9005   2   98  200 1250G 1 1 1250G 2 2
    1001*  1   82  100 1980  1 1
                              31
    9002*  1   82  135        1980  1 1
                              31
 3351   3    1
    3352   1   48  100  770G 1 1  640G 1 1
    6029*  1   82 1023 1980  1 1  760X 1 1
                              21
```

1001* 1 82 623 1730 1 1 1980 1 1

21

4257 3 1 0 0

4258 1 48 100 770G 1 1 640G 1 1

4255 1 32 376 1980 1 1 760X 1 1

4266 1 32 180 1730 1 1 1980 1 1

**New nodes E2

7015 4 1

7014 0

152 7013 2 96 426 3970 1 2

7012 1 96 235 1930M 1 1

4168* 2 80 91 1930 1 1 3970 1 2

12

* Nodes from P

7027 3 1

7047* 4 113 236 1930 1 1 6360 2 4

2

7013 0

7028 0

7028 3 1

7027* 3 113 366 6360 1 3

3

81 7013 1 96 337 1930M 1 1

7029 0

7013 4 5

1001* 1 54 3120 1600 1 1 1600 1 1

14

7015 2 96 426 1985 1 1 1985 2 2

```
   7028   0

   7027   2   96  421        3970  1 2

1001   3   5   0   0

   3351*  1   48  623 1200  1 1 1200  1 1

                         21

   7013*  1   54 3120 1200  1 1 1200  1 1

                         14

   9003*  1   54  100 1200  1 1 1200  1 1

                         31
```

West 1 Scheme Coding

**** west 1 option coding**

**Arm Amended

```
 4165   4   1   0   0
    4169   0
    4001   2   48   66 1900  1 1 1900  1 1 1900  2 2
    1502*   1   75 2875 1880G 1 1 1880G 1 1    0  0 0
                              16
    4166   0
```

**New Node

```
 1502   2   5   1  2250          16
    9014*   1   75 1354 1100  1 1
                              16
    4165*   1   75 2875 1100  1 1
                              16
 4266   4   1   0   0
    4257   1   32  180 1730  1 1   0  0 0 1980  1 1
    9013*   1   58  245    0  0 0  640G 1 1  640G 1 1
         58   25 1680         1.03   33
    4018   1   32  142 -770G 1 1 -640G 1 1 -640G 1 1
    4267   1   32  150 1980  1 1  760X 1 1    0  0 0
 4159   4   3   2   0  60   60
  167 4006*   2   82  889 1730  1 1 1980  1 1 1800X 2 2
         82   53 1328         2.04   16
    9017*   2   58  170 1730  1 1 1980  2 2 1800X 2 2
         58   25 1680         1.03   33
  160 4130*   2   82  855 1730  1 1 1980  2 2 1800X 2 2
         82   53 1328         2.04   16
```

```
  47 1165*   2   48  230 1730  1 1 1980  2 2 1800X 2 2
        48   25 1680         1.28   34
        25    5   12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006
                4130 9017
        25    5   12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017
                1165 4130
9013    3    5   10 2250           16
   4266*   1   58  245 1100  1 1 1100  1 1
        58   25 1680         1.03   33
   9022    1   48  100 1100  1 1 1100  1 1
*                                                    33
   9012*   1   58  660 1100  1 1 1100  1 1
        58   25 1680         1.03   33
9022    1    0    0    0        1
   9013    1   48  100
9012    2    5   10 2250           16
   9013*   1   58  660 1100  1 1
        58   25 1680         1.03   33
   9014*   1   58  990 1100  1 1
        58   25 1680         1.03   33
9014    4    5   10 2250           16
   9012*   1   58  990 1100  1 1 1100  1 1 1100  1 1
        58   25 1680         1.03   33
   9019    1   48  100 1100  1 1 1100  1 1 1100  1 1
   9015*   1   58  765 1100  1 1 1100  1 1 1100  1 1
        58   25 1680         1.03   33
   1502*   1   75 1354 1100  1 1 1100  1 1 1100  1 1
                           16
```

```
 9015   2   1   0   0
    9014*  1   58  765 1980  1 1
          58   25 1680         1.03   33
    9017*  1   58  430 1980  1 1
          58   25 1680         1.03   33
 9017   2   5   10 2250           16
    9015*  1   58  430 1100  1 1 1100  1 1
          58   25 1680         1.03   33
    4159*  1   58  170 1100  1 1 1100  1 1
          58   25 1680         1.03   33
*     9018   1   48  100 1100  1 1 1100  1 1
*     1505   1   48  100 1100  1 1 1100  1 1
 9019   1   0   0   0       1
    9014   1   48  100
```

** Zone connectors removed

