

Transport Assessment

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Executive Summary

Introduction and Background

The City of Bradford Metropolitan District Council, “the Council”, has developed a Transport Assessment in partnership with the West Yorkshire Combined Authority (WYCA) and the consulting firm Jacobs. This assessment examines the impacts of future growth associated with the Regulation 19 Local Plan (R19 Local Plan) to the highway network (strategic and non-strategic) and, where possible, public transport (bus and rail). This has been undertaken to demonstrate that the Council’s R19 Local Plan is sound in that it is justified, effective and consistent with national policy.

Approach

For the purpose of this Transport Assessment, the effect of the R19 Local Plan on the District’s transport networks has been carried out using a combination of existing and updated traffic models that are used to estimate the level of additional demand, by mode, expected to be delivered by a combination of R19 Local Plan allocations.

Bradford's existing traffic model (BTM) had a 2018 Base Year, which reflected pre-Covid conditions and was out of date. The Council decided to work with WYCA to make use of the extensive data collection which informed the 2023 base year West Yorkshire Transport Model (WYTM) and the expertise of their consultants in developing and running of that model. In short, WYTM is used to inform the travel choices and mode share associated with various future scenarios and the resulting highway demand is passed through to an update of the BTM network to assess the impact of changes in demand on the highway network. Changes in demand for the rail and bus networks are taken directly from WYTM.

BTM output is also used to evaluate the likely impact of additional demand for travel on carbon emissions and air quality.

Planning and modelling assumptions

The updated BTM has a 2023 Base Year and assigned traffic flows and travel times are validated against the 2023 dataset compiled by WYCA and Bradford Council.

Future year models are prepared for 2034 (approximately 9 years into the R19 Local Plan) and 2043 (the end of the R19 Local Plan period). Within each future year model there are two scenarios:

- A Reference Case version of the model which includes all committed development and background growth within each West Yorkshire district, a “No Local Plan” (NLP) scenario; and
- A R19 Local Plan version in which trips expected to be generated by Local Plan allocation sites are added to the Reference Case, a “with Local Plan” (WLP) scenario.

Highway demand associated with each scenario is determined by the WYTM.

The NLP scenario includes sites already under construction or with planning permission, a threshold has been applied which excludes smaller sites with fewer than 100 homes or 200 jobs before inclusion in the WYTM. This resulted in a total of 17 housing sites and 8 employment sites being included in the WYTM NLP Scenario, providing 3,815 new homes and around 65,500 sqm of additional employment floorspace. For the WLP scenario all allocated sites are added, resulting in a further 25,578 homes and around 85 Ha of employment space.

Housing sites located in areas of high public transport accessibility have been modelled with lower car ownership than other locations to reflect parking policies and standards within the Reg 19 Local Plan. This encourages use of non-car modes within the WYTM.

For residential and employment sites, a forecast delivery profile of committed households and jobs between the 2023 Base Year and both 2034 and 2043 forecast years is modelled in WYTM to establish highway mode share of overall demand across AM and PM peak time periods. The resulting highway trip totals are passed through to the BTM and the increase in demand pivoted against the updated Base Year demand.

Public Transport

To understand the capacity on the rail network, an analysis was undertaken of all services running to and from Bradford across three different rail periods in 2025/26. This analysis identified that during peak hours no services are currently at, or over, capacity.

When the additional trips arising from development over the R19 Local Plan period were added into the network, it did not result in the services exceeding capacity in 2034, but did identify a small number of routes where capacity is expected to be reached by 2043. Rail service analysis is provided in Chapter 9.

Assessment of the impact of the R19 Local Plan on the bus network considered the capacity of the existing network with regard to recent decline in passenger numbers and the understanding that the network will at least be maintained under future bus franchising proposals.

Relatively small differences in forecast change on passenger numbers are predicted across the network and the additional bus passengers associated with the proposals can be accommodated within existing network.

Highway performance

Headline results

The effect of additional 'with R19 Local Plan' (WLP) traffic on the local road network has been assessed in two ways:

- Nodes analysis – increased delay >60 seconds or volume to capacity ratio >100%

- Turns analysis – individual turns analysis (delay and volume to capacity ratio)

In the short term to 2034, the modelling has identified that the main nodes affected by additional R19 Local Plan traffic demand are located close to the major development site planned at Esholt, Apperley Bridge. There is also a cluster of junctions along A641 Huddersfield Road, near Low Moor, where additional delay is expected and it is in these parts of the network where some form of mitigation will be focussed.

Other notable locations where a significant increase in delay is forecast, and where mitigation will need to be considered, are:

- A650 Bradford Road/Mercure Hotel junction, west of Saltaire
- A6177 Killinghall Road/Leeds Old Road junction
- Cutler Heights Lane/Broad Lane/ Tyersal Lane junction
- A641 Manchester Rd/St Stephen's Rd/Ransdale Rd junction
- A58 Leeds Rd/A644 Brighouse Rd, Calderdale

By 2043, other areas of the District will start to experience increases in delay both with and without impact of additional R19 Local Plan allocations and resilience will be built into the mitigation of any of the above junctions to accommodate continued growth in demand by 2043.

As set out in Chapter 10, the exact form of mitigation that might be required at other junctions by 2043 is more difficult to predict. It is proposed that traffic levels at each of the following locations is monitored as developments are brought forward. The Council will commit to a programme of bi-annual surveys at each location and monitoring of junctions in neighbouring authorities will be agreed through appropriate consultation.

- John St/Darley St/North Parade
- Bridge St/Vicar Lane
- Shipley-Airedale Rd/Barkerend Road
- Barkerend Rd/Otley Road
- A644/High St, Queensbury
- A629, Silsden roundabout
- A650 Hard Ings Rd/Lawkhholme Lane, Keighley
- Otley Rd/Bradford Rd (Leeds district)
- A6120 Leeds ORR/Rodley Lane (Leeds district)
- A658 Harrogate Rd/Bayton Lane (Leeds district)
- A65 New Rd/Henshaw La (Leeds district)
- A658 Apperley La/Micklefield Lane (Leeds district)
- A6038 Hollins Hill/B6153 Park Road (Leeds district)
- A629 Keighley Rd/Per La/Cow Hill Gate Lane (Calderdale district)

Strategic Road Network

In Bradford district, the Strategic Road Network (SRN) is represented by the M606, which connects to parts of the M62 either side of the M606 junction at Chain Bar.

The effect of additional 'with R19 Local Plan' (WLP) traffic on the SRN has been assessed in two ways:

- Link capacity analysis
- Merge/diverge analysis

If a part of the network is calculated to be over capacity in the model in the NLP scenario, then this is considered an existing constraint, and no mitigation would be proposed. The same approach is followed if an existing merge/diverge slip-road is sub-standard. Only those links or slip roads made worse in the WLP scenario are considered for mitigation.

By 2034, no mitigation is proposed for the SRN. By 2043, vehicular traffic flows are expected to continue to increase and, particularly in the southbound direction on the M606, more links are expected to operate above theoretical capacity in the AM peak. There are also 2 locations on the M606 network where the recommended merge/diverge layout differs between the NLP and WLP scenarios in 2043.

It is also noted that the Bradford approach to the M62/M606 roundabout at Chain Bar is expected to have increased delay related to the employment site allocation at NuFarm. Mitigation at this location will need to be agreed between the developer, National Highways and Kirklees Council.

Given the level of uncertainty in forecast traffic conditions by 2043, it is difficult to predict the exact form of mitigation on the SRN that is likely to be required. Ongoing review and modelling will provide more certainty on mitigation requirements as delivery of the R19 Local Plan takes shape.

Carbon Impacts and Air Quality

Output from the traffic model has been used to inform an assessment of the carbon impacts of the R19 Local Plan allocations across the Bradford District.

The Department for Transport (DfT) Vehicle Emissions Carbon Tool (VECAT) has been used to predict increases in District-wide transport-related carbon emissions for different classes of vehicle.

By the end of the R19 Local Plan period there is expected to be a slight reduction in emissions from commercial vehicles, largely a result of changes in vehicle fleet composition over time and a move towards use of less polluting vehicles. A small increase in car emissions by 2043 is, however, predicted from an increase in car vehicle kms travelled by journeys made to/from new R19 Local Plan sites.

An in-depth assessment of Air Quality demonstrates that growth associated with the R19 Local Plan is likely to result in limited impacts on air quality within the district in 2034, however by 2043 there will be more substantial impacts.

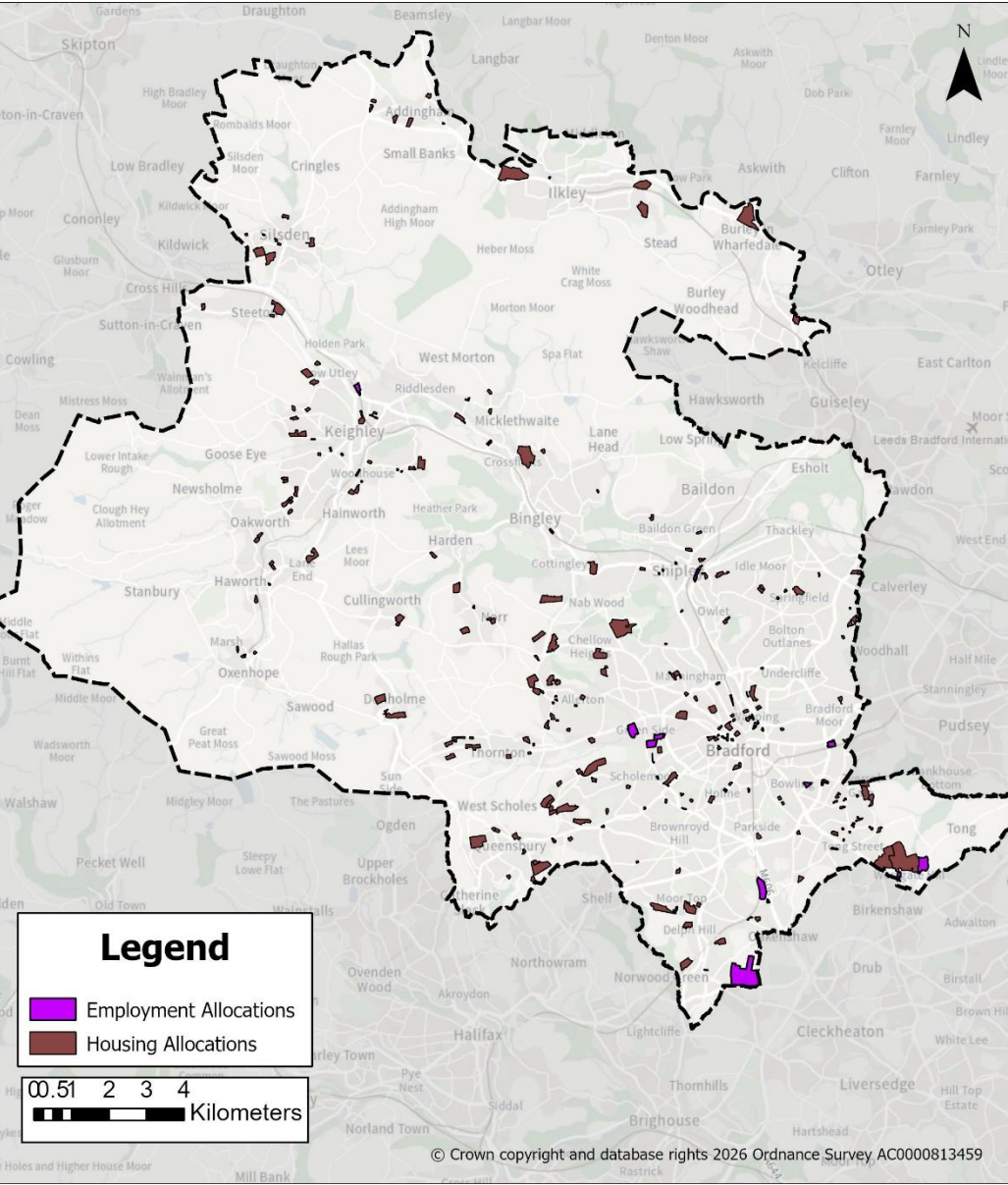
In 2043, cumulative R19 Local Plan-related growth across the District results in more extensive traffic increases, with several corridors exceeding the screening thresholds. However, the R19 Local Plan also introduces substantial traffic reductions on key links, which will deliver meaningful air quality benefits to sensitive receptors. The results of the assessment identify locations where air quality considerations may need to be incorporated into future transport planning and project-level assessments, allowing any necessary mitigation measures to be identified and implemented.

1 Introduction

1.1 Context

- 1.1.1.1 The City of Bradford Metropolitan District Council (CBMDC) is developing its pre-submission Regulation 19 Local Plan, the “R19 Local Plan” (2025-2043) in order to guide decisions on future development and address the needs and opportunities of the area.
- 1.1.1.2 The R19 Local Plan site allocations comprise 33,927 new homes and 101.6ha of employment floorspace to be delivered by 2043. These allocated sites are shown below in Figure 1.1.

Figure 1.1: R19 Local Plan (2025-2043) Site Allocations



- 1.1.1.3 The allocated residential sites are focussed on the urban area with circa 66% of all residential allocations located in the Regional City. A further 21% are located in Towns and the remaining 13% being in villages. Employment site allocations follow a similar spatial distribution with the exception of the Nufarm site located in Wyke and the Major Development Site located in Esholt.
- 1.1.1.4 This Transport Assessment (TA) has been created to set out the transport network baseline and understand the impacts of the residential and employment growth expected in the R19 Local Plan period. This TA assesses highway impacts and well as impacts on public transport.

1.2 Report Structure

- 1.2.1.1 The report sets out the background to the Transport Assessment, describes existing transport networks and reports on the impact from the R19 Local Plan developments on the future transport networks. It is divided into 12 Chapters as follows:
- Chapter 2 describes the background to the Transport Assessment;
 - Chapter 3 describes the public transport networks;
 - Chapter 4 describes the active travel network;
 - Chapter 5 describes the highway network;
 - Chapter 6 outlines the strategic assessment methodology;
 - Chapter 7 provides details on the model development;
 - Chapter 8 details the modelling assumptions used in the analysis, including future changes to the public transport, active travel and highways networks;
 - Chapter 9 provides the strategic transport assessment of the public transport and active travel networks;
 - Chapter 10 provides the strategic transport assessment of the highways network;
 - Chapter 11 outlines the proposed mitigation for all transport networks;
 - Chapter 12 sets out the carbon and air quality impacts; and
 - Chapter 13 draws conclusions from the analysis undertaken in this report
- 1.2.1.2 Where necessary we have included further details within a set of Appendices.

2 Background to the Assessment

2.1 Introduction

- 2.1.1.1 This chapter provides the background to the assessment, describing the Bradford context, introducing the R19 Local Plan and the policy framework within which this assessment was developed.

2.2 Context

2.2.1 Bradford District

- 2.2.1.1 Bradford District is located in West Yorkshire and is bounded by Leeds District to the east, North Yorkshire to the northwest, and Calderdale and Kirklees to the south. The western boundary of the District forms part of the West Yorkshire and Lancashire County boundary.
- 2.2.1.2 With a growing population of 563,600, Bradford is currently England's 5th biggest Metropolitan Authority. The population is forecast to reach over 570,000 by 2032. It is among the youngest places in the UK with over 22% of people aged under 16.
- 2.2.1.3 The District has a distinct urban rural split. The southern section is predominantly urban with the highest urban density located in the southeast around the city of Bradford and its surrounding settlements. To the north west of the District, the area is mainly rural and is comprised of small towns and villages such as Silsden, Addingham, Ilkley and Haworth.

2.2.2 Local Plan Development

- 2.2.2.1 Local Planning Authorities must produce a Local Plan for its area to guide land use, sustainable development and environmental protection. The Council first consulted in 2019 on scoping and then detailed changes to the adopted Core Strategy, which was subsequently followed in February 2021 with consultation on an emerging fully integrated Local Plan (Regulation 18) in February 2021.
- 2.2.2.2 Since the conclusion of the consultation in 2021, significant work has been undertaken on the Local Plan. This included the review of representations, the continued development of evidence base and appraisal material, and further sites analysis and evaluation. Together, this work has supported plan content and refined the spatial strategy, strategic objectives and vision to ensure they are focused and deliverable.
- 2.2.2.3 Following the requirements of Regulation 18, Town and Country Planning (Local Planning) (England) Regulations 2012 (as amended), the Council has now reached the pre-submission Regulation 19 Publication stage.

- 2.2.2.4 The R19 Local Plan sets out how the district will grow sustainably over the next 18 years and features new sites for housing and employment and a range of policies which will help guide development and the determination of planning applications. It also sets out information on a variety of other priorities including transport, open spaces, green infrastructure and places of ecological value across the district.
- 2.2.2.5 The key plan ambitions for the Bradford District are focused upon delivering sustainable development and unlocking urban growth and regeneration at scale while taking a balanced approach to growth across the district and a clear focus upon quality place-making and design.
- 2.2.2.6 The focus for the R19 Local Plan has been to combine and update aspects of the adopted Core Strategy, Area Action Plans for the City Centre and Shipley /Canal Road Corridor and the Bradford Waste Management Development Plan Document into a single plan publication. The plan has also been developed and aligned with the new West Yorkshire Mass Transit: Spatial Development Framework (SDF) which sets out shared planning principles for shaping growth around future Mass Transit corridors.
- 2.2.2.7 At a detailed level, the R19 Local Plan sets out a finalised set of policies, designations and site allocations which the Council believes will deliver sustainable development for the lifetime of the plan (2025-2043). It presents a well-balanced strategy that supports urban brownfield regeneration, economic growth and jobs, while supporting the delivery of new homes to meet a diverse range of needs, placemaking and the protection of much valued natural assets and built heritage. Importantly, it also aligns with proposals to support major infrastructure improvements and investment, underpinning urban renewal and improving the quality of places.

2.3 National Policy

2.3.1 National Planning Policy Framework (2024)

- 2.3.1.1 The R19 Local Plan will be examined under the legacy plan-making system and the National Planning Policy Framework (NPPF) published in 2024.
- 2.3.1.2 The NPPF forms a singular national planning guidance for local planning authorities both in drawing up plans and as a material consideration in determining applications.
- 2.3.1.3 The NPPF Framework states that the purpose of the planning system is to contribute towards sustainable development. Sustainable development is defined in terms of economic, social and environmental sustainability.

- 2.3.1.4 In relation to transport, the NPPF outlines that new development should contribute towards sustainability and health objectives by promoting development in sustainable locations. The transport system needs to be balanced in favour of sustainable transport modes for all users, giving users a real choice about how they travel. Smarter technology should also be used to reduce the need to travel.
- 2.3.1.5 Section 9 of the NPPF “Promoting Sustainable Transport” outlines the important role that transport policies have to play in facilitating sustainable development. Paragraph 109c) states that plan-making should involve “understanding and addressing the potential impacts of development on transport networks” and “*identifying, assessing and taking into account the environmental impacts of traffic and transport infrastructure – including appropriate opportunities for avoiding and mitigating any adverse effects*” which this TA aims to do.

2.3.2 National Planning Policy Framework (2026)

- 2.3.2.1 In August 2026 an updated NPPF was released, the R19 Local Plan will not be examined under this NPPF. The 2026 NPPF Chapter 15 provides sustainable transport policies for plan-making and decision-making which have been considered in the development of this TA.

2.3.3 MHCLG Guidance: Transport Evidence Bases in Plan Making and Decision Taking (2015)

- 2.3.3.1 Guidance from MHCLG states that local planning authorities need to undertake an assessment of the transport implications in developing their Local Plan to identify infrastructure requirements required as a result of future development. In line with this, this TA will review growth scenarios associated with the Local Plan site allocations, including a scenario with only baseline growth to understand the transport impacts arising from the R19 Local Plan.

2.4 Regional Policy

2.4.1 West Yorkshire Combined Authority Transport Strategy 2040

- 2.4.1.1 The West Yorkshire Combined Authority (WYCA) Transport Strategy sets out a vision and framework to deliver a “world-class, modern, integrated transport system.” The strategy was developed in partnership with Bradford Council and the other West Yorkshire local authorities to reflect the shared challenges and priorities of the region in relation to transport.
- 2.4.1.2 The Transport Strategy sets out targets and strategies for shifting modal share away from private car journeys and toward rail, bus and active travel modes. In particular, it aims for a 300% increase in cycle trips by 2027.

- 2.4.1.3 The policy direction from the Transport Strategy is a clear shift away from unsustainable travel choices, this is reflected in the R19 Local Plan policies and allocations and accounted for within the assumptions of this assessment.

2.4.2 West Yorkshire Combined Authority Local Transport Plan

- 2.4.2.1 The WYCA Local Transport Plan (LTP)(2026) provides the vision for the Weaver Network, a multi-modal interconnected transport network “benefitting people, places and our planet by embedding sustainable transport choices to enable the economy to grow” in West Yorkshire.
- 2.4.2.2 The WYCA LTP sets out policies which intend to meaningfully improve the bus, rail and active travel network so as to provide a realistic alternative to journeys by private car. These ambitions are captured within the R19 Local Plan policies and accounted for within the assumptions of this assessment.