```
 4257   3   1   0   0
    4258   1   48  100  770G 1 1  640G 1 1
    4255   1   32  376 1980  1 1  760X 1 1
    4266   1   32  180 1730  1 1 1980  1 1
 3355   2   1
    4246*  1   67  405 1980  1 1
                             39
    4245*  1   67  447 1980  1 1
                             39
```

****West 2 Scheme Coding****

```
**** west 1 option coding**

**New Node

 1505   2   5   10 2250

     9017*   1   75  966 1100  1 1

                                  16

     1506*   1   75 2338 1100  1 1

                                  16

**New Node

 1506   3   1

     4002*   1   48  513  770G 1 1  640G 1 1

                                  34

     3368*   1   80   80 1980  1 1  640X 1 1

                                  17

     1505*   1   75 2338 1730  1 1 1980  1 1

                                  16


**Arm Amended

 4002   4   3   2       91

     4006*   1   48  246 1400  1 1 1900  1 1 1200XD1 1

                                  34

     3371*   1   82  262 1400  1 1 1630  1 1 1200XD1 1

                                  21

     1506*   1   48  513 1400  1 1 1900  1 1 1200XD1 1

                                  34

     4240    1   32  343 1400  1 1 1630  1 1 1200XD1 1

           40   22   12 4006 3371 4006 1506 4006 4240 1506 4240 1506 4006

                        1506 3371
```

14 15 12 3371 1506 3371 4240 3371 4006 4240 4006 4240 3371

4240 1506

**Arm Amended

3368 2 1

4166* 1 80 500 1980 1 1

17

1506* 1 48 80 1980 1 1

17

**Copied from Scen R

4266 4 1 0 0

4257 1 32 180 1730 1 1 0 0 0 1980 1 1

9013* 1 58 245 0 0 0 640G 1 1 640G 1 1

58 25 1680 1.03 33

4018 1 32 142 -770G 1 1 -640G 1 1 -640G 1 1

4267 1 32 150 1980 1 1 760X 1 1 0 0 0

9013 3 5 10 2250 16

4266* 1 58 245 1100 1 1 1100 1 1

58 25 1680 1.03 33

9022 1 48 100 1100 1 1 1100 1 1

33

9012* 1 58 660 1100 1 1 1100 1 1

58 25 1680 1.03 33

9022 1 0 0 0 1

9013 1 48 100

9012 2 5 10 2250 16

9013* 1 58 660 1100 1 1

58 25 1680 1.03 33

9014* 1 58 990 1100 1 1

58 25 1680 1.03 33

9014 3 5 10 2250 16

9012* 1 58 990 1100 1 1 1100 1 1

58 25 1680 1.03 33

9019 1 48 100 1100 1 1 1100 1 1

9015* 1 58 765 1100 1 1 1100 1 1

58 25 1680 1.03 33

9015 2 1 0 0

9014* 1 58 765 1980 1 1

58 25 1680 1.03 33

9017* 1 58 430 1980 1 1

58 25 1680 1.03 33

9017 3 5 10 2250 16

9015* 1 58 430 1100 1 1 1100 1 1

58 25 1680 1.03 33

4159* 1 58 170 1100 1 1 1100 1 1

58 25 1680 1.03 33

1505 1 82 966 1100 1 1 1100 1 1

* 16

9019 1 0 0 0 1

9014 1 48 100

4159 4 3 2 0 60 60

167 4006* 2 82 889 1730 1 1 1980 1 1 1800X 2 2

82 53 1328 2.04 16

9017* 2 58 170 1730 1 1 1980 2 2 1800X 2 2

58 25 1680 1.03 33

160 4130* 2 82 855 1730 1 1 1980 2 2 1800X 2 2

82 53 1328 2.04 16

47 1165* 2 48 230 1730 1 1 1980 2 2 1800X 2 2

48 25 1680 1.28 34

25 5 12 4006 9017 4006 4130 4006 1165 4130 1165 4130 4006

4130 9017

25 5 12 9017 4130 9017 1165 9017 4006 1165 4006 1165 9017

1165 4130

4257 3 1 0 0

4258 1 48 100 770G 1 1 640G 1 1

4255 1 32 376 1980 1 1 760X 1 1

4266 1 32 180 1730 1 1 1980 1 1

3355 2 1

4246* 1 67 405 1980 1 1

39

4245* 1 67 447 1980 1 1

39