2.4.3 Emerging West Yorkshire Spatial Development Framework

- 2.4.3.1 The WYCA Mass Transit Spatial Development Framework (SDF) is a joint Development Plan Document that aims to maximise the benefits from Mass Transit.
- 2.4.3.2 The SDF was being consulted on publicly at the time of writing so is referred to as an “emerging document”.
- 2.4.3.3 The SDF focusses on the delivery of Mass Transit, a Transport Improvement scheme planned for West Yorkshire. However, as the scheme for Mass Transit is in the early stages of development and routes and sites required for delivery of Mass Transit are not fixed, it has not been considered within this Assessment. It is considered likely that Mass Transit would assist in relieving congestion on key routes within the District.

2.5 Local Policy

2.5.1 Emerging R19 Local Plan

Headline Figures and Spatial Strategy

- 2.5.1.1 The R19 Local Plan sets out a positive vision for the future of Bradford District which provides a framework for sites and policies within the plan period but also underpins the longer-range direction of transformation and growth across our neighbourhoods and communities.
- 2.5.1.2 The R19 Local Plan site allocations comprise approximately 33,900 new homes and 101.6ha of employment floorspace to be delivered by 2043, the allocations can be seen in Figure 1.1.
- 2.5.1.3 The spatial strategy for the R19 Local Plan focuses on:
- Prioritising housing growth within and on the edge of existing sustainable urban areas including the Regional City, sustaining access to a wide range of

services and facilities, with support for the retention and enhancement of physical, social and environmental infrastructure.

- Maximising opportunities and densities for housing and employment growth near rail stations, transit and public transport corridors to enhance quality and efficiency and accessibility of sustainable transport infrastructure and active travel networks.
- Supporting new sustainable transport infrastructure investment to assist with strengthening district connectivity and the transition towards a low carbon future.
- Focusing medium and longer term transformational physical change, regeneration activities and housing and economic growth within the Broad Locations of Growth identified as Regeneration Areas of Bradford City Centre, Keighley, Shipley and Holme Wood.

Transport Policies

2.5.1.4 The transport policies within the R19 Local Plan focus on enabling sustainable movement and improving connectivity, particularly through public transport and active travel. The policies are likely to impact transport in the district throughout the life of the R19 Local Plan in the following ways:

- Policy ST2: Sustainable Movement and Connectivity sets out a list of priority transport schemes, with additional schemes provided in the Local Infrastructure Plan which are planned to be delivered during the R19 Local Plan period (2025-2043). These schemes include improvements to junctions, bus lanes and active travel infrastructure. Where appropriate, these schemes have been included within this TA, additional detail is provided in Chapter 8.
- Policy TR1: Safeguarding outlines the approach to safeguarding land for transport improvement schemes when routes or sites are confirmed. It is not known at what point the schemes will come forward, so no specific impact arising from the potential schemes is considered within this TA.
- Policy TR2: Integrating Sustainable Transport and Development and Policy TR4: Cycling and Walking seek to ensure that new development provides access to active travel infrastructure and public transport networks. Additionally, policy TR2 requires major developments to provide Transport Assessments and Travel Plans which explore how the occupants of new development will be encouraged to make sustainable travel choices. These policies are expected to contribute towards shifting mode shares away from private car journeys and towards sustainable transport modes.
- Policy TR3: Parking supports the reduction of parking and sets maximum parking standards in areas with high public transport and active travel connectivity (such as the City Centre). These reduced standards have been taken into account in this TA when designating trip rates from selected sites.

2.5.2 Vision Zero

2.5.2.1 Bradford Council is part of a multi-agency group that is working to make our roads safer, to prevent death and serious injury on our roads and support the people of Bradford to achieve safe and healthy journeys. To support our ambition to make our roads safer for everyone and eliminate death and serious injury the Council has adopted the principles of Vision Zero and the safe systems approach. This TA undertakes analysis of road traffic collisions in the District, including assessing the impacts of the R19 Local Plan on existing cluster zones.

3 Public Transport Network

3.1 Introduction

3.1.1.1 This Chapter assesses the current situation on the public transport networks including rail and bus. We also address the future potential changes to the network.

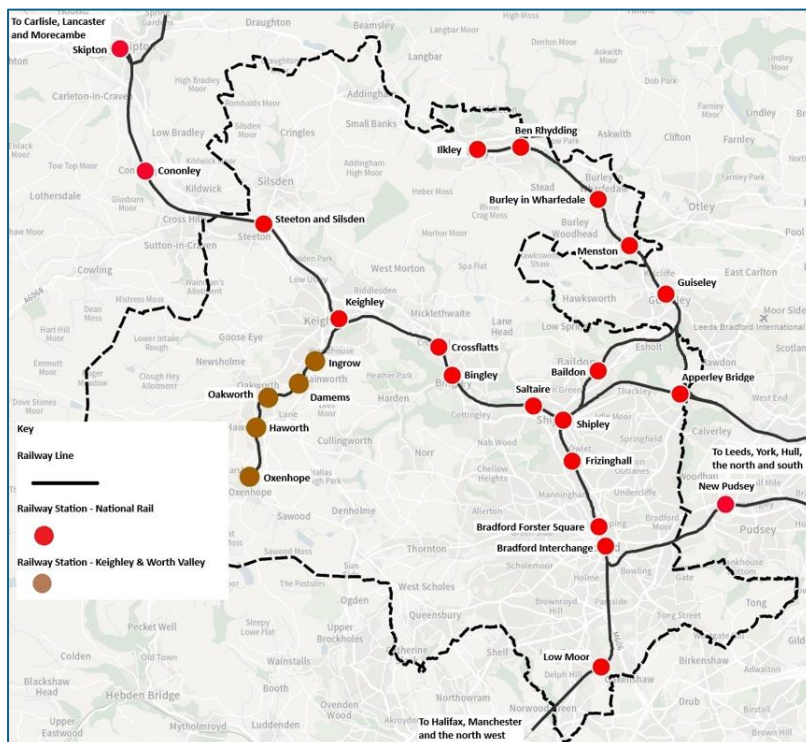
3.2 Rail

3.2.1 Introduction

3.2.1.1 Local rail services in Bradford District are provided by Northern, with long distance intercity services to/from London Kings Cross being provided by Grand Central and London North Eastern Railway (LNER). Northern and LNER are subsidiaries of DfT Operator Ltd (DFTO), a government holding company. Grand Central is an open access operator that is a subsidiary of Arriva UK Trains.

3.2.1.2 There are 16 railway stations within the District (see Figure 3.1) which provide good access to both Leeds and Bradford City Centres as well as to other destinations such as Blackpool, Halifax, Huddersfield, Hull, Manchester, Preston, Rochdale and York. The most recent additions to the network are Low Moor (on the Calder Valley line) and Apperley Bridge (on the Airedale & Wharfedale Lines) in December 2015 and April 2017 respectively. All stations within the District are owned by Network Rail but are managed by Northern.

Figure 3.1: Bradford Railway Network

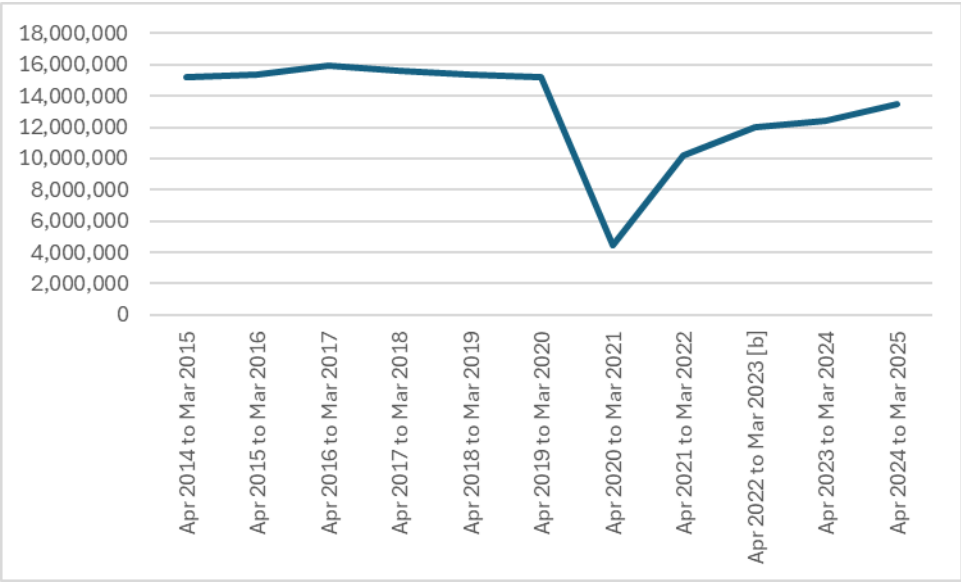


3.2.1.3 The electrified Airedale and Wharfedale lines link Leeds and Bradford Forster Square to Ilkley and Skipton, whilst the Calder Valley line links Bradford Interchange with Leeds, Halifax, York, Greater Manchester and the North West of England. Beyond the limit of the Airedale line at Skipton, services link stations in Bradford district (Shipley, Bingley & Keighley) with Carlisle (via the Settle & Carlisle line) and Lancaster/Morecambe (via the Bentham Line).

3.2.2 Existing Rail Network

3.2.2.1 The Office for Rail and Road (ORR) publish annual data on the number of entries and exits for each railway station in the country. For the 16 rail stations in the Bradford district, Figure 3.2 illustrates the total number of entries/exits across all stations for the last 10 years.

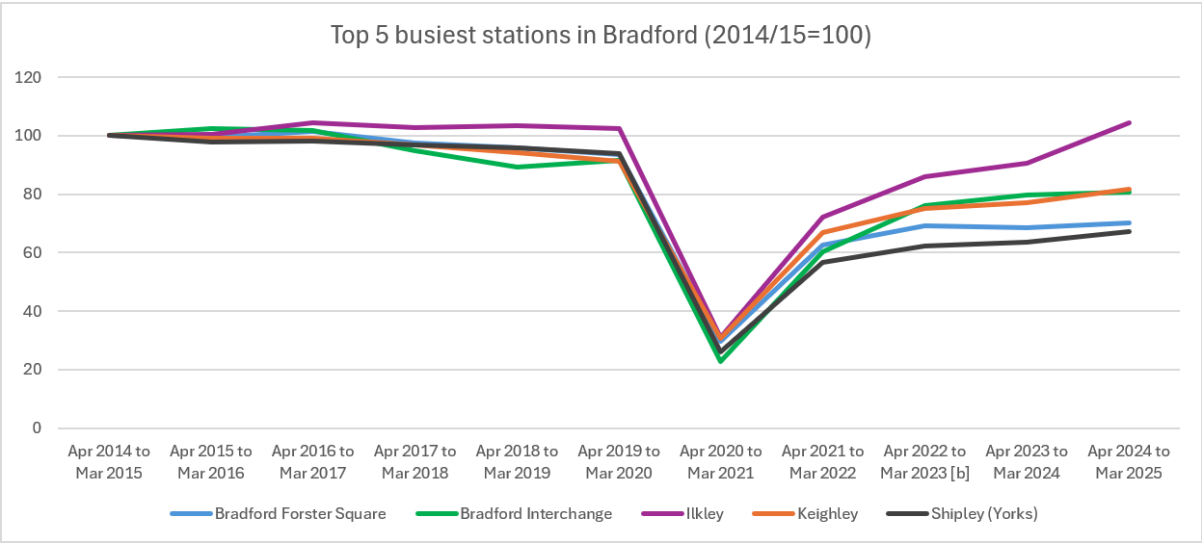
Figure 3.2: Total entries/exits - Bradford stations



Source: Office for Rail and Road (2025) Estimates of Station Usage

- 3.2.2.2 Total passenger numbers remained relatively flat at around 15.25m per year in the run up to the Covid-pandemic (2014/15 to 2019/20). Despite relatively strong recovery, 2024/25 passenger numbers across the district remain -11.3% below pre-pandemic levels.
- 3.2.2.3 Within that, there is variation between stations. Shipley and Baildon stations are still 28% below pre-pandemic levels, Ilkley (+2.2%) and Frizinghall (+1.3%) have fully recovered and Low Moor station, which only opened in 2017, has increased relatively low baseline passenger numbers by 79%.
- 3.2.2.4 The five busiest stations in Bradford are Bradford Interchange, Forster Square, Shipley, Keighley and Ilkley. For those five stations, Figure 3.3 presents the evolution of passenger number since 2014/15. To illustrate the relative performance of each station, passenger numbers are indexed to 2014/15.

Figure 3.3: Rail passenger numbers for the 5 busiest Bradford stations (Index 100 = year Apr 2014 to Mar 2015)



Source: Office for Rail and Road (2025) Estimates of Station Usage

- 3.2.2.5 Ilkley was the only ‘Top 5’ station to serve more passengers in 2019/20 than in 2014/15 and is the only station to have returned to exceed pre-pandemic passenger numbers.
- 3.2.2.6 For the same 5 stations, Table 3.1 presents passenger numbers in the years prior to the first Covid lockdown (March 2020) along with estimates of the number of passengers we would have expected at each station had the pandemic not occurred. The same results are illustrated in Figure 3.4.
- 3.2.2.7 These estimates are based on the trend in passenger numbers between 2014/15 and 2019/20. The table then compares these estimates against actual passenger numbers since 2021/22.

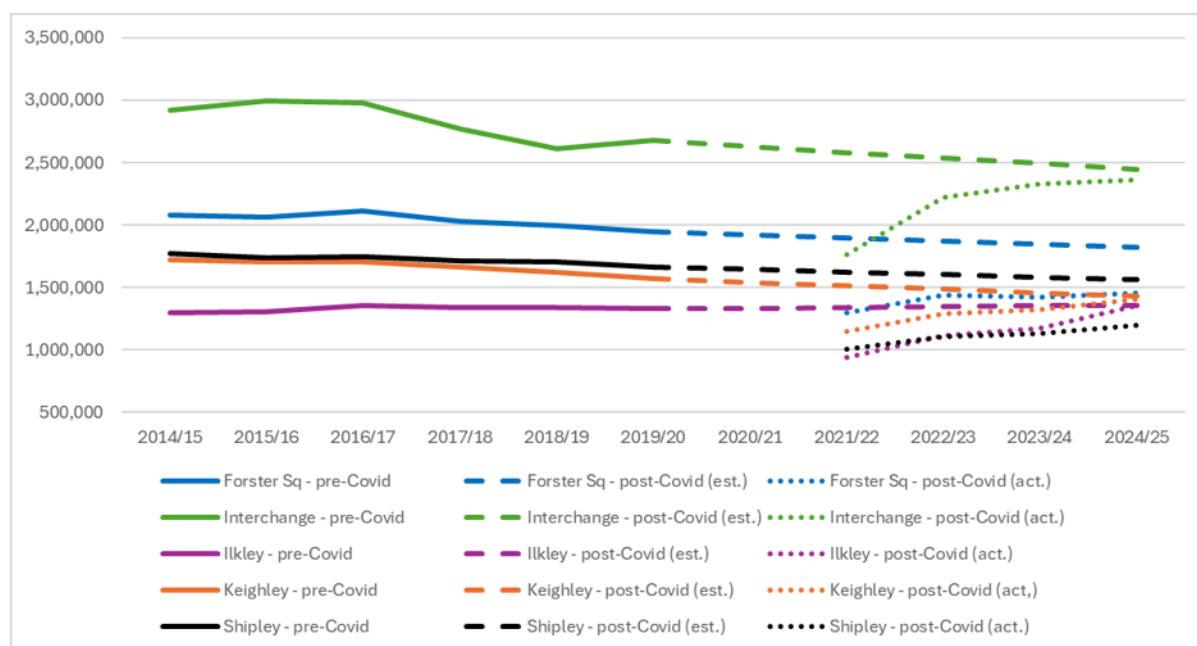
Table 3.1: Pre and Post-Covid rail passenger numbers at 5 busiest Bradford stations

		Bradford Forster Square	Bradford Interchange	Ilkley	Keighley	Shipley
2014/15	Pre-Covid	2,080,602	2,922,956	1,299,496	1,720,804	1,775,968
2015/16	Pre-Covid	2,065,658	2,993,340	1,303,810	1,702,720	1,739,258
2016/17	Pre-Covid	2,112,894	2,976,052	1,357,702	1,705,022	1,744,520
2017/18	Pre-Covid	2,027,260	2,768,436	1,336,520	1,664,578	1,716,314
2018/19	Pre-Covid	1,994,854	2,609,372	1,341,652	1,623,002	1,704,388
2019/20	Pre-Covid	1,946,622	2,675,278	1,328,924	1,570,638	1,665,754
2020/21	Post-Covid (est) Post-Covid (act)	1,920,880 614,708 -68%	2,628,320 662,282 -75%	1,334,889 401,276 -70%	1,542,215 527,384 -66%	1,644,546 459,298 -72%
2021/22	Post-Covid (est) Post-Covid (act)	1,895,478 1,301,266 -31%	2,582,186 1,762,388 -32%	1,340,881 936,760 -30%	1,514,307 1,150,000 -24%	1,623,608 1,004,806 -38%
2022/23	Post-Covid (est) Post-Covid (act)	1,870,412 1,437,732 -23%	2,536,862 2,224,912 -12%	1,346,900 1,118,700 -17%	1,486,904 1,290,608 -13%	1,602,936 1,106,944 -31%
2023/24	Post-Covid (est) Post-Covid (act)	1,845,677 1,425,866 -23%	2,492,334 2,328,886 -7%	1,352,946 1,175,906 -13%	1,459,997 1,325,068 -9%	1,582,528 1,129,942 -29%
2025/25	Post-Covid (est) Post-Covid (act)	1,821,270 1,457,418 -20%	2,448,587 2,359,354 -4%	1,359,018 1,358,126 -0%	1,433,576 1,405,910 -2%	1,562,380 1,195,542 -23%

Source: Bradford analysis of Office for Rail and Road (2025) Estimates of Station Usage

3.2.2.8 Passenger numbers at each station had been relatively consistent in the years leading to the pandemic with all except Ilkley having seen a minor year-on-year reduction. The fall in passenger numbers during Covid was around 65-75% but, at each station, passenger numbers have been getting progressively closer to pre-Covid estimates. Entries/exits at Bradford Interchange, Ilkley and Keighley are now close to where we would have expected, but passenger numbers at Bradford Forster Square and Shipley remain around 20% down.

Figure 3.4: Comparison of forecast v actual rail passengers at 5 busiest Bradford stations



Source: Bradford analysis of Office for Rail and Road (2025) Estimates of Station Usage

3.2.2.9 An assessment of rail capacity in the AM and PM peak has been undertaken across all services which operate in and/or through the District to understand existing capacities. This analysis is presented below in Table 3.2, showing the average flow across the AM peak (0700-0930) and PM peak (1600-1830) periods along with the corresponding maximum passenger demand observed. The analysis excludes weekend services and the figure in brackets represents the corresponding % of available capacity, routes with available capacity are shown in green.

Table 3.2: Existing rail capacity in Bradford district (2025/26)

From Station	To Station	AM ave	AM max	PM ave	PM max
Skipton	Cononley	66 (7%)	141 (14%)	110 (11%)	289 (28%)
Cononley	Skipton	136 (14%)	402 (42%)	88 (9%)	380 (37%)
Cononley	Steeton & Silsden	77 (8%)	166 (17%)	110 (10%)	270 (26%)
Steeton & Silsden	Cononley	125 (13%)	348 (37%)	98 (10%)	397 (39%)
Steeton & Silsden	Keighley	122 (12%)	264 (27%)	142 (14%)	264 (25%)
Keighley	Steeton & Silsden	131 (14%)	336 (35%)	142 (14%)	437 (43%)
Keighley	Crossflatts	210 (22%)	428 (44%)	176 (17%)	316 (30%)
Crossflatts	Keighley	113 (12%)	235 (25%)	215 (21%)	535 (53%)
Crossflatts	Bingley	238 (24%)	486 (50%)	191 (18%)	355 (34%)
Bingley	Crossflatts	133 (14%)	321 (34%)	249 (25%)	582 (58%)
Bingley	Saltaire	320 (33%)	650 (67%)	221 (21%)	459 (44%)
Saltaire	Bingley	119 (12%)	270 (28%)	317 (32%)	678 (67%)
Saltaire	Shipley	364 (38%)	734 (76%)	241 (23%)	500 (48%)

From Station	To Station	AM ave	AM max	PM ave	PM max
Shipley	Saltaire	115 (12%)	219 (23%)	363 (36%)	722 (72%)
Shipley	Frizinghall	219 (18%)	548 (45%)	182 (14%)	432 (33%)
Frizinghall	Shipley	172 (14%)	350 (28%)	220 (18%)	441 (36%)
Frizinghall	Forster Square	176 (14%)	374 (31%)	142 (11%)	374 (29%)
Forster Square	Frizinghall	109 (9%)	209 (17%)	173 (14%)	355 (29%)
Shipley	Apperley Bridge	122 (31%)	196 (50%)	69 (16%)	126 (28%)
Apperley Bridge	Shipley	48 (12%)	92 (22%)	138 (29%)	318 (66%)
Apperley Bridge	Kirkstall Forge	189 (48%)	294 (75%)	83 (19%)	166 (38%)
Kirkstall Forge	Apperley Bridge	54 (14%)	111 (27%)	195 (41%)	371 (77%)
Kirkstall Forge	Leeds	231 (59%)	373 (95%)	81 (19%)	187 (43%)
Leeds	Kirkstall Forge	44 (11%)	113 (28%)	226 (47%)	402 (84%)
Shipley	Baildon	61 (15%)	145 (37%)	80 (21%)	189 (48%)
Baildon	Shipley	84 (21%)	248 (62%)	41 (11%)	84 (22%)
Baildon	Guiseley	88 (23%)	237 (62%)	66 (17%)	156 (40%)
Guiseley	Baildon	68 (17%)	204 (51%)	46 (12%)	81 (21%)
Guiseley	Menston	77 (8%)	193 (21%)	191 (23%)	497 (59%)
Menston	Guiseley	214 (23%)	422 (46%)	89 (10%)	181 (21%)
Menston	Burley in Wharfedale	111 (12%)	286 (31%)	144 (17%)	408 (48%)
Burley in Wharfedale	Menston	157 (17%)	332 (36%)	84 (10%)	167 (19%)
Burley in Wharfedale	Ben Rhydding	177 (19%)	539 (57%)	110 (13%)	355 (42%)
Ben Rhydding	Burley in Wharfedale	113 (12%)	235 (26%)	90 (10%)	203 (23%)
Ben Rhydding	Ilkley	173 (18%)	527 (56%)	86 (10%)	324 (38%)
Ilkley	Ben Rhydding	85 (9%)	162 (18%)	85 (10%)	198 (22%)
Bradford Interchange	New Pudsey	100 (27%)	289 (77%)	64 (17%)	242 (63%)
New Pudsey	Bradford Interchange	90 (24%)	213 (57%)	126 (33%)	346 (92%)
Bradford Interchange	Low Moor	69 (18%)	252 (68%)	120 (32%)	347 (93%)
Low Moor	Bradford Interchange	106 (26%)	178 (44%)	58 (15%)	143 (36%)

Source: Data for all Northern train services have been downloaded from railwaydata.org for the months of September/October 2025, November/December 2025 and February 2026.

3.2.2.10 This analysis demonstrates that there is currently a significant amount of additional capacity available on the majority of rail services which serve the district. It is noted that the current Kirkstall Forge to Leeds line is operating closest to capacity and it is estimated that conditions between New Pudsey and Leeds are similar to conditions between Bradford Interchange and New Pudsey.

3.2.3 Future Rail Network

3.2.3.1 There are a number of improvements to the rail network planned with details provided below:

- **New Bradford City Centre Station:** As part of the Bradford Rail Programme⁸ and the Council's regeneration plans for the Southern Gateway area of Bradford, it is proposed develop a brand-new through station to replace the existing Bradford Interchange. It will act as a catalyst for investment through an improved passenger experience and cut journey times to neighbouring towns and cities. The new station will be integrated with WYCA's ambitions for a Mass Transit system for West Yorkshire, which will provide links to the city centre and Forster Square Station, as well as the bus network. The Council is working with the DfT on a business case for the new station. It is anticipated that the Bradford Rail Programme will improve the city's intercity connectivity including between Bradford and Leeds and Bradford and Manchester.
- **Northern Powerhouse Rail:** announced in January 2026, this outline plan under part of the Government's Northern Growth Strategy sets out high level proposals for enhanced rail connectivity across northern England. It would be delivered in three phases:
 - **Phase 1** includes electrification and upgrades to existing lines between Leeds and Sheffield, potential electrification and upgrades in the Leeds to Bradford corridor including the continued development of a new station in Bradford, and potential enhancements between Leeds and York.
 - **Phase 2:** Construction of predominately new line between Liverpool and Manchester via Warrington and Manchester Airport.
 - **Phase 3** includes improved connectivity between Leeds and Manchester, building upon the Transpennine Route Upgrade, a feasibility study of a new line from Birmingham to Manchester and provision to build on work delivered Phase 1 in the Manchester to Sheffield and Manchester to Bradford Corridors.
- **Transpennine Route Upgrade** – this project is a multi-billion-pound programme of railway improvements to better connected passengers across northern England between Manchester and York via Huddersfield and Leeds. A range of different projects along the route have been completed, are under construction or planned to be delivered up to the early 2030s.

- **Calder Valley Line** – one of medium/long term schemes/priorities identified in the West Yorkshire Rail Strategy is to develop a case for the electrification of several key routes in the sub-region including the Calder Valley Line between Leeds and Manchester via Bradford, including rolling stock improvements.
- **Mass Transit** - The initial phase of the proposed West Yorkshire Mass Transit scheme is expected to include a route linking Leeds and Bradford city centres. The scheme will be government funded and a new business case is currently being prepared by WYCA

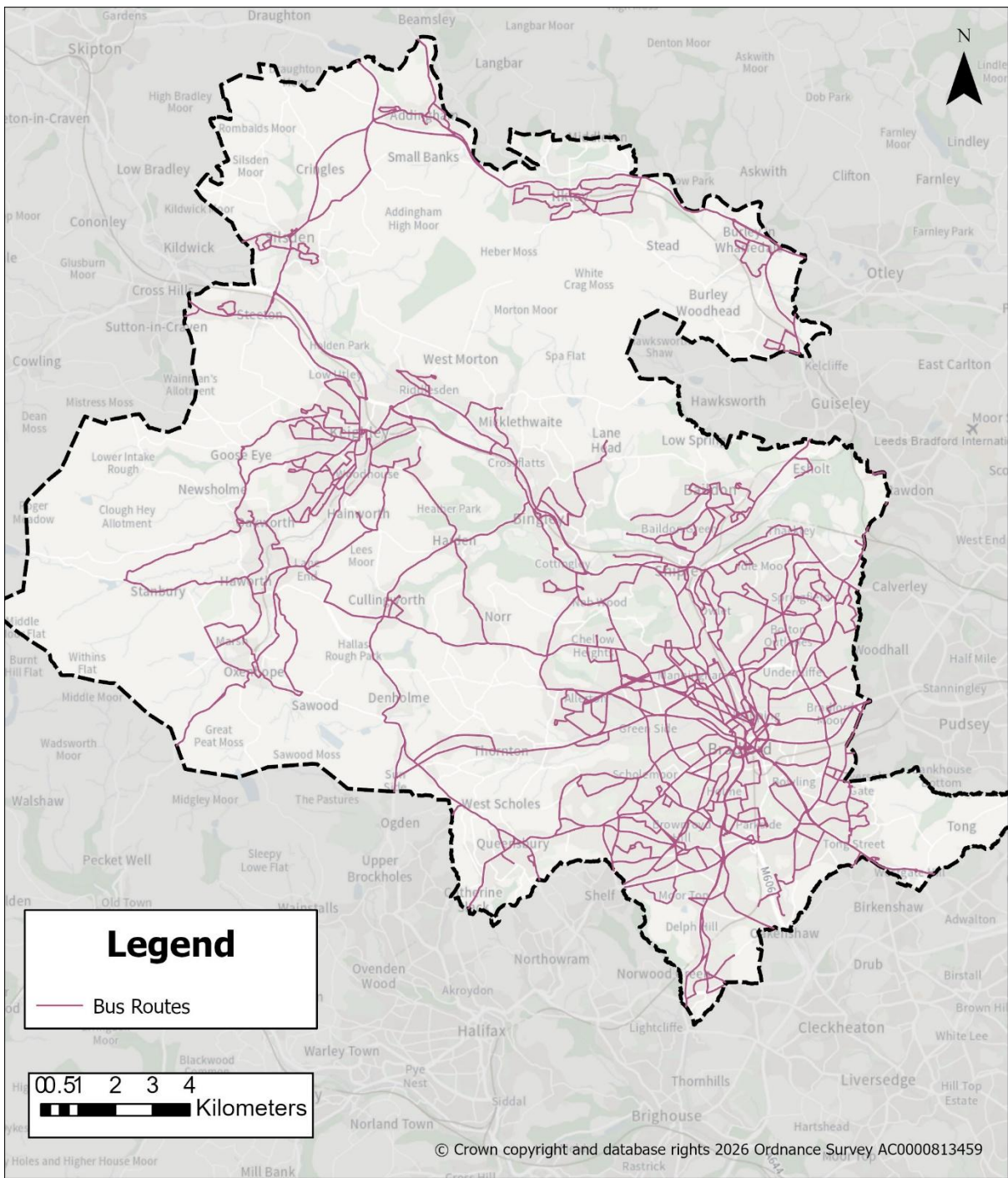
3.2.3.2 Each of these major schemes is supported by Bradford Council and have the scope to increase passenger capacity for journeys to and from the city centre and impact on travel patterns in later days/years of the R19 Local Plan period.

3.3 Bus

3.3.1 Introduction

- 3.3.1.1 Most of Bradford's bus services are run on a commercial basis by operators who determine the routes and timetables. Other services are funded principally by the West Yorkshire Combined Authority (WYCA). Service frequencies vary across the District.
- 3.3.1.2 First Bradford is the major operator within the district, with other services provided by Transdev (Keighley Bus Company, Burnley Bus Company, Flyer A1, A2 & A3), Arriva Yorkshire and TLC Travel as well as other smaller operators. Cross boundary services link the District with Burnley, Dewsbury, Halifax, Harrogate, Hebden Bridge, Huddersfield, Leeds, Leeds Bradford Airport, Otley, Skipton and Wakefield. Bus services in Bradford are shown in **Figure 3.5**.

Figure 3.5: Bus Services



Source: Bradford Council

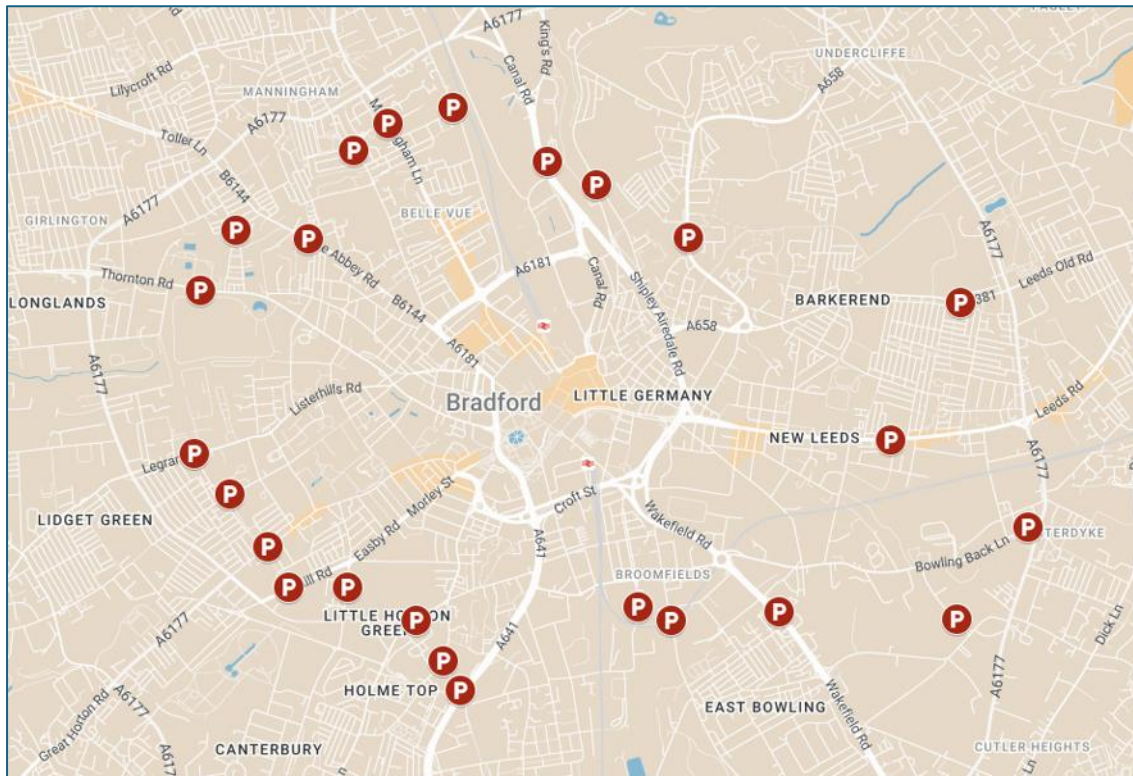
3.3.1.3 Bus stations are located at Bradford Interchange, Keighley and Ilkley. All three are owned and operated by WY Metro, who also provide bus stops, shelters and information across the District.

3.3.1.4 In addition to bus stations and stops, there are numerous bus lanes, bus gates and bus-only streets across the district. These are aimed at ensuring the efficient operation of the area's bus network as part of wider circulation plans.

3.3.2 Baseline Network

3.3.2.1 Bus passenger numbers are collected at 24 locations forming a cordon around Bradford city centre. The data has been collected every year since 2002, excluding 2020 during the Covid pandemic. The locations of the count sites are illustrated in Figure 3.6.

Figure 3.6: Cordon count locations



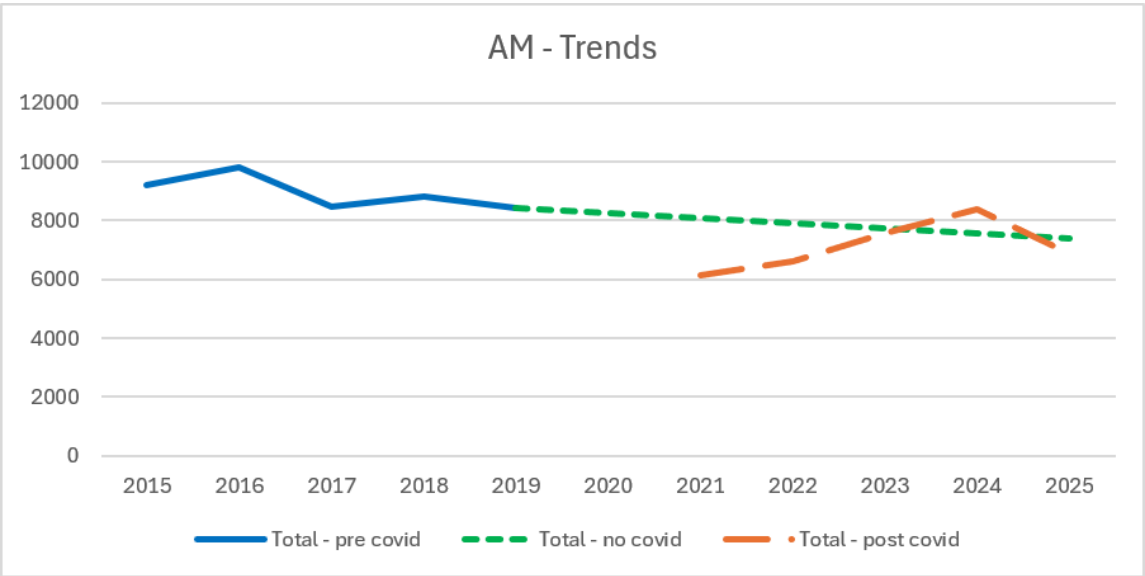
Source: Bradford Council (2026) Cordon Bus Passenger Data

3.3.2.2 Passenger data is collected for trips inbound to the city centre in the morning and outbound in the evening. For each bus that passes the site, an estimate of the number of passengers is recorded. If there are relatively few passengers, it might be possible to count them. Otherwise, buses are recorded as follows, and the size of bus (single, double) and associated capacity is used to estimate the number of passengers on board. Although not a perfect record of the number of passengers on each bus, the methodology used is consistent across all survey years and, as such, trends can be analysed.

- Empty
- ¼ full
- ½ full
- ¾ full
- Full

3.3.2.3 The following charts present observed bus passenger numbers in the AM and PM peak for the years prior to the Covid pandemic and the potential trend had the pandemic not occurred, against actual passenger numbers in recent years.

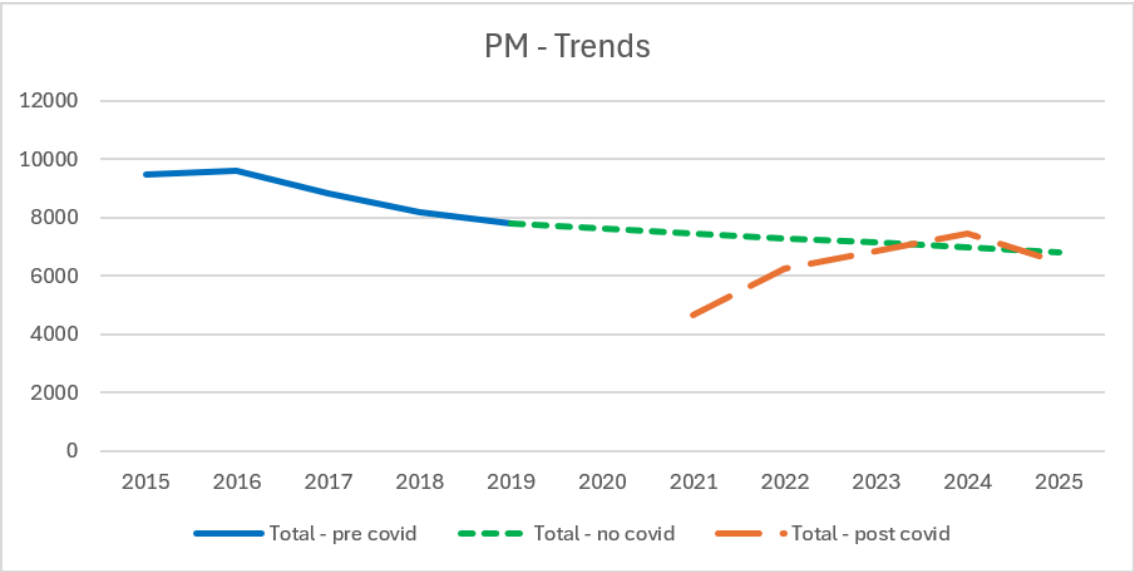
Figure 3.7: Comparison of forecast v actual bus passenger levels, 0700-0930 inbound



Source: Bradford Council data

3.3.2.4 Before Covid, there was a declining trend in morning peak bus passengers by – 2.2% pa and, even had the declining rates continued, 2025 passenger numbers across the cordon are –7.5% below where they might have been expected to be.

Figure 3.8: Comparison of forecast v actual bus passenger levels, 1600-1800 outbound



Source: Bradford Council data

- 3.3.2.5 Similar to the morning peak, there was a declining trend in evening peak bus passengers of –4.8% pa and despite the declining trend, the 2025 passenger numbers remain –5.0% below where they might have been expected to be.
- 3.3.2.6 In both time periods, initial growth in bus passenger numbers since 2021 (from a lower base) has not been sustained and most recent 2025 passenger volumes have again started to decline to a position which is below pre-Covid levels. Although this reduction in passenger numbers between 2024 and 2025 can largely be attributed to the temporary closure of Interchange bus station, followed by numerous road closures to facilitate the Transforming Cities Fund Bradford City Centre works, it is understood that latest passenger figures are not likely to show sufficient recovery to pre-Covid levels.

3.4 Future Bus Network

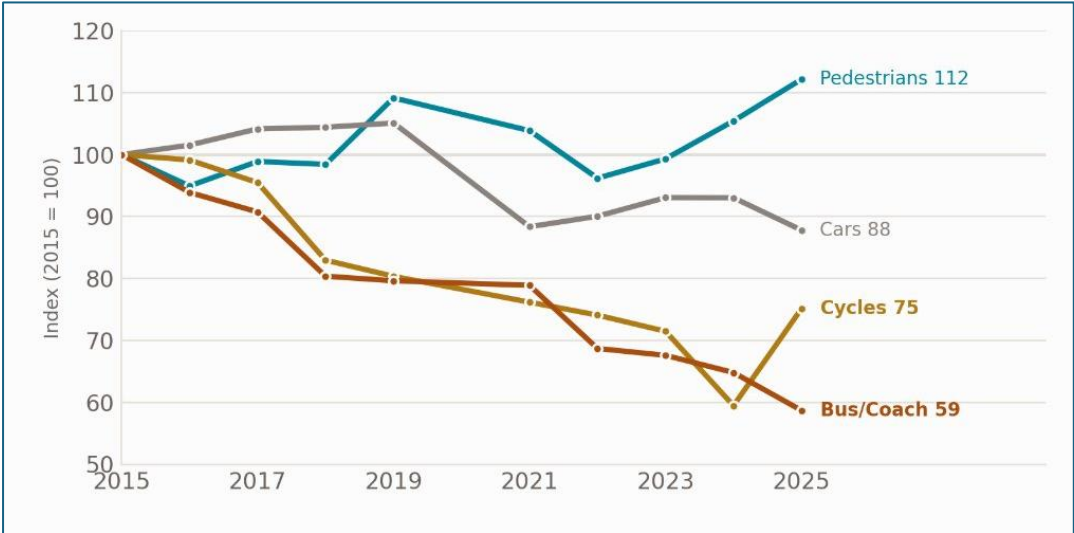
- 3.4.1.1 It is assumed that WYCA will maintain bus service levels across the district, broadly similar to 2023, under new bus franchising (Weaver Network) proposals. Routes, frequencies, fares and overall standards for buses in the region will be set by the West Yorkshire Combined Authority with franchised services starting in April 2027.
- 3.4.1.2 Junction improvements for better bus operations at Westgate/Drewton Road and Leeds Roads Gyratory are planned for future delivery.

4 Active Travel Network

4.1 Introduction

- 4.1.1.1 Bradford District has a comprehensive network of rights of way, cycle lanes and paths and less formal routes for non-motorised travel. This includes routes used for everyday access to and from homes, schools and services. It also includes important recreational routes, which are a key amenity for leisure, and a draw for tourism.
- 4.1.1.2 The Department for Transport’s Active Lives Survey reports that, in 2023, 6.7% of Bradford residents cycled at least once a week and 60.2% walked at least once a week. These figures compare to 6% and 65% across West Yorkshire and 10% and 69% across England. From this, we might conclude that the propensity to cycle in Bradford District is slightly more than across West Yorkshire but falls short of national figures. Walking, however, is less popular in Bradford than both West Yorkshire and England as a whole.
- 4.1.1.3 These figures are from before the completion of improved active travel measures in Bradford city centre, Phase 1 of the Cycle Superhighway and introduction of the bike share scheme. The Council’s count of people entering Bradford city by mode in the AM peak (see Figure 4.1) shows both pedestrian and cycling numbers increase between 2023 and 2025 and it is expected that these figures will continue to rise as the Council delivers more opportunities for active travel across the District.

Figure 4.1: AM Peak Cordon Counts (Index 2015 = 100)



Source: Bradford Traffic Unit

4.2 Existing Active Travel Network

4.2.1.1 Several sections of the National Cycle Network (NCN) run across Bradford district. Sustrans (now known as the Walk Wheel Cycle Trust) are custodians of this 16,575-mile network of signed paths and routes for walking and cycling across the UK. The routes passing through the district are:

- NCN Route 66: Manchester to Spurn Head – it runs south to north through the district from Oakenshaw to Apperley Bridge via Low Moor station, Euroway Industrial Estate, Bierley, Bowling Park, Bradford City Centre, Frizinghall to Shipley and then eastwards along the Leeds Liverpool Canal to Apperley Bridge. It is a mixture of traffic free and on road routes.
- NCN Route 69: Morecambe to Grimsby (also known in part as the Great Northern Rail Trail) – it runs along the Leeds Liverpool Canal from Silsden to Riddlesden, with a further section from Cullingworth to and including Hewenden Viaduct, then from Thornton to Queensbury. It is not continuous within the district.
- NCN Route 696 - A combined walking and cycling route connecting Riddlesden, Bingley, Saltaire and Shipley and is also known as The Airedale Greenway. It follows the Leeds Liverpool Canal and connects to - also forming part of - The Aire Valley Towpath between Leeds and Bingley. The City Connect programme resurfaced the majority of this route. The section from Apperley Bridge to Shipley was completed in 2022. The section from Kildwick to Riddlesden was improved in 2025 part funded by Active Travel England. Sustrans have also repaired the section between Shipley and Hirst Wood in 2024 and Bingley 3 rise locks to 5 rise locks in 2026.

4.2.1.2 Bradford also has 3 Cycle Superhighways:

- CS1 from Bradford to Leeds
- Canal Road Cycleway and Greenway (forming part of the NCN66)
- CS4 West Bradford Cycle Superhighway Phase 1 from Bradford to Girdlington

4.2.1.3 The district has a well-developed network of over 1,000km of urban and rural Public Rights of Way (PROWs). This network is for walkers and riders to enjoy the area's natural environment and to access local facilities by foot, on horseback or cycle. They are an important part of the area's transport network. There are several categories of PROWs:

- Footpaths – which can be used on foot only. These are often way-marked with yellow arrows.
- Bridleways – which can be used on foot or by horse or cycle. These may be way-marked with blue arrows.

- Restricted Byways – which can be used on foot, horse and cycle or with non-mechanically propelled vehicles. These may be way-marked with purple arrows.

4.2.1.4 A bike share scheme was introduced in Spring 2026 funded with revenue from the Clean Air Zone. This will ultimately comprise 200 e-bikes across at least 40 docking stations across Bradford main urban area with a focus of provision between Bradford City Centre and Shipley / Saltaire and east Bradford. Approval has been received from the DfT for the introduction of e-scooters alongside the e-bikes and, subject to internal Council agreement, could be delivered in Spring 2027.

4.2.1.5 In relation to walking, six Green Line Miles have been established in the Bradford urban area. These mile-long circular routes are aimed at encouraging more people to walk, jog or run across the city. Bradford is the first city in the country to install these routes as part of a national initiative to help people get active. The six routes are:

- Route 1: City Park and the University – following part of the well-established Bradford City Runs route along Thornton Road before going around the Bradford University campus and returning to the Alhambra.
- Route 2: Little Germany – A route that winds itself through the beautiful architecture of this historic part of the city, next to the Cathedral.
- Route 3: Manningham Lane – Around the Valley Parade football stadium, this route links Manningham Lane, Thorncliffe Road and Midland Road passing the nursery and children's centre.
- Route 4: Myra Shay – Taking in the Myra Shay playing fields and linking the Lapage, Delius Bradford Moor and Byron schools.
- Route 5: Lund Park - A circular route around the fabulous historic Lund Park in Keighley.
- Route 6: Girdlington - An active walk linking key locations in the area including the popular and friendly community park, West Park, with many facilities including fixed play, basketball court, crown green bowls and skate park.

4.3 Future Active Travel Network

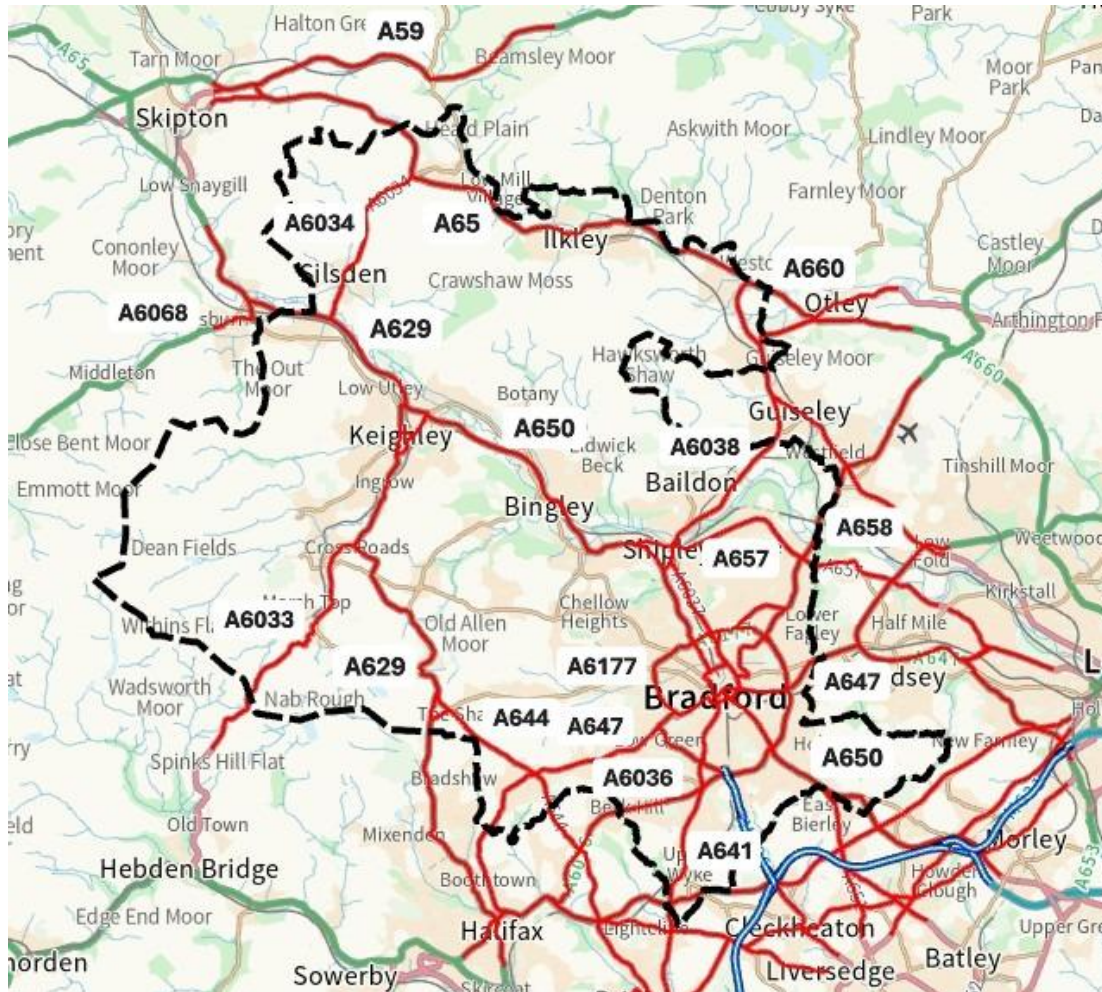
- 4.3.1.1 The Council seeks to promote walking, wheeling and cycling as part of achieving a healthy city, and aims to create appealing places to walk, wheel and cycle supported by better connectivity between all sustainable travel modes including public transport.
- 4.3.1.2 LCWIP2 was developed during 2021/22 by the Council and WYCA. It provided a prioritisation methodology to help the Council identify which schemes will generate the most usage and are the most deliverable and this informed our Investment Plan. It also incorporated WYCA's Connectivity Strategy corridors. These corridors have been incorporated into the emerging West Yorkshire Local Cycling and Walking Infrastructure Plan (LCWIP) 3 and complementary Bradford LCWIP which is yet to be published. Necessary infrastructure includes new and improved walking, wheeling and cycling routes and facilities, the reallocation of road space, improved signage, cycling parking and road safety measures.
- 4.3.1.3 Other strategic schemes in various stages of development and delivery include:
- Keighley has been granted £33.6m and Shipley £25m from the Towns Fund. A significant proportion of these funding streams (up to £3.3m in Keighley and £4m in Shipley plus an additional £1m from WYCA) will be used for a range of active travel and public realm improvements including improvements to walking and cycling facilities in the town centres in and around the town centres, to make them more attractive.
 - The Great North Rail Trail missing link between Hewenden Viaduct and Thornton
 - Wharfedale Greenway
 - Queensbury to Halifax Greenway (incorporating the Great Northern Rail Trail missing link)
 - Queensbury to West Bradford Greenway
- 4.3.1.4 The following schemes are combined highways and active travel improvement schemes, with further detail provided in Chapter 5.
- Bradford to Shipley Route Improvement Scheme
 - A650 Tong Street
 - Wakefield Road Sustainable Transport Corridor
 - Kings Road Sustainable Transport Corridor
 - Steeton and Silsden crossing and active mode connectivity.
- 4.3.1.5 The Council are in discussions with the West Yorkshire Combined Authority (WYCA) prioritising the future transport programme up to and including 2031/32. This includes a range of active travel schemes improving access to schools and walking improvement.

5 Highways Network

5.1 Introduction

5.1.1.1 The road network in Bradford is shown below in Figure 5.1 and consists of major roads shown in red, local roads shown in brown and the strategic road network (SRN) shown in blue.

Figure 5.1: Road Network



5.2 Existing Highways Network

5.2.1.1 The main highway routes to the north of the District follow or link Airedale and Wharfedale and there is also an important network of routes serving Keighley and smaller settlements to the west of the District. The Major and Local Road network key routes include:

- A6033: Hebden Bridge – Haworth
- A6034: Steeton – Silsden – Addingham
- A6036: Halifax – Bradford
- A6037: Canal Road (Bradford – Shipley)
- A6038: Shipley – Baildon – Guiseley – A65

- A6177: Bradford Outer Ring Road
- A6181: Bradford Inner Ring Road
- A629: Halifax – Keighley – Skipton
- A641: Huddersfield – Brighouse – Bradford
- A644: Brighouse – Queensbury – A629
- A647: Halifax – Bradford – Leeds
- A65: Leeds – Menston – Burley in Wharfedale – Ilkley – Addingham – Skipton (extends to meet the M6 southeast of Kendal)
- A650: Wakefield – Bradford – Shipley – Bingley – Keighley
- A657: Saltaire – Shipley – Calverley – Leeds
- A658: Bradford – Greengates – Rawdon – Leeds Bradford Airport – Harrogate/Knaresborough
- B6145: Bradford – Thornton – A629
- B6265: Cottingley – Bingley – Crossflatts

5.2.1.2 Within this network, there are six junctions which the Council’s Highways team have identified as being locations with congestion and/or safety issues to keep watch on as the R19 Local Plan progresses. These are:

- A6177 Sticker Lane/Bowling Back Lane
- Dick Lane/New Lane
- Little Horton Lane/Horton Park Avenue
- A657 Leeds Road/Thackley Road/Town Lane
- A6037 Canal Road/Frizinghall Road/Gaisby Lane
- A629 Halifax Road/B6144 Haworth Road

5.2.1.3 The Strategic Road Network (SRN) consists of the M606, a three-mile motorway spur that connects the M62 at junction 26 (Chain Bar) (in the Kirklees Council area) with the A6177 Bradford Ring Road. It has one intermediary junction.

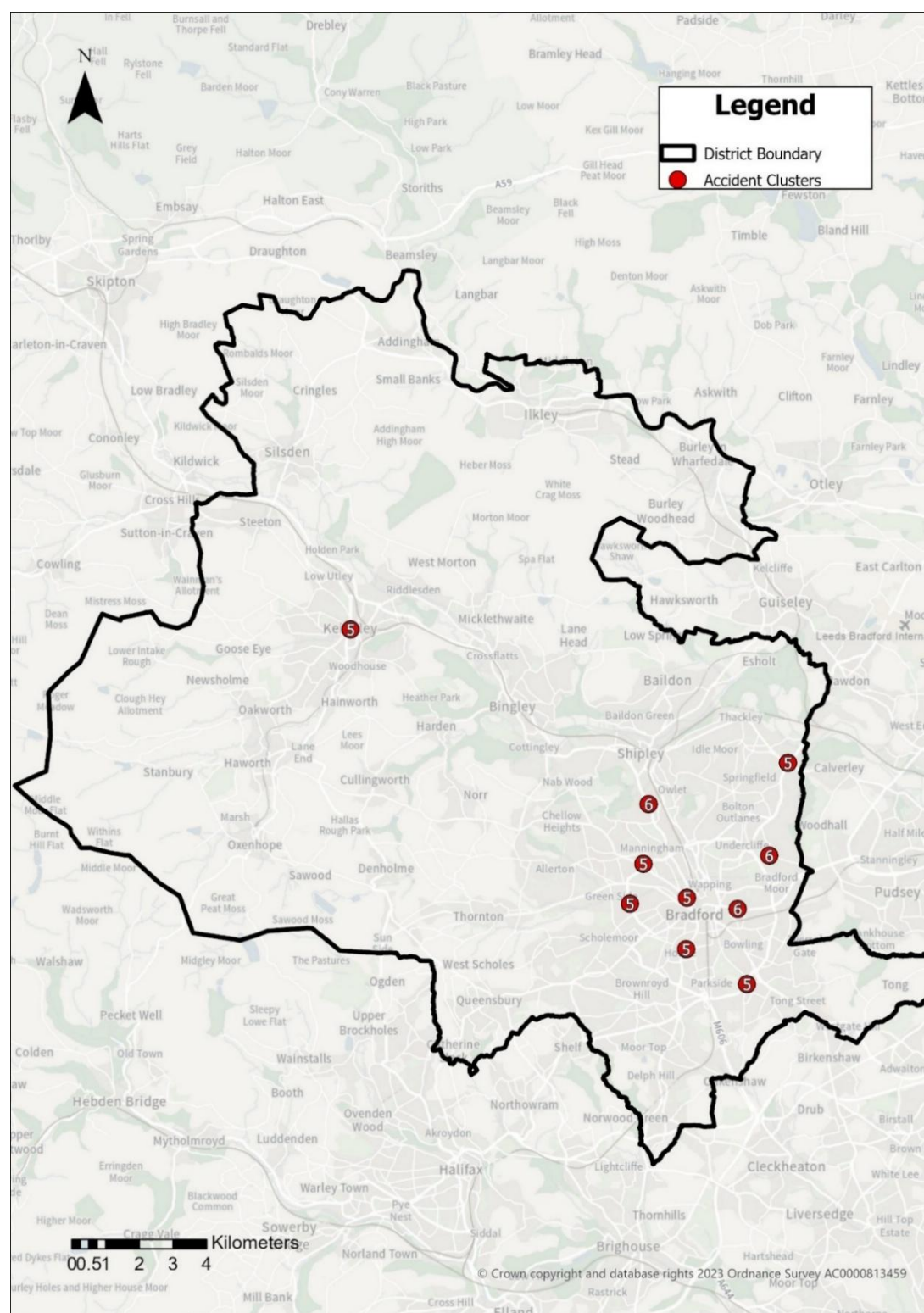
5.2.1.4 The M62 is the key transpennine route in the north of England providing links to the rest of West Yorkshire, the Humber, Greater Manchester, Merseyside, the North East and North West of England, as well as South Yorkshire, the Midlands and South via the M1 and M6.

5.2.2 Road Collisions

5.2.2.1 As part of the assessment, we have identified Killed and Seriously Injured (KSI) clusters in the District. These are defined as locations where five or more KSI have occurred in a three-year period; in this case between 2023 and 2025, inclusive.

5.2.2.2 Table 5.1 and Figure 5.2 below provide a descriptive and visual summary of where these clusters have occurred in the District.

Figure 5.2: Road Collision Cluster Analysis



Source: Bradford Council

Table 5.1: Road Collision Cluster Analysis

Junction	Number of KSI	Description
Manchester Road/Ripley Street/Newall Street	5	Dual carriageway in Bradford South West
North Street/Cavendish Street/Lawkholve Lane	5	Junctions located in the town centre of Keighley
A657 New Line / A658 Harrogate Road	5	Crossroads with an automatic traffic signal near Apperley Bridge
Intake Road/Fagley Road/Gain Lane/Leeds Road	6	Junction - more than 4 arms (not a roundabout), Automatic traffic signal in Bradford North East
Toller Lane/Church Street	5	Uncontrolled crossroads in Bradford North West
Keighley Road/Aireville Road	6	Uncontrolled junction in Bradford North West

Source: Bradford Council

5.2.2.3 Link clusters have been observed at the following locations:

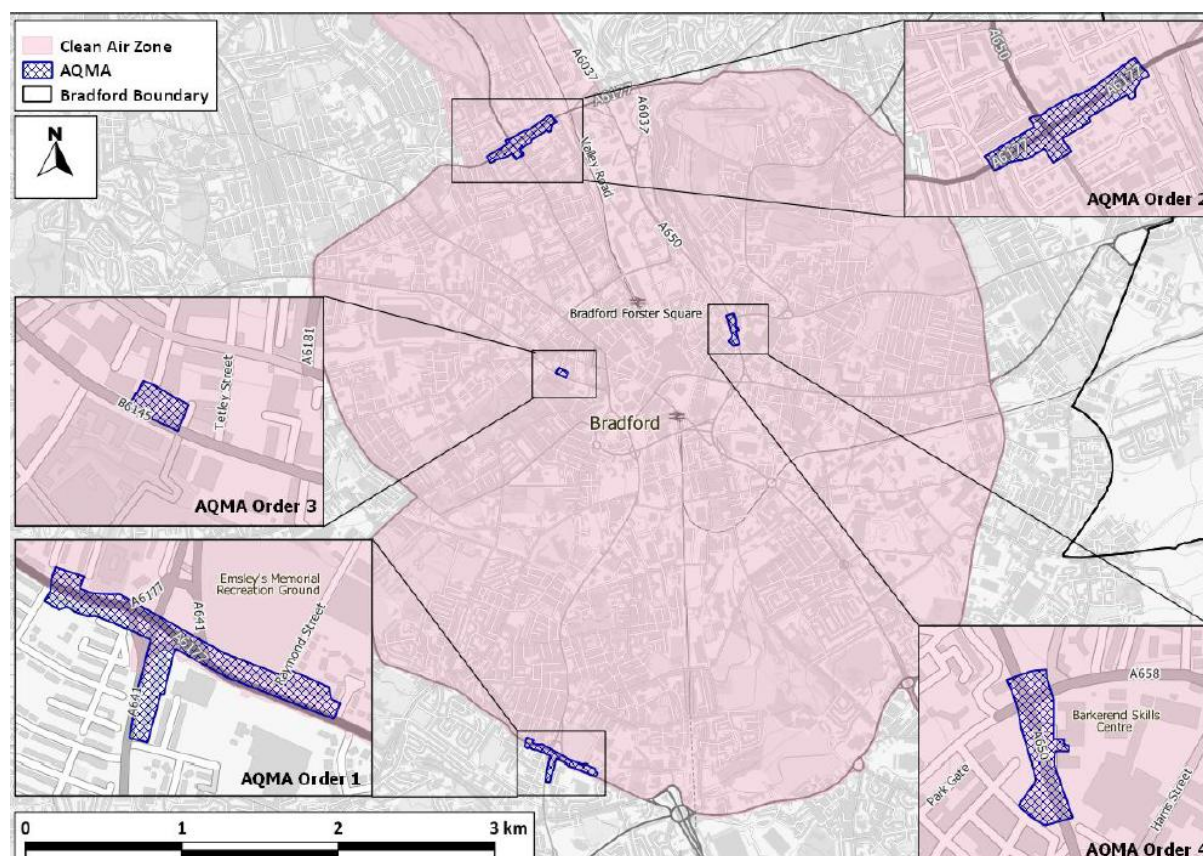
- Westgate
- Ingleby Road
- A6177/Rooley Lane
- Leeds Road (Seymour Street to Birksland Street)

5.2.2.4 Collision clusters have been found to occur mainly where orbital roads meet with radial routes to and from Bradford City Centre. Additionally, North Street in Keighley has been the site of a cluster of 5 KSIs between 2023 and 2025.

5.3 Air Quality

- 5.3.1.1 The Environment Act 1995 requires all local authorities to review and assess air quality in their areas and declare Air Quality Management Areas (AQMA) where objectives are unlikely to be met. Once an AQMA is declared the council has a further 18 months to develop an Air Quality Action Plan (AQAP) setting out the steps to be taken to improve air quality.
- 5.3.1.2 Progress on improving air quality has to be reported to government every year in the Annual Status Report (ASR). Together these steps are called Local Air Quality Management.
- 5.3.1.3 Bradford currently has 4 AQMAs. These are located close to the city centre at Manningham Lane, Thornton Road, Mayo Avenue / Manchester Road and Shipley Airedale Road. The AQMAs were declared in 2006 due to exceedance of the nitrogen dioxide (NO₂) air quality objectives. Since 2006 air quality in the AQMAs has considerably improved. Bradford also has an established Clean Air Zone (CAZ) which is helping to deliver compliance within all the AQMAs. The Clean Air Zone and AQMAs can be viewed below in Figure 5.3.

Figure 5.3: Clean Air Zone and AQMAs



Source: Air Quality Consultants

- 5.3.1.4 The 2026 Annual Status Report shows that air pollution in Bradford is improving, with 2025 recording some of the lowest NO₂ concentrations since Bradford's records began. Within the City Centre there was a major improvement in air quality in 2025 due to recent pedestrianisation of a large proportion of city centre and changes to traffic routing.
- 5.3.1.5 The 2025 automatic monitoring results (City of Bradford Metropolitan District Council, 2026) show that both the long term and short term objectives for NO₂ were met at the seven automatic monitoring stations (comprising of six roadside locations and one urban centre).

5.4 Future Highways Network

- 5.4.1.1 There are a number of road schemes and projects in the Bradford District that have been identified for delivery:
- **Bradford to Shipley Route Improvement Scheme (BSRIS)** - this is a major transport corridor scheme between Bradford City Centre and Shipley focussed on improving sustainable travel, public transport reliability, road safety, connectivity and access to employment, education and key destinations. The corridor includes Canal Road, Manningham Lane, Queens Road, Otley Road, Frizinghall station and associated junctions. The scheme has been developed to address congestion, poor air quality, severance for pedestrians and cyclists, safety concerns and forecast traffic growth associated with significant planned housing and employment development. The preferred approach now focuses on targeted highway improvements, public transport enhancements, pedestrian crossing improvement, parking enforcement, rail station access improvements and active travel measures.
 - **A641 Bradford – Huddersfield Corridor** - the A641 between Bradford, Brighouse and Huddersfield, including the A644 between Brighouse and the M62's Junction 25 is an important manufacturing corridor that forms part of West Yorkshire's Key Route Network. It carries more than 20,000 vehicles a day and has significant traffic congestion issues in a number of locations. Reducing journey times along the route will increase economic investment in the area by unlocking land for employment and housing growth, as well as improving conditions for all users. This will include increasing the use of sustainable transport and improving facilities for public transport.
 - **CIP A6177 Toller Lane** – this is a junction improvement scheme which aims to reduce congestion and journey times, improve air quality and increase road safety, improving highway efficiency for the benefit of all road users. It is located on the A6177 Outer Ring Road to the north west of Bradford City Centre and forms part of the West Yorkshire Key Route Network.

- **Thornton Road Corridor Improvement Scheme¹** – Located on Thornton Road between the extents of Spring Head Road and Girdlington Road, the scheme will deliver improved traffic flow through the two major junctions (West Park Road and Cemetery Road), safer pedestrian facilities, improved bus facilities and segregated cycleways with safer cyclist road crossings. This has now been incorporated within the wider Thornton Road Corridor Improvement Scheme
- **A650 Connect: Wakefield Road/Tong Street** – it is proposed to upgrade the existing A650 as part of a strategy to improve major transport routes into Bradford City Centre and around the wider District. The proposals aim to create a better-connected transport route that improves traffic flow, makes walking, wheeling and cycling easier, and ensures that the public transport is more reliable.

Proposals involve better footpaths, improved crossings, improved bus stops and segregated cycleways along the route, whilst for Wakefield Road it involves provision of dedicated bus lanes and removing existing subways (to be replaced with road level crossings). On Tong Street, it is proposed to widen the road to make space for two lanes of traffic in each direction to reduce congestion and ensure smoother traffic flows, this is primarily funded by DfT MRN funding.

- **Steeton and Silsden Connect** – the project is located at the A629/Keighley Road/Station Road roundabout between Steeton and Silsden in Bradford District. The scheme addresses a significant barrier to walking and cycling caused by the A629 dual carriageway, which separates residential communities from the rail station, employment areas, schools, health services and local amenities. The key proposals are for a new pedestrian and cycle bridge over the A629 with additional segregated pedestrian and cycle infrastructure. An at-grade solution is also being explored.
- **Sustainable Transport – West Yorkshire Places – Bradford Moor** – the project aims to help create safer, healthier and better-connected streets in the Bradford Moor ward. This scheme aims to establish an area where people are encouraged to walk, cycle and wheel by making the area feel safer and more welcoming to residents. The measures would address this through improving existing walking and cycling infrastructure as well as traffic calming measures to discourage excessive speeds to make the area safer.
- **Kings Road Connect** - The Kings Road Connect project is a scheme between Five Lane Ends Roundabout, Enterprise 5 Retail Park and Bradford City Centre via Kings Road and Canal Road.

The scheme aims to provide improved facilities for cyclists and pedestrians at key junctions along the route and will seek to improve bus reliability, improve safety, and contribute towards net zero and Vision Zero objectives.

¹ Future Bradford website – Thornton Road Improvements Project - <https://www.future-bradford.co.uk/thornton-road> (Accessed 03.09.2026)

The corridor serves communities with high levels of deprivation, low car ownership and future housing growth sites at Bolton Woods and New Bolton Woods. The scheme seeks to provide safer, more reliable and accessible transport options while improving connectivity to employment, education and retail destinations.

5.4.1.2 In addition, a neighbouring scheme in the Leeds District is also worthy of note:

- **Dawsons Corner** – Construction began in May 2025 to upgrade the junction at Dawsons Corner (A647/A6120). The scheme forms part of the Connecting Leeds transport strategy to maintain and improve the city's Inner and Outer Ring Roads, supporting future growth and offering smoother, more reliable journeys. Dawsons Corner connects the A647 Stanningley Road and the A6120 Ring Road – two of Leeds' most important transport routes. Dawsons Corner is also a major junction on the route between Bradford and Leeds city centres. Every day, around 57,000 vehicles and 1,200 pedestrians and cyclists travel through the junction, highlighting the need for long-term improvements.

5.4.1.3 At the time of writing, no enhancements to SRN are proposed within Bradford District. However, the scheme to reconstruct the Lofthouse Interchange (junction between the M1 and M62) will be included as a "pipeline" project for the next Road Investment Strategy.

6 Assessment Methodology

6.1.1.1 The assessment methodology for this TA is summarised below in Table 6.1 with detailed assumptions around the use of updated and existing traffic models provided in Chapter 7.

Table 6.1: Assessment Methodology

Stage	Description
1	Consider the transport issues/opportunities/proposals as currently identified within CBMDC (internal consultation and consultation with other stakeholders such as National Highways and Network Rail) as well as review of the R19 Local Plan and other relevant documents, etc.
2	Quantify the level of travel demand by AM/PM peak time periods (for a typical weekday) and mode of travel for all R19 Local Plan housing, employment and commercial developments. Information relating to R19 Local Plan commitments and allocations is used to update the demand for travel in and around Bradford within the West Yorkshire Transport model (WYTM) and this is used to give a breakdown of demand associated with R19 Local Plan sites by time period and by mode. WYTM contains locally agreed rates of numbers of people and workers per new household and the number of jobs per sqm of employment use. The resulting highway trips are passed from WYTM to an updated Bradford Highway Traffic Model (BTM), with WYTM effectively operating as a highway demand model and public transport model.
3	Bradford's existing highway assignment model (BSHM) had a 2018 base year (pre-COVID) and was out of data for assessment of R19 Local Plan growth. In addition to taking highway demand from WYTM, a full audit of the highway network was undertaken to ensure that all changes in the district's highway network since 2018 are accurately reflected in an updated BTM. A new base year of 2023 has been created (consistent with the WYTM base year) and details of the network update and subsequent updates are included in the BTM model validation report. A copy of the WYTM model validation report is also available for download.
4	Assess the impacts of the R19 Local Plan developments, through a combination of network modelling (WYTM and BTM for highway capacity assessment), analysis of existing data (e.g. raildata.org.uk data for rail demand and cordon data for bus demand).
5	Develop measures which would be required to mitigate the impacts and test them using the relevant methodology for each mode of transport. The scale of difference in conditions on the highway and public transport networks will be evaluated between a 'No Local Plan' (committed sites) and 'With Local Plan' (allocated sites) scenario and thresholds agreed for the need for, and type, of mitigation proposed.
6	To assess impacts on the highways network we have used the updated BTM (SATURN v11.6.03E).
7	To assess impacts on the rail network we have identified the stations within the District Borough and stations near to the district boundary and the

	relationship of development sites to each station. Outputs from WYTM provide forecasts of increase in rail use over time and additional demand associated with R19 Local Plan sites. For assessment of the impact on passenger loadings between stations, WYTM passenger forecasts are compared against existing line loads to identify if and where peak services are expected to become overcapacity as sites are delivered within the R19 Local Plan period.
8	To assess impacts on the bus network we have again taken passenger forecasts from WYTM. Where significant increase in bus passenger demand is forecast, this will be noted and an assessment made whether additional capacity may be required.
9	Outputs from the updated BTM, with and without R19 Local Plan allocations will also be used to inform assessment of the Plan's impact on carbon emissions and Air Quality. The carbon impact of the R19 Local Plan has been assessed using the Department for Transport's Vehicle Emissions Carbon Tool (VECAT) and Air Quality is assessed using output direct from the traffic model in relation to forecast changes in daily traffic flows and speeds, in accordance with LA 105 guidance (National Highways, 2024).

7 Model Development

7.1 Introduction

- 7.1.1.1 This chapter describes the development of the models used in the evaluation of transport-related impacts of the R19 Local Plan.
- 7.1.1.2 Bradford's existing traffic model had a 2018 Base Year, which reflected pre-Covid conditions and was out of date. An update to the BTM has been completed, based on the latest version of the West Yorkshire Transport Model (WYTM) which, in itself, has been approved as the basis for assessment of the first phase of the proposed West Yorkshire Mass Transit scheme. This update provides the benefits of a more detailed Bradford network and more refined zoning, alongside use of the extensive 2023 data collection programme. The WYCA traffic count data was primarily focussed on the planned mass transit corridors and, as such, this dataset has been supplemented with additional traffic data collected by Bradford Council in other areas of the district.

7.2 Use of WYTM strategic variable demand model

- 7.2.1.1 WYTM covers all five West Yorkshire districts in detail, with surrounding authorities and the rest of the country included in less detail. One benefit of using WYTM to inform demand for Bradford is that it includes detail of development proposals (households and jobs) and committed transport schemes in neighbouring districts, which will contribute to changes in demand between the Base Year (2023) and future Reference Case years (2034 and 2043).
- 7.2.1.2 The model was developed by WYCA for use in developing the business case for the proposed Mass Transit scheme across West Yorkshire. As such, the R19 Local Plan modelling assessment is based on a model that has been developed fully in line with Department for Transport guidance (TAG) and approved for assessment of major regional transport investment.
- 7.2.1.3 Despite prior approval of WYTM for Mass Transit appraisal, an update of the future year models has been undertaken to incorporate latest thinking on the phasing of committed developments and transport schemes in Bradford.
- 7.2.1.4 Furthermore, it has been acknowledged that WYTM development has been focussed on future Mass Transit corridors and, as such, the representation of some parts of the Bradford District is not as detailed as required for analysis of the impact of multiple R19 Local Plan allocation sites spread across the district. This drove the decision to maintain a separate model for Bradford with more detailed zoning particularly in areas such as Keighley, Shipley, Silsden and the Wharfedale corridor.

- 7.2.1.5 The WYTM highway demand matrices have 2,055 zones, covering the whole of West Yorkshire and beyond. The BTM has only 1,100 zones, so a conversion is required. Although the zoning in some parts of the district is more detailed within the Bradford model, the difference in the total number of zones largely relates to WYTM having greater zone detail in Leeds, Halifax, Huddersfield and Wakefield.
- 7.2.1.6 Each WYTM zone has been reviewed and either allocated to a specific Bradford zone (1-1 or amalgamation of WYTM zones) or identified for zone splitting. A total of 204 WYTM zones are split into multiple BTM zones.
- 7.2.1.7 For each split zone, the proportion of trips to and from that zone are allocated to each relevant BTM zone. The percentage has been estimated by eye, based on the distribution of activity within a zone, rather than an adopting an automated process based on area alone.
- 7.2.1.8 Post-conversion checks are carried out on the total demand in each matrix, by user class, to confirm that trips are not 'lost' in the process.
- 7.2.1.9 The same process for conversion between WYTM and BTM zones has been followed for both the base year prior matrices and subsequent future year matrices, with and without R19 Local Plan. The only difference being that where R19 Local Plan developments are of sufficient size to warrant inclusion of a new specific development zone, the new zone is included in both WYTM and BTM.
- 7.2.1.10 New zones are added for the following developments.
- Zone 95040 Raikes Lane East (H911, residential)
 - Zone 95041 Westgate Terrace + Tong Academy (H946 + H1554, residential)
 - Zone 95080 Land at NuFarm (E157, employment)
 - Zone 95081 Apperley Bridge/Esholt (E158, employment)
 - Zone 95082 North of Westgate Hill & West of Tong Lane (E57, employment)
 - Zone 95083 Westgate Hill Street (E61, employment)

8 Modelling Assumptions

8.1 Background

- 8.1.1.1 This chapter describes key modelling assumptions that have been adopted as part of this Transport Assessment. The assumptions are in part dictated by data availability and the nature of existing transport models. For example, the size of the zoning system in SATURN may restrict the ability of the model to test some types of schemes.
- 8.1.1.2 The Council decided to work with WYCA to make use of the extensive data collection which informed the 2023 base year West Yorkshire Transport Model (WYTM) and the expertise of their consultants in developing and running of that model. In short, WYTM is used to inform the travel choices and mode share associated with various future scenarios and the resulting highway demand is passed through to an update of the Bradford Transport Model (BTM) network to assess the impact of changes in demand on the highway network.
- 8.1.1.3 The traffic model covers both the AM peak (08:00-09:00) and PM peak (16:30-17:30) time periods and Bradford District is divided into 635 traffic zones, with a further 465 zones representing the rest of West Yorkshire and the surrounding areas.
- 8.1.1.4 The updated BTM has a 2023 Base Year and assigned traffic flows and travel times are validated against the 2023 dataset compiled by WYCA and Bradford Council. Further detail on the update of the 2023 BTM is provided in Appendix A.
- 8.1.1.5 In effect, WYTM has been used as a demand tool, with a zonal level correspondence between both models established to translate mode share forecasts from WYTM to the highway-only BTM.
- 8.1.1.6 It should be noted that the methodology and approach to the study have been developed alongside WYCA and were discussed with National Highways in August 2026. The chosen approach was considered reasonable given the strategic nature of the study.

8.2 Future Year Modelling

- 8.2.1.1 Future year models are prepared for 2034 (approximately 5 years into the R19 Local Plan) and 2043 (the end of the R19 Local Plan period). In each year, there is a Reference Case version of the model which includes all committed development, committed transport schemes and background growth within each West Yorkshire district (a no local plan or “NLP” scenario), and a version in which trips expected to be generated by R19 Local Plan allocation sites are added to the Reference Case (a with local plan or “WLP” scenario). Highway demand associated with each scenario is determined by the WYTM.

- 8.2.1.2 The WYTM reference case models have been updated with latest version of Uncertainty Logs for committed residential sites, employment sites and transport infrastructure schemes.
- 8.2.1.3 For residential and employment sites, a forecast delivery profile of committed households and jobs between the 2023 Base Year and both 2034 and 2043 forecast years is modelled in WYTM to establish highway mode share of overall demand across AM and PM peak time periods. The resulting highway trip totals are passed through to the BTM and the increase in demand pivoted against the updated Base Year demand.
- 8.2.1.4 The WLP scenario is also modelled in WYTM (2034 and 2043) to again establish mode share of highway demand across the AM and PM peak time periods. Forecasts of WLP demand are based on the projected delivery profile of allocated households and jobs and, again, the resulting highway demand is passed through to the BTM and pivoted against the Base Year demand.
- 8.2.1.5 The BTM is then used to compare road traffic conditions in the NLP against the change in conditions resulting from the WLP allocations, to identify the scale of impact on the highway network and any need for mitigation. Early mitigation requirements are assessed against traffic conditions in 2034, with longer term needs assessed against forecast conditions at the end of the R19 Local Plan period (2043). The scale of impact and potential mitigation requirements has been evaluated on both the local and strategic highway network.
- 8.2.1.6 The increase in demand for rail and bus is a direct output from future year versions of the WYTM. Qualitative analysis of the impact on passenger loadings and capacity is made against wider Council initiatives for sustainable travel (i.e. active travel schemes, Travel Plans, parking policy), WYCA's bus franchising proposals and longer-term intentions to deliver a Mass Transit network and new through railway station for Bradford.

8.3 Housing and Employment Projections

- 8.3.1.1 For the R19 Local Plan, WYTM has been used for 2 future years (2034 and 2043) and for both a 'no Local Plan' (NLP) and 'with Local Plan' (WLP) scenario.

8.3.2 No Local Plan

- 8.3.2.1 The NLP scenario considers all committed housing and employment development sites as of the 1st May 2026 (housing sites) and 11th May 2026 (employment sites). Before including in the WYTM, a threshold has been applied which excludes smaller sites with fewer than 100 homes or 200 jobs.
- 8.3.2.2 This resulted in a total of 17 housing sites and 8 employment sites being specifically included in the WYTM NLP Scenario, providing 3,815 new homes and around 65,500 sqm of additional mixed employment space. Details of 'No Local Plan' sites are provided at Figure 8.1 and Figure 8.2 for housing and employment sites respectively.

Figure 8.1: Committed residential sites

Order ID	LOCAL AUTHORITY	SITE REFERENCE	PLANNING REFERENCE	SITE DESCRIPTION	EASTING	NORTHING	LAND USE TYPE	PLANNING STATUS	UNCERTAINTY CATEGORY	Include in Core DM model (BCC Apr26 review)	Yield - 2023 to 2034	Post 2034?
6	Bradford	B1/066	Aire Valley House, Crossflatts	21/04062/POR & 22/03573/MAF	409812	440733	C3	Full	More than Likely	Yes	167	0
30	Bradford	CC/089	Arndale House	19/02201/POR	416457	433109	C3	On Site	More than Likely	Yes	126	0
39	Bradford	CR/014A (BWQ1)	Bolton Woods Quarry, Bolton Woods	15/06249/mao	416318	436108	C3	Outline	More than Likely	Yes	890	0
48	Bradford	KY/019	Holme Mill Lane	16/08422/mao	404672	440765	C3	Outline	More than Likely	Yes	139	0
64	Bradford	NE/035	Barkerend Mill, Barkerend Road	20/04492/maf	417398	433357	C3	Full	More than Likely	Yes	132	0
5	Bradford	B1/039	Whitelock Grange, Keighley Road	18/02085/maf	410490	439799	C3	On Site	Near Certain	Yes	104	0
7	Bradford	B1/001	Ilkley Road,	21/05850/mar	415748	446864	C3	On Site	Near Certain	Yes	475	0
46	Bradford	KY/007	Shann Lane	18/01755/mar	405010	442098	C3	On Site	Near Certain	Yes	128	0
58	Bradford	NE/003	Derry Hill	19/04546/maf (113) 19/02790/maf (47)	416523	443851	C3	On Site	Near Certain	Yes	126	0
65	Bradford	NE/038	Moorside Road, Ecclestone	18/00897/mar, 18/01127/mar, 19/05171/MAR	418681	435269	C3	On Site	Near Certain	Yes	412	0
68	Bradford	NE/056	Cote Farm Leeds Road, Thackley	13/03145/maf, 17/05902/maf	417096	436185	C3	On Site	Near Certain	Yes	142	0
84	Bradford	NW/122	Thorn Lane/Bingley Road	18/04238/MAF	412755	436079	C3	On Site	Near Certain	Yes	266	0
96	Bradford	SE/069	Dean Beck Avenue	21/01137/maf	416634	429725	C3	On Site	Near Certain	Yes	145	0
100	Bradford	SE/109	Shetcliffe Lane, Bierley	21/05853/MAR	418390	429697	C3	Full	Near Certain	Yes	106	0
114	Bradford	SW/020	Keighley Road	19/05267/MAR	403937	445831	C3	On Site	Near Certain	Yes	156	0
126	Bradford	SW/061A	Northside Rd	19/01268/maf	414224	432971	C3	On Site	Near Certain	Yes	141	0
138	Bradford	TH/027	Thornton Road west	21/00321/MAR	408264	432549	C3	On Site	Near Certain	Yes	160	0

Source: Bradford Council

Figure 8.2: Committed employment sites

Order ID	LOCAL AUTHORITY	SITE REFERENCE	PLANNING REFERENCE	SITE DESCRIPTION	EASTING	NORTHING	LAND USE TYPE	PLANNING STATUS	UNCERTAINTY CATEGORY	Include in Core DM model (BCC May26 review)	Yield - 2023 to 2034	Post 2034?
1	Bradford	ELR/0018	02/00629/FUL	Castlefields Industrial Estate Castlefields RoadBingleyWest Yorkshire	409845	440439	B2	On Site	Near Certain	Yes	as 2023 UL	
											12000sqft industrial (11148sqm) + 5650sqft offices (525sqm)	0
2	Bradford	ELR/0044	21/03550/MAR	Phase 3 Land At Woodhall Road Bradford West Yorkshire	419222	434509	B1	On Site	Near Certain	Yes	2680sqm D2 (wedding venue) and 1416sqm B2 uses	0
3/4	Bradford	ELR/0081	18/04052/MAF	Land At Princeville Industrial Estate 2 Princeroyd Way Bradford West Yorkshire BD7 2BH	414528	433189	B2/B8	Full	More than Likely	Yes	0	2348sqm B8, with 5% B1
12	Bradford	ELR/0585	21/00842/MAF	Bulmer And Lumb Limited Bulmers Mill Roys Hall Lane Bradford West Yorkshire BD6 2NE	414390	429249	B2	Full	More than Likely	Yes	total floorspace of 11210sqm, continuing B1/B2/B8 uses	0
13/14/15	Bradford	ELR/0596	21/02307/MAO	Aire Valley Business Centre Lawkholme Lane Keighley West Yorkshire	406224	441596	B1/B2/B8	Outline	More than Likely	Yes	5240sqm office + 273sqm retail, 15015sqm mix of B2/B8	0
16	Bradford	ELR/0619	21/03653/MAF	Prince's Way / One City Park	416234	432833	B1	On Site	Near Certain	Yes		
5/6	Bradford	ELR/0559	20/00949/MAO	Land At Parry Lane Bradford West Yorkshire	418327	432164	B2/B8	Outline	More than Likely	Yes	B2 = 2,100sqm / B8 = 13,650sqm	
				Northside Road, Girdlington (E83, 23/04013/MAO)				Local Plan E83		Yes		

Source: Bradford Council

8.3.2.3 These values are input to WYTM in terms of population, workers and jobs. For the committed sites, the factors to convert households to people and workers are 2.417 and 1.086 respectively. The factor used to convert employment sqm to jobs varies by business type and location as shown in Table 8.1.

Table 8.1: Conversion of employment sqm to jobs

Land Use	Units	Town/City centre	Suburb	Edge of Urban/Rural
B1 Office	m ² /job	12	20	20
B2 Industrial	m ² /job	36	36	36
B8 Warehousing	m ² /job	70	77	95

Source: WYTM

8.3.2.4 These factors were deemed reasonable assumptions by the Local Plan team.

8.3.2.5 In both 2034 and 2043, the resulting numbers of people and jobs fall short of NTEM forecasts and, as such, top up growth is applied to meet NTEM forecast levels of future demand.

8.3.3 With Local Plan

8.3.3.1 The WLP scenario includes all additional LP allocations as agreed on 5th June 2026 (housing sites) and 9th June 2026 (employment sites).

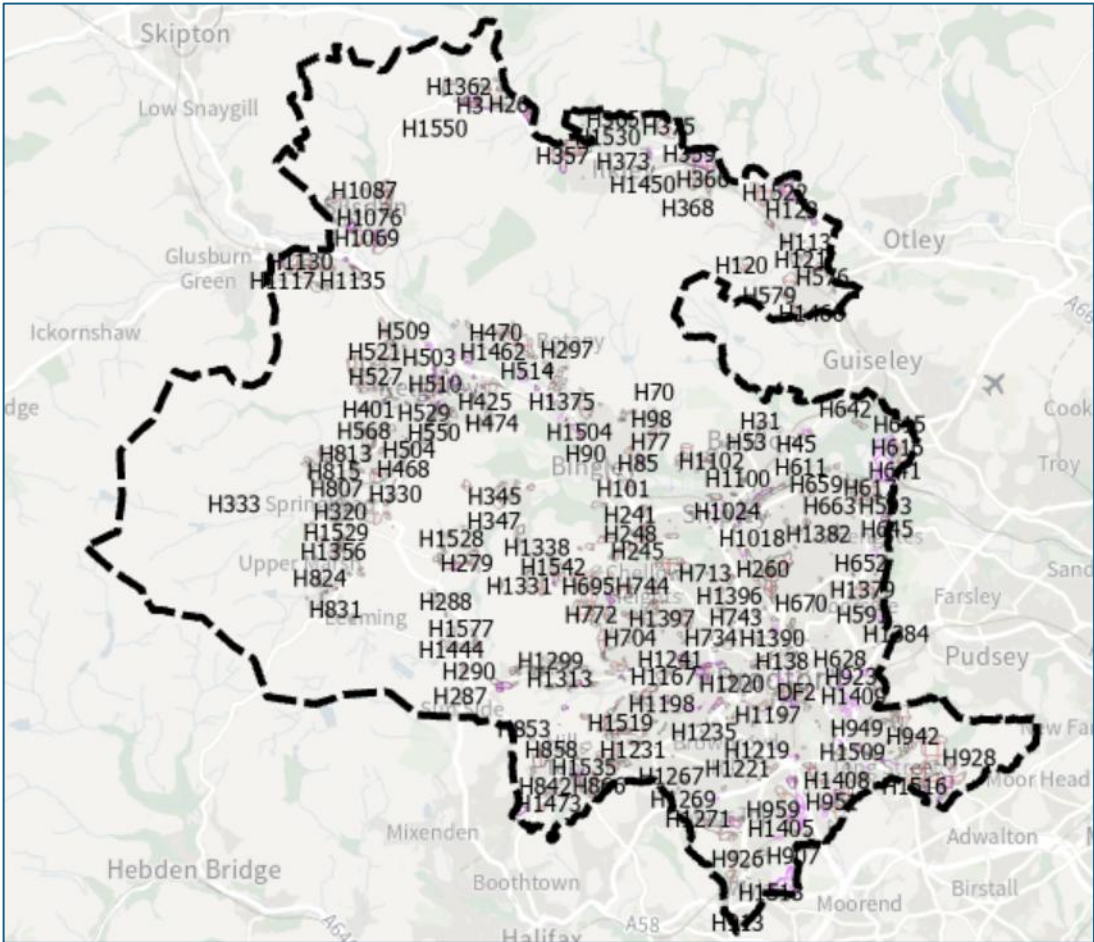
8.3.3.2 For housing, this results in an overall total of 28,578 additional new homes, spread between individual site allocations, regeneration areas or windfall sites as shown in Table 8.2.

Table 8.2: With R19 Local Plan – number of new homes by timescale

Category	Total	Up to 2034	2034 to 2043	Total
Site Allocations		8,724	10,104	18,828
Regeneration Areas		-	6,000	6,000
Windfall		1,500	2,250	3,750
Total		10,224	18,354	28,578

8.3.3.3 Details of R19 Local Plan Allocation housing sites used within this assessment are provided at Appendix B and Figure 8.3.

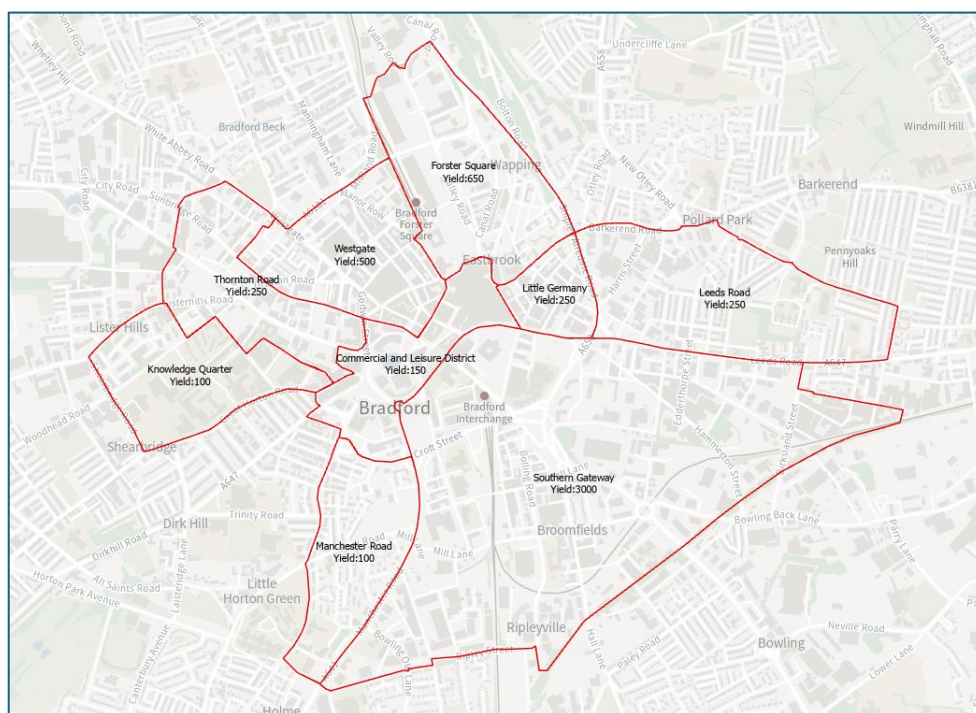
Figure 8.3: Location of R19 Local Plan Residential Development Sites



Source: Bradford Council

- 8.3.3.4 Figure 8.4 shows the location of nine regeneration areas around Braford City Centre. Two further regeneration areas cover the town centres of Keighley and Shipley.
- 8.3.3.5 It should be noted that it is assumed windfall sites will be evenly spread across areas without any defined allocations and/or outside Regeneration areas.

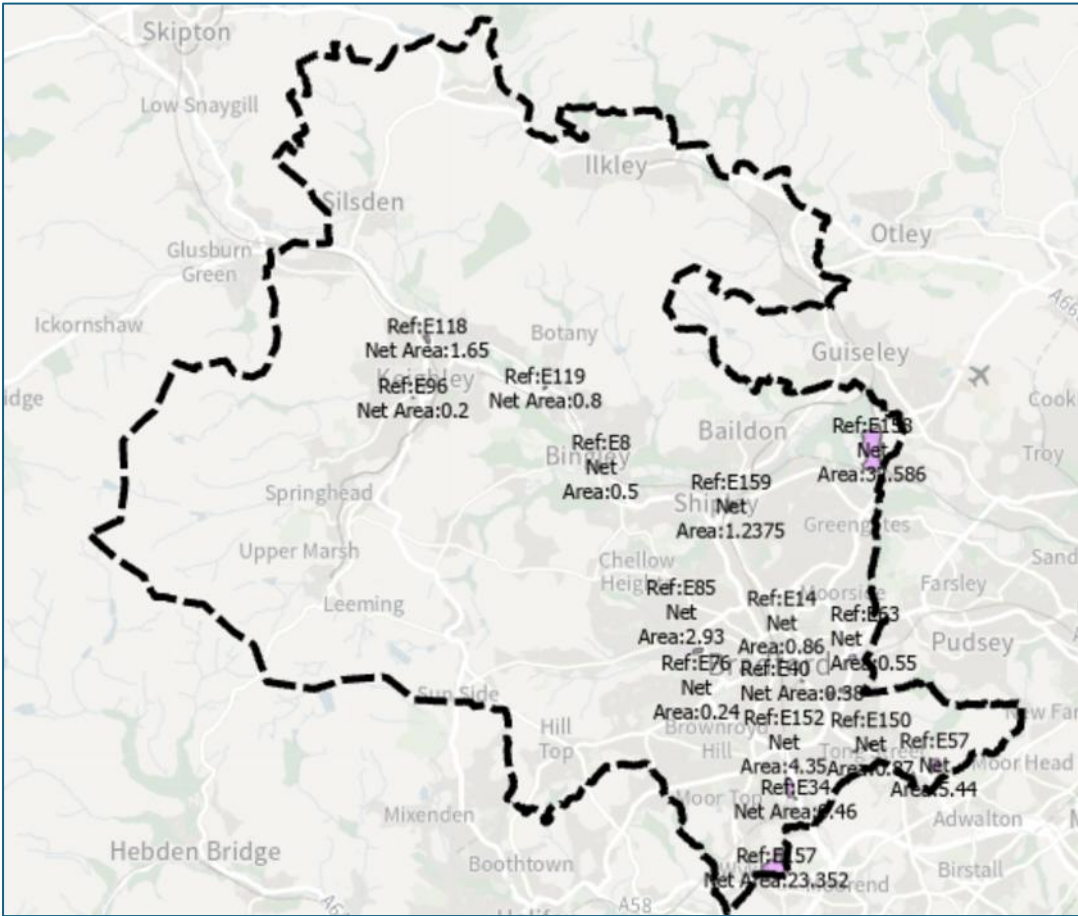
Figure 8.4: Regeneration areas within Bradford City Centre



Source: Bradford Council

- 8.3.3.6 For employment, some 23 site allocations are expected to provide 84.98 Ha of predominantly B1-8 Mixed use. Except 6 sites that already have planning permission, sites are assumed to have a split of B1 Office, B2 industrial and B8 warehousing at a ratio of 10:45:45. Some 35.63Ha are expected to be delivered by 2034 with the remaining 49.35Ha by 2043.
- 8.3.3.7 Details of R19 Local Plan Allocation employment sites are provided at Appendix C and the geographical spread of sites is presented below at Figure 8.5.
- 8.3.3.8 The same population, worker and jobs factors as applied in the NLP scenario are assumed.

Figure 8.5: Location of R19 Local Plan Employment Development Sites



Source: Bradford Council

- 8.3.3.9 The same population, worker and jobs factors as applied in the NLP scenario are assumed.

8.4 Future Transport Network Assumptions

8.4.1 Public Transport and Active Travel

- 8.4.1.1 For the purposes of modelling, it is assumed that rail services will continue to operate at broadly similar frequencies and capacities as at 2025/2026. Potential future schemes outlined in Chapter 3 have not been included within the modelling assumptions as there is currently insufficient detail for these schemes and/or insufficient certainty at this point in time that they will be delivered within the R19 Local Plan timeframe. It is however, considered likely that these schemes will aid in reducing congestion in future years as they consist of improvements or additions to the rail network.
- 8.4.1.2 It is assumed that WYCA will maintain bus service levels across the district, broadly similar to 2023, under new bus franchising (Weaver Network) proposals. Routes, frequencies, fares and overall standards for buses in the region will be set by the West Yorkshire Combined Authority with franchised services starting in April 2027.
- 8.4.1.3 It is assumed that the active travel network will continue to grow over the span of the R19 Local Plan.

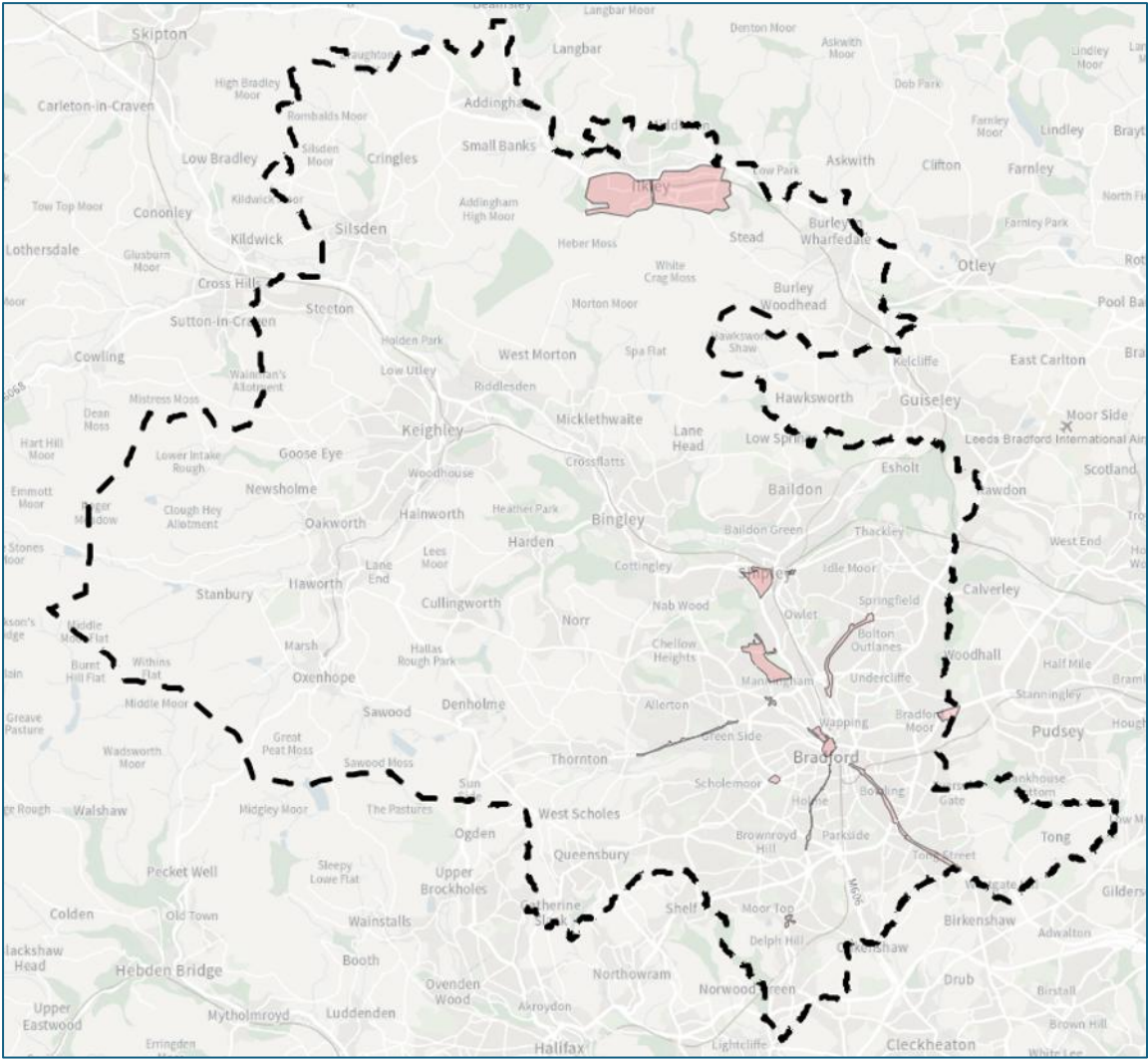
8.4.2 Highways

- 8.4.2.1 Since 2023, the base year of the WYTM and BSHM models, a small number of highway schemes have been delivered and there are further schemes which are considered ‘More than likely’ to be delivered during the life of the R19 Local Plan. These are included in both models to ensure that future year highway demand forecasts passed from WYTM to BSHM have taken account of the change in network supply delivered by these schemes.
- 8.4.2.2 There is continued negotiation over funding for future highway schemes and, ultimately, some uncertainty over the timing of delivery. As such, a ‘modelling freeze’ was applied to schemes on 17th April 2026. At this point, drawings of the following highway schemes were sent to WYCA for inclusion in future year versions of the WYTM. For the 12 highway schemes included in the traffic models, a brief description is provided below, and Figure 8.5 shows their geographical location within the Bradford district. Apart from schemes already completed by the updated 2023 Base Year, all future schemes have been included in the 2043 model.
- Bradford City Centre Active Travel improvements (completed since 2023)
 - Pedestrianisation of the City Centre and closure of Hall Ings, Market Street, Bridge Street, Broadway and Bank Street to general traffic and complementary capacity improvements to the Manchester Road/Croft Street Gyratory

- Great Horton Road/Horton Grange Road junction (completed since 2023)
 - Includes new highway link between All Saints Rd/Dirkhill Rd and Horton Park Avenue and one-way eastbound operation of All Saints Road from the Great Horton Road/Horton Grange Road junction
- A650 Tong Street and Wakefield Road
 - Additional highway capacity on Tong Street and improved pedestrian and cycling facilities along Wakefield Road
- Toller Lane CIP
 - Reconfiguration of A6177/Toller Lane junction and junction with Church Street to provide increased capacity and pedestrian and cycling facilities
- Thornton Road/Cemetery Road CIP
 - Reconfiguration of Thornton Road junctions with Cemetery Road and West Park Road to provide increased capacity and segregated cycling facilities
- Thornton Road Cycle Superhighway Extension Phase 2
 - Under construction. Continuous segregated cycle way between Cemetery Road and Thornton village, with associated junction works and cycle crossing points
- Bus Hotspots
 - Junction improvements for better bus operations at Westgate/Drewton Road and Thornbury Gyratory
- King's Road sustainable transport corridor
 - Introducing formal crossing facilities on all arms of the Five Lane Ends junction, improved cycling facilities between Five Lane Ends and Queen's Road, signalling King's Road/Bolton Lane junction and bus priority at Canal Road
- Leeds Road/Carr Lane junction improvement
 - Changes to junction layout to provide better crossing facilities for pedestrians and cyclists as well as westbound bus priority
- A641 Huddersfield Road/New Works Road/Abb Scott Lane junction improvement
 - Realignment of staggered junction and signalisation to provide bus priority and improve general traffic flow
 - It is noted that £500,000 funding is being provided by a residential development on Abb Scott Lane towards the cost of the scheme
- Manchester Road Targeted Bus Improvement scheme (24/02887/MAF)
 - Targeted bus priority measures between Rooley Avenue (south) and Croft Street (north)
- 20mph zones (completed since 2023)
 - Completed schemes in Manningham, Shipley and Ilkley

8.4.2.3 It should be noted that only those schemes that are fully designed and are likely to affect traffic routing or significantly affect mode choice have been included. As such, other ‘pure’ Active Travel schemes, with limited effect on mode share, and proposed improvements to Forster Square rail station have not been explicitly modelled. It has also been assumed, in simple terms, that the forthcoming bus franchising and Weaver network will deliver a broadly similar bus service to that in 2023.

Figure 8.6: Geographical spread of modelled highway schemes



Source: Bradford Council

8.5 Other modelling assumptions

8.5.1 Car ownership

- 8.5.1.1 Housing sites located in areas of high public transport accessibility, including each of the Regeneration Areas, have been modelled with lower car ownership than other locations to reflect likely restrictions to parking allocations at these sites. The low car ownership and the proximity to public transport hubs, particularly rail stations, encourages use of non-car modes within the WYTM.
- 8.5.1.2 At the time of modelling, public transport accessibility was derived from WYCA's PTAL methodology. Accessibility levels are used within WYTM to associate selected sites with low car availability and, therefore, increased likelihood of travel y non-car modes. It is understood that the preferred method now is to use the DfT Connectivity Tool, but we do not believe there is a significant difference between the two approaches and time constraints have prevented any changes to the methodology.

8.5.2 Households Trip Generation and Mode Share Estimates

- 8.5.2.1 As discussed, the NLP scenario applies growth beyond the committed allocations to correspond with overall NTEM expectations of household and employment growth up to 2034 and 2043.
- 8.5.2.2 In the WLP scenario, both years, the amount of new housing exceeds NTEM forecasts of growth, and new employment growth is approximately equal to NTEM. As such, there is no capping applied in the WLP scenario and no application of NTEM.
- 8.5.2.3 Because we are not using NTEM growth, WLP site allocations generate more people/workers than jobs and this is reflected in the number of additional peak hour highway trips generated by WYTM. It is worth noting that the model effectively assumes jobs grow everywhere across the UK such that, within the wider model area, the balance between workers and jobs is maintained. By way of example:
- the number of houses in the NLP scenario, driven by a combination of commitments and NTEM, increases by 9,597 between 2023 and 2034.
 - in the WLP scenario, the corresponding increase is 14,039 houses, a difference of 4,442 houses between NLP and WLP in 2034.
- 8.5.2.4 This results in an additional 1,100 highway trips in the peak hours in 2034, approximately 0.25 trips per additional household. While this might appear a low rate per household, we also see an increase in the share of non-car trips (see Table 8.3 below) and the figures also reflect the expectation that some of the new houses will be taken up by existing Bradford residents, moving out of households of high occupation.

8.5.2.5 The corresponding increase in peak highway trips in 2043 is around 4,000 per hour.

Table 8.3: 2043 WYTM mode shares (Bradford zones, 24-hour origins)

Mode	NLP trips	NLP %	WLP trips	WLP %	Change due to LP	
Car	1,029,843	73.3%	1,099,344	72.4%	69,501	-0.9%
PT	91,888	6.5%	101,579	6.7%	9,691	+0.2%
Active	284,026	20.2%	317,398	20.9%	33,373	+0.7%
Total	1,405,756		1,518,322		112,565	

9 Public Transport and Active Travel Impact Assessment

9.1 Overview

9.1.1.1 This chapter assesses how the rail, bus and active travel networks are expected to be impacted by developments associated with the R19 Local Plan within Bradford.

9.2 Rail

9.2.1.1 The public transport rail network has been assessed using an excel-based preliminary static capacity analysis to determine impact on the capacity of the network.

9.2.2 Existing Capacity

9.2.2.1 As outlined in Chapter 3, there is currently a significant amount of additional capacity available on the majority of rail services which serve the district.

9.2.3 Future Impacts

9.2.3.1 Change in rail passenger demand is a direct output from the West Yorkshire Transport Model (WYTM).

9.2.3.2 WYTM exports the change in passenger numbers between the 2023 base year and the 2034/2043 NLP scenarios, along with the corresponding difference between the NLP and WLP scenarios.

9.2.3.3 To compare WYTM output with existing data, the 2025/26 volumes given above are converted to 2023 values based on analysis of total boarders and alighters at Bradford stations between 2023 and 2025. This is extrapolated to 2026 and a factor of 0.84 has been derived.

9.2.3.4 As shown in Table 9.1, by 2034 the local rail network is expected to still accommodate additional demand in the WLP scenario.

Table 9.1: Forecast rail capacity in Bradford district (2034)

From Station	To Station	AM ave	AM max	PM ave	PM max
Skipton	Cononley	71 (7%)	135 (14%)	111 (11%)	261 (25%)
Cononley	Skipton	128 (14%)	352 (37%)	88 (9%)	333 (33%)
Cononley	Steeton & Silsden	80 (8%)	156 (16%)	110 (11%)	245 (23%)
Steeton & Silsden	Cononley	119 (13%)	306 (32%)	97 (10%)	345 (34%)
Steeton & Silsden	Keighley	117 (12%)	236 (24%)	133 (13%)	236 (23%)
Keighley	Steeton & Silsden	125 (13%)	296 (31%)	138 (14%)	385 (38%)
Keighley	Crossflatts	197 (20%)	380 (39%)	174 (17%)	292 (28%)
Crossflatts	Keighley	103 (11%)	206 (22%)	203 (20%)	472 (47%)
Crossflatts	Bingley	222 (23%)	430 (44%)	185 (18%)	322 (31%)

From Station	To Station	AM ave	AM max	PM ave	PM max
Bingley	Crossflatts	120 (13%)	278 (19%)	235 (23%)	515 (51%)
Bingley	Saltaire	289 (30%)	566 (59%)	206 (20%)	406 (39%)
Saltaire	Bingley	104 (11%)	231 (24%)	285 (28%)	588 (58%)
Saltaire	Shipley	326 (34%)	637 (66%)	224 (22%)	442 (42%)
Shipley	Saltaire	111 (12%)	198 (21%)	325 (33%)	627 (63%)
Shipley	Frizinghall	234 (19%)	511 (42%)	211 (16%)	421 (33%)
Frizinghall	Shipley	166 (13%)	316 (26%)	251 (21%)	437 (36%)
Frizinghall	Forster Square	194 (16%)	360 (30%)	169 (13%)	364 (28%)
Forster Square	Frizinghall	104 (8%)	188 (15%)	207 (17%)	360 (29%)
Shipley	Apperley Bridge	171 (44%)	233 (60%)	114 (26%)	162 (37%)
Apperley Bridge	Shipley	85 (21%)	121 (30%)	202 (42%)	353 (74%)
Apperley Bridge	Kirkstall Forge	173 (44%)	261 (67%)	144 (33%)	214 (48%)
Kirkstall Forge	Apperley Bridge	103 (25%)	151 (37%)	212 (44%)	360 (75%)
Kirkstall Forge	Leeds	208 (53%)	327 (83%)	142 (32%)	231 (53%)
Leeds	Kirkstall Forge	95 (23%)	153 (38%)	236 (49%)	384 (80%)
Shipley	Baildon	51 (13%)	122 (31%)	68 (17%)	159 (41%)
Baildon	Shipley	71 (18%)	208 (52%)	34 (9%)	71 (18%)
Baildon	Guiseley	74 (19%)	199 (52%)	55 (14%)	131 (34%)
Guiseley	Baildon	57 (14%)	171 (43%)	39 (10%)	68 (18%)
Guiseley	Menston	61 (7%)	158 (17%)	151 (18%)	408 (48%)
Menston	Guiseley	156 (17%)	331 (36%)	67 (8%)	144 (16%)
Menston	Burley in Wharfedale	89 (10%)	236 (25%)	117 (14%)	339 (40%)
Burley in Wharfedale	Menston	116 (13%)	263 (29%)	67 (8%)	136 (16%)
Burley in Wharfedale	Ben Rhydding	145 (15%)	449 (47%)	84 (10%)	290 (34%)
Ben Rhydding	Burley in Wharfedale	81 (9%)	184 (20%)	72 (8%)	167 (19%)
Ben Rhydding	Ilkley	142 (15%)	439 (46%)	64 (8%)	264 (31%)
Ilkley	Ben Rhydding	58 (6%)	122 (13%)	67 (8%)	162 (18%)
Bradford Interchange	New Pudsey	82 (22%)	241 (64%)	73 (19%)	223 (59%)
New Pudsey	Bradford Interchange	110 (29%)	213 (57%)	68 (18%)	253 (67%)
Bradford Interchange	Low Moor	94 (25%)	248 (67%)	71 (19%)	262 (70%)
Low Moor	Bradford Interchange	55 (14%)	116 (29%)	91 (23%)	162 (41%)

9.2.3.5 By 2043, parts of the network are expected to operate above capacity even in the NLP scenario. The section between Apperley Bridge, Kirkstall Forge and Leeds is predicted to approach or exceed capacity towards Leeds in the morning and in the return direction in the evening peak. Routes in and out of Bradford Interchange from New Pudsey and Low Moor will also be approaching capacity by 2043. Although on each of those routes the WLP scenario is predicted to increase congestion, only the section between Shipley and Apperley bridge is expected to be pushed above capacity by the additional passengers generated by the R19 Local Plan allocations.

9.2.3.6 In the WLP scenario, these sections of the network will come under additional strain, as shown in Table 9.2.

Table 9.2: Forecast rail capacity in Bradford district (2043)

From Station	To Station	AM ave	AM max	PM ave	PM max
Skipton	Cononley	139 (14%)	203 (21%)	205 (20%)	354 (34%)
Cononley	Skipton	168 (18%)	392 (41%)	146 (14%)	391 (38%)
Cononley	Steeton & Silsden	148 (15%)	224 (23%)	204 (20%)	339 (32%)
Steeton & Silsden	Cononley	159 (17%)	346 (37%)	155 (15%)	406 (40%)
Steeton & Silsden	Keighley	189 (19%)	308 (32%)	239 (23%)	342 (33%)
Keighley	Steeton & Silsden	197 (21%)	368 (39%)	208 (21%)	455 (45%)
Keighley	Crossflatts	327 (34%)	510 (53%)	296 (28%)	414 (40%)
Crossflatts	Keighley	187 (20%)	290 (30%)	339 (34%)	607 (61%)
Crossflatts	Bingley	372 (38%)	580 (60%)	307 (29%)	444 (43%)
Bingley	Crossflatts	204 (21%)	362 (38%)	381 (38%)	661 (66%)
Bingley	Saltaire	467 (48%)	744 (77%)	324 (31%)	524 (50%)
Saltaire	Bingley	184 (19%)	311 (33%)	465 (46%)	767 (76%)
Saltaire	Shipley	524 (54%)	835 (87%)	344 (33%)	562 (54%)
Shipley	Saltaire	185 (19%)	272 (29%)	521 (52%)	823 (82%)
Shipley	Frizinghall	282 (23%)	559 (46%)	357 (28%)	567 (44%)
Frizinghall	Shipley	304 (25%)	454 (37%)	315 (26%)	501 (41%)
Frizinghall	Forster Square	234 (19%)	400 (33%)	193 (15%)	388 (30%)
Forster Square	Frizinghall	214 (17%)	298 (24%)	365 (29%)	518 (42%)
Shipley	Apperley Bridge	511 (132%)	573 (147%)	244 (55%)	292 (66%)
Apperley Bridge	Shipley	161 (39%)	197 (48%)	523 (110%)	679 (142%)
Apperley Bridge	Kirkstall Forge	531 (136%)	619 (158%)	326 (74%)	396 (90%)
Kirkstall Forge	Apperley Bridge	243 (59%)	291 (71%)	556 (116%)	704 (147%)
Kirkstall Forge	Leeds	564 (143%)	683 (174%)	322 (73%)	411 (94%)

From Station	To Station	AM ave	AM max	PM ave	PM max
Leeds	Kirkstall Forge	231 (57%)	289 (71%)	580 (121%)	728 (152%)
Shipley	Baildon	59 (15%)	130 (33%)	78 (20%)	169 (43%)
Baildon	Shipley	71 (18%)	208 (52%)	42 (11%)	79 (20%)
Baildon	Guiseley	82 (21%)	207 (54%)	61 (16%)	137 (35%)
Guiseley	Baildon	51 (13%)	165 (41%)	39 (10%)	68 (18%)
Guiseley	Menston	79 (8%)	176 (19%)	199 (24%)	456 (54%)
Menston	Guiseley	210 (23%)	385 (42%)	89 (10%)	166 (19%)
Menston	Burley in Wharfedale	105 (11%)	252 (27%)	151 (18%)	373 (44%)
Burley in Wharfedale	Menston	160 (17%)	307 (34%)	87 (10%)	156 (18%)
Burley in Wharfedale	Ben Rhydding	161 (17%)	465 (49%)	110 (13%)	316 (37%)
Ben Rhydding	Burley in Wharfedale	117 (13%)	220 (24%)	90 (10%)	184 (21%)
Ben Rhydding	Ilkley	158 (17%)	455 (48%)	90 (11%)	290 (34%)
Ilkley	Ben Rhydding	90 (10%)	154 (17%)	85 (10%)	180 (21%)
Bradford Interchange	New Pudsey	266 (71%)	425 (113%)	203 (53%)	353 (93%)
New Pudsey	Bradford Interchange	208 (56%)	311 (84%)	264 (70%)	449 (119%)
Bradford Interchange	Low Moor	236 (64%)	390 (105%)	161 (43%)	352 (95%)
Low Moor	Bradford Interchange	119 (30%)	180 (45%)	223 (56%)	294 (74%)

9.2.3.7 It is recommended that passenger numbers be monitored in the latter years of the R19 Local Plan before recommending any upgrades to the rail network. In particular, services into and out of Bradford Interchange are expected to be enhanced as part of the NPR through station proposals.

9.3 Bus

9.3.1 Existing Capacity

9.3.1.1 Bus data is extremely limited given its commercial nature, therefore an in-depth analysis of existing capacity has not been possible. However, in Chapter 3 we demonstrate that current bus passenger numbers are below pre-Covid levels and it is believed that there is spare capacity on the network to accommodate a degree of additional demand.

9.3.2 Future Impacts

9.3.2.1 Despite a lack of baseline data, the change in bus passenger demand is again a direct output from the WYTM. WYTM exports the change in forecast passenger numbers between the NLP and WLP scenarios for 2034 and 2043.

9.3.2.2 Relatively small differences in forecast change on passenger numbers are seen across the network and, due the nature of traffic modelling, WYTM predicts small decreases in demand in some cases.

9.3.2.3 Table 8.4 provides a summary of forecast changes in bus passenger demand between the NLP and WLP scenarios for journeys IN and OUT of Bradford City Centre and in both 2034 and 2043. The passenger forecasts are for a 1-hour period in both the AM and PM peaks. Along each route, the forecast changes vary as passengers get on and off along the route. As such, Table 9.3 presents the maximum increase in bus passenger numbers along each of the key corridors.

Table 9.3: Changes in bus passenger forecasts – key corridors – 2034/2043

Corridor	AM 2034		PM 2034		AM 2043		PM 2043	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Leeds Rd	+8	12	12	-	6	42	24	14
Wakefield Rd	-	10	6	-	6	32	22	10
Manchester Rd	-4	12	8	-4	4	40	32	10
Manningham La	-	6	6	4	-	26	20	8
Kings Rd	-4	6	-	-4	-10	20	12	-4
Thornton Rd	4	4	4	-	10	4	14	10

- 9.3.2.4 In most cases, increases in bus passengers over a 1-hour period are relatively small, particularly in 2034 with maximum increases out of the city centre of +12 passengers along both Leeds Road and Manchester Road, and this increase can be accommodated within existing service capacity.
- 9.3.2.5 By 2043, the increase in demand for services along Manningham Lane, Kings Road and Thornton Road remains relatively modest in both the AM and PM peak periods. The greatest increases are outbound from the city centre in the morning peak linked to an increase in commuting out of the District. Again, increases are highest along Leeds Road, Wakefield Road and Manchester Road which each carry 6, 10 and 10 buses per hour respectively. As such, increases of up to 42 passengers should be accommodated within the existing network, with up to 7 additional passengers per bus. It is also noted that this increase in outbound demand is in the opposite direction to the current peak demand in the morning peak.

9.4 Active Travel

- 9.4.1.1 As outlined in Chapter 8, one of the assumptions of the transport modelling is an increase in cycling mode share, arising from policy impacts and improvements to infrastructure. This would result in additional active travel users on the network both in 2034 and 2043.

10 Highway Capacity Impact Assessment

10.1 Introduction

10.1.1.1 This section presents an assessment of the impacts of the Reg 19 Local Plan growth on the highway network.

10.2 Approach

10.2.1.1 The effect of additional 'with Local Plan' (WLP) traffic on the local road network has been assessed in two ways:

- Nodes analysis
 - Nodes (representations of junctions in the local highway network) have been identified where the average delay across all movements increase by more than 60 seconds and where the volume to capacity ratio (V/C) is increased to >100% in the WLP scenario.
- Turns analysis
 - The predominant turn flow assessment has focussed on individual turning movements where the forecast delay is increased by more than 60 seconds between the with/without Local Plan scenarios in 2034. With less certainty around model forecasts by 2043, the criterium has been relaxed to 120 seconds.
 - Additionally, turns analysis has identified where the V/C for that movement increases from less than 85% in the 'no Local Plan' (NLP) scenario to >100% in the WLP scenario. This represents a significant increase in pressure in that part of the local highway network.

10.2.1.2 In addition to the primary analysis set out above, the 2034 traffic model has also been reviewed to identify nodes/junctions where the V/C is expected to be above 85% in the NLP scenario. These are locations where, although not a direct result of the proposed R19 Local Plan allocations, consideration might be given for more day-to-day mitigation of the Council’s highway network.

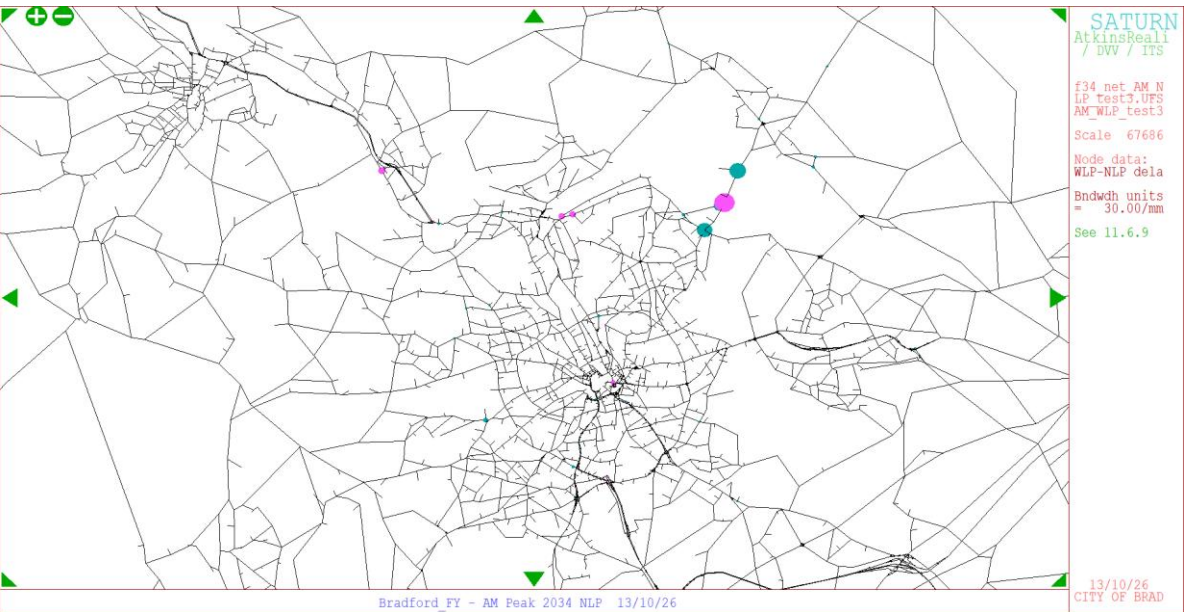
10.3 Review of 2034 network conditions

10.3.1 2034 Nodes Analysis

10.3.1.1 In the short term to 2034, the modelling has identified that the main nodes affected by additional R19 Local Plan traffic demand are located close to the major development site planned at Esholt, Apperley Bridge. This site will have direct access to A658 Apperley Road and is planned to share an improved junction with access to the Apperley Bridge rail station car park. As shown in Table 10.1Table 10.2, Figure 10.1 and Figure 10.2, the highway modelling has identified the following nodes where average delay is predicted to increase by more than 60 seconds, and this includes initial modelling of the revised arrangements for the Esholt site access road, as set out in the application’s Transport Assessment.

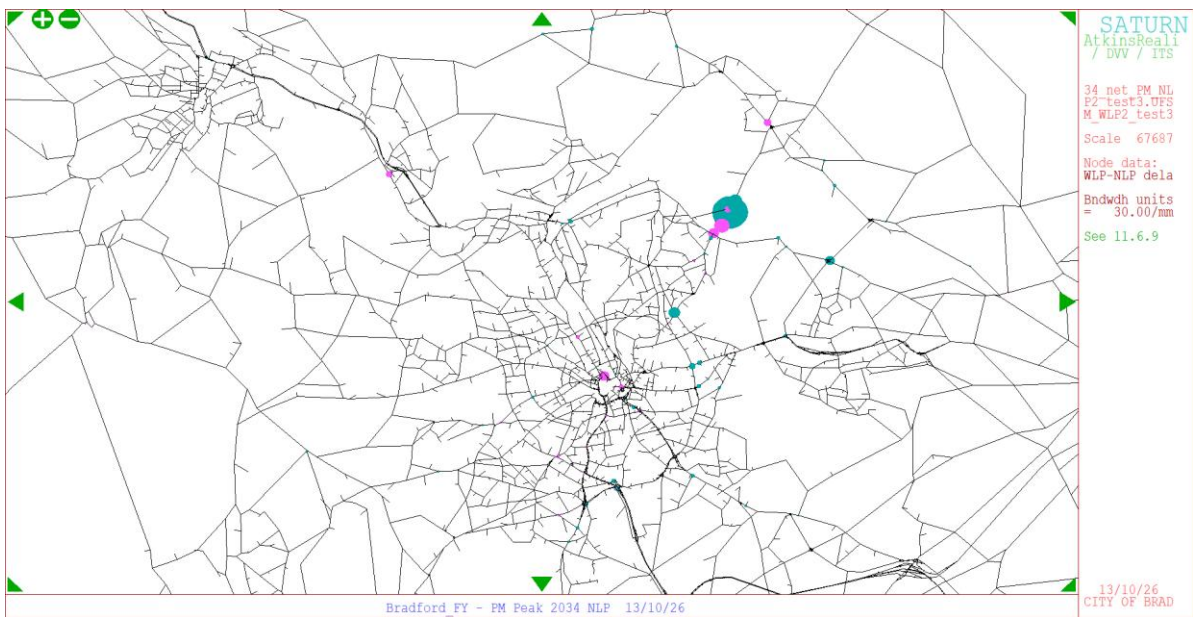
10.3.1.2 In Figure 10.1 and Figure 10.2, a green circle represents an increase in delay with the size indicating the scale of increase, and a pink circle represents a reduction in delay at a particular junction. Reductions in delay can appear to occur where the model redistributes some trips to avoid congestion.

Figure 10.1: Changes in junction delay – 2034 WLP-NLP – AM peak



Source: Bradford Traffic Model

Figure 10.2: Changes in junction delay – 2034 WLP-NLP – PM peak



Source: Bradford Traffic Model

10.3.1.3 Some form of short-term mitigation in this part of the network will be required.

10.3.1.4 It is noted that a preliminary version of the access junction to the Esholt site has been approved through reference to the Transport Assessment for that site in isolation. However, the modelling has identified that an enhanced arrangement will be required to deliver the additional capacity that an in-combination assessment of other sites has identified at this location.

Table 10.1: Nodes with increase in average delay of more than 60 seconds - 2034

Node	Location	District	Time period	NLP delay (s)	WLP delay (s)	Delay diff (s)
11727	A658 Harrogate Rd/Leeds Rd	Bradford	PM	52.7	115.1	62.4
11755	A658 Harrogate Rd/New Line	Bradford	AM	78.2	162.8	84.6
11783	A658 Harrogate Rd/Apperley Rd/ Parkin La	Bradford	PM	51.3	247.8	196.5
16474	Apperley Rd/Apperley La	Bradford	AM	201.8	262.4	60.6
17509	A658, north of Esholt site	Bradford	AM	97.7	188.2	90.5
41418	Apperley Station access road	Bradford	PM	121.2	198.8	70.6

10.3.1.5 Table 10.2, below, also shows those nodes where R19 Local Plan allocations push the V/C above 100%. In each case, it can be seen that the NLP V/C was already very high. Although the increase is relatively modest at both junctions, it is noted that average PM peak delays at the Hillings Lane/Bingley Road southern junction do increase from around 2 minutes to 2.5 minutes.

Table 10.2: Nodes with V/C >100% in WLP Scenario - 2034

Node	Location	District	Time period	NLP V/C	WLP V/C
41235	Hillings La/Bingley Rd S	Leeds	PM	96.8	104.9
78001	A629 Keighley Rd/Ings La	N Yorks	AM	99.6	100.1

10.3.1.6 Although recommended that mitigation work is undertaken to reduce delays at the Hillings Lane junction, the predicted change in V/C at Keighley Road/Ings Lane is negligible and no mitigation is proposed.

10.3.2 2034 Turns Analysis

10.3.2.1 The Bradford traffic model includes more than 10,500 individual turning movements across the district, with a further 2,300 across neighbouring districts.

10.3.2.2 By 2034, it is predicted that a difference of more than 60 seconds' delay between the NLP and WLP scenarios will be experienced at just 13 of those turns in the AM peak hour. Those 13 turns are spread across 9 junctions, with often multiple turns at the same node experiencing similar impact. In the PM peak hour, a difference of more than 60 seconds' delay is predicted for 33 turns across 13 junctions. A combined total of 20 junctions are affected across both time periods.

10.3.2.3 These junctions, and the main approach effected, are listed in Table 10.3 and their locations illustrated in Figure 10.3.

Table 10.3: Nodes with increase in turn flow delay of more than 60 seconds - 2034

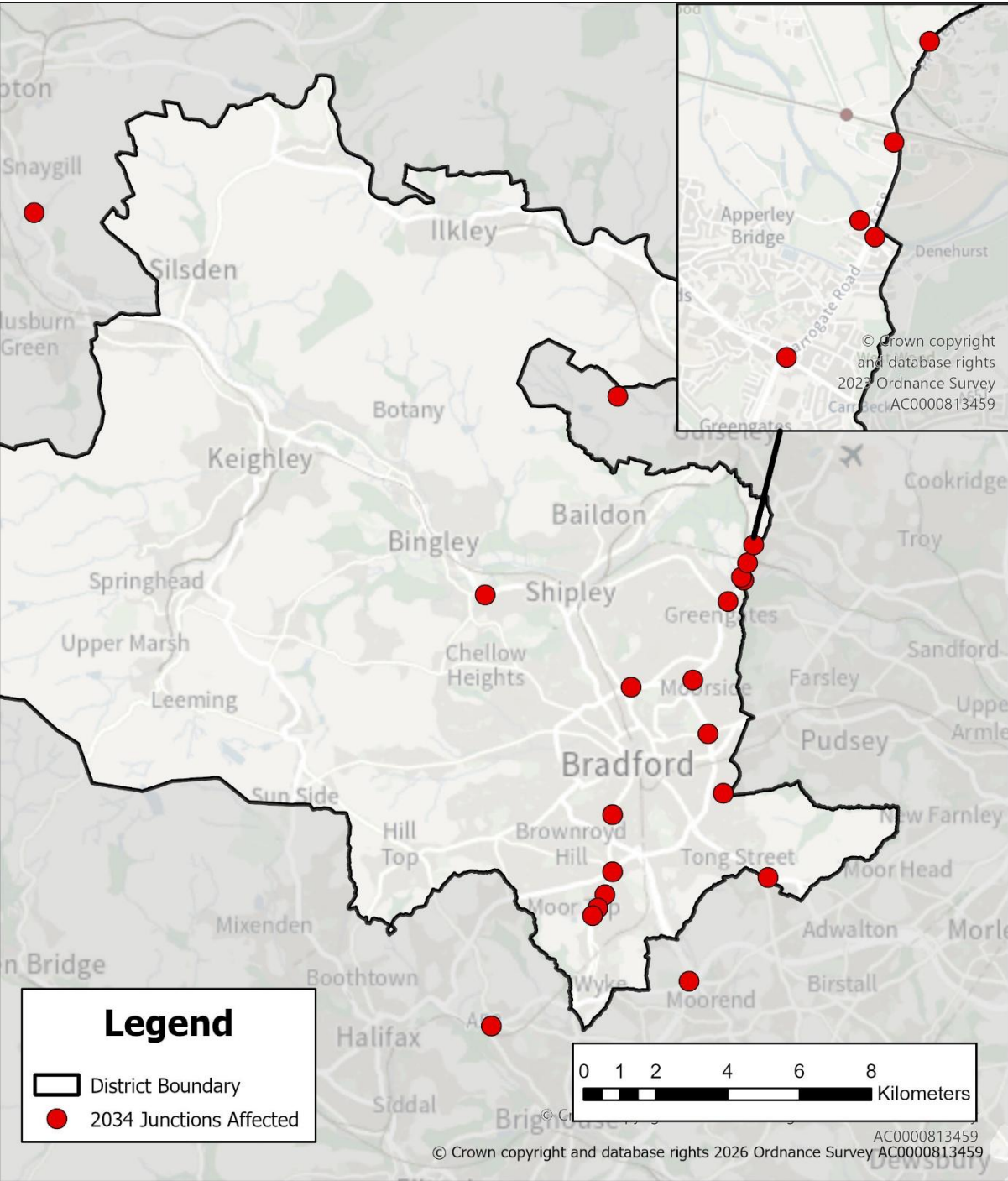
Node	Location	Approach arm	Junction type	Time period	Ave. NLP delay (sec)	Ave. WLP delay (sec)	Ave, delay diff (sec)
11755	A658 Harrogate Rd/New Line	New Line W	signals	AM	20	877	857
11783	A658 Harrogate Rd/Apperley Rd/Parkin La	Harrogate Rd S	priority	PM	16	507	490
13116	A650 Bradford	Mercure Hotel exit	signals	AM	200	635	435

Node	Location	Approach arm	Junction type	Time period	Ave. NLP delay (sec)	Ave. WLP delay (sec)	Ave, delay diff (sec)
	Rd/Mercure Hotel						
11727	A658 Harrogate Rd/Leeds Rd	Leeds Rd S	priority	PM	200	577	377
16475	A658 Harrogate Rd/Apperley La	Apperley La	priority	PM	516	876	359
78001	A629 Keighley Rd/Ings La	Keighley Rd S	priority	AM	56	371	315
11783	A658 Harrogate Rd/Apperley Rd/Parkin La	Apperley Rd	priority	PM	345	620	275
11755	A658 Harrogate Rd/New Line	New Line E	signals	AM	163	403	240
17509	A658 Apperley Rd, n of Esholt	side road	priority	AM	163	403	239
41418	Apperley Station access road	Apperley La N	signals	PM	139	319	180
11714	A6177 Killinghall Rd/Leeds Old Rd	Leeds Old Rd E	signals	PM	102	250	148
11469	A641 Huddersfield Rd/Netherlands Ave	Netherlands Ave E	priority	PM	162	298	136
11648	Cutler Heights La/Broad La/Tyersal La	Tyersal La	priority	AM	68	177	109
11553	A641 Huddersfield Rd/Rooley Ave (Odsal Top)	Cleckheaton Rd	r'about	PM	148	254	106

Node	Location	Approach arm	Junction type	Time period	Ave. NLP delay (sec)	Ave. WLP delay (sec)	Ave, delay diff (sec)
11465	A641 Manchester Rd/ St Stephens Rd/ Ransdale Rd	Ransdale Rd	signals	PM	147	246	100
11465	A641 Manchester Rd/ St Stephens Rd/ Ransdale Rd	Ransdale Rd	signals	AM	61	158	98
11476	A641 Huddersfield Rd/Abb Scott La/ New Works Rd	New Works Rd	priority	PM	258	344	86
11470	A641 Huddersfield Rd/ Common Rd	Common Rd	priority	PM	148	230	83
11742	A6177 Queens Rd/Kings Rd	Queens Rd W	signals	AM	21	96	75
16475	A658 Harrogate Rd/Apperley La	Harrogate Rd S	priority	PM	160	234	74
31541	Chain Bar Rbt: Bradford Rd (Kirklees)	Bradford Rd	R'about	PM	557	630	72
11646	A650 Westgate Hill St/N View Rd/new Westgate Terrace site	North View Rd	priority	PM	n/a	67	67
41235	Hillings La/Bingley Rd S (Leeds)	Hillings La N	priority	PM	60	123	63
21559	A58 Leeds Rd/A644 Brighouse Rd (Calderdale)	Halifax Rd W	signals	AM	497	558	62

10.3.2.4 It is noted that the model predicts an increase in delay at the Ings Lane junction with A629 Keighley Road (node 78001). In the model, the Ings Lane junction is a proxy for entry from a large North Yorkshire zone onto the road network and, as such, the traffic is unlikely to be focussed on a single junction. It is also noted that, despite this, the predicted change in V/C at Keighley Road/Ings Lane is negligible and no mitigation is proposed.

Figure 10.3: Nodes/junctions for short-term mitigation - 2034



- 10.3.2.5 Figure 10.3 illustrates that the list of junctions with significant changes in turn delays includes a small selection of nodes outside Bradford district, and Table 10.3 shows that these ‘external’ junctions have a relatively low increase in delay, except at the A629 Keighley Rd/Ings Lane junction discussed above.
- 10.3.2.6 There are a cluster of junctions along the A658 Harrogate Road close to the Esholt site (see also Table 10.1) where the largest increases in average delay are forecast. There is also a second cluster of junctions along A641 Huddersfield Road, near Low Moor. These are the locations where local network mitigation by 2034 will be focussed.
- 10.3.2.7 Other notable locations where a significant increase in delay is forecast, and where mitigation will need to be considered, are:
- A650 Bradford Road/Mercure Hotel junction, west of Saltaire (+435 seconds)
 - A6177 Killinghall Road/Leeds Old Road junction (+148 seconds)
 - Cutler Heights Lane/Broad Lane/ Tyersal Lane junction (+109 seconds)
 - A641 Manchester Rd/St Stephen’s Rd/Ransdale Rd junction (+99 seconds)
 - A58 Leeds Rd/A644 Brighouse Rd, Calderdale (+62 seconds)
- 10.3.2.8 It is noted that the Bradford Road approach to the M62/M606 roundabout at Chain Bar is also expected to have increased delay, although the predicted NLP delay is already very high. This is the only unsignalised approach to the roundabout and the potential introduction of traffic signal control should be discussed with National Highways.
- 10.3.2.9 The initial modelling has also identified that the exact form of the update to the A650 Westgate Hill Street/North View Road junction will need to be reviewed to accommodate demand associated with the new Westgate Terrace R19 Local Plan site.
- 10.3.2.10 Figure 10.3 shows that by 2034 there are no areas of concern in west Bradford, Keighley, Shipley or along the Wharfedale corridor.

10.4 Review of 2043 network conditions

10.4.1 2043 Nodes Analysis

10.4.1.1 As shown in Table 10.4, Figure 10.4 and Figure 10.5 other areas of the district will start to experience increases in delay through impact of the R19 Local Plan by 2043. Although most junctions identified with an increase in delay of more than 60 seconds are still located close to the Esholt site and the A658 corridor, three sites in the City Centre will also need to be monitored, along with a junction in Guiseley and on the Leeds Outer Ring Road at Rodley.

10.4.1.2 Again, the green circles in Figure 10.4 show increases in AM peak delay in 2043 along the A658 Harrogate Road corridor along with the introduction of additional delays around the city centre. In the PM peak, Figure 10.5 illustrates that the delay around the A658 and the Esholt site is more severe. We also see a noticeable change in PM peak delay at the Rodley roundabout on the Leeds Outer Ring Road.

Figure 10.4: Changes in junction delay – 2043 WLP-NLP – AM peak

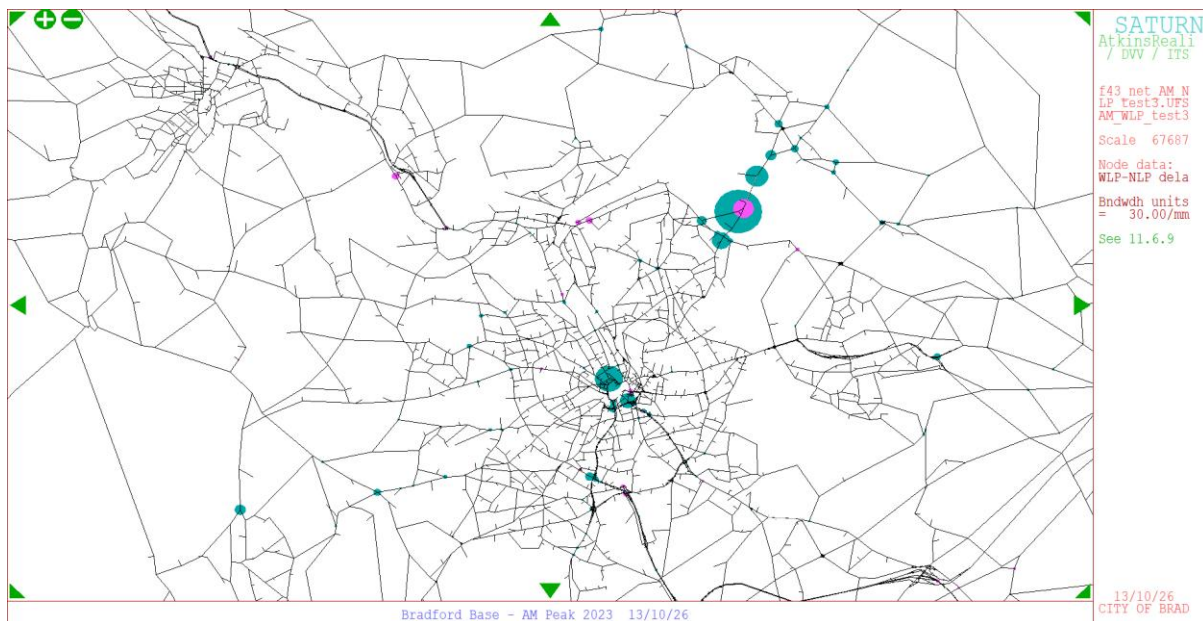
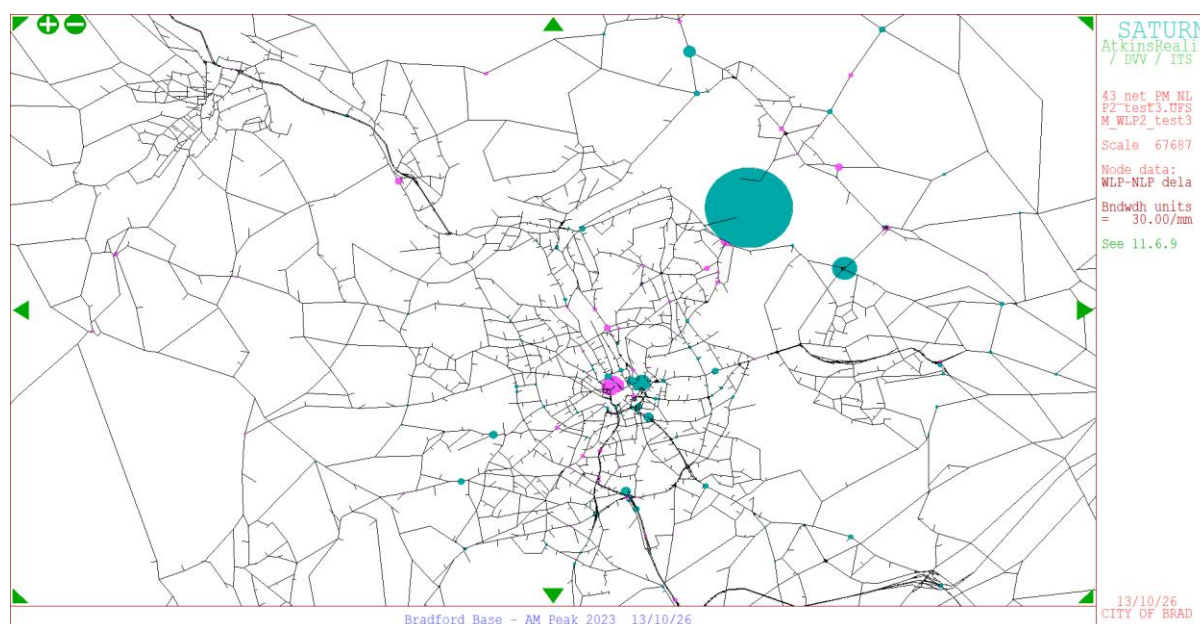


Figure 10.5: Changes in junction delay – 2043 WLP-NLP – PM peak

- 10.4.1.3 Table 10.4 lists nodes/junctions where 2043 increases in average delay are greater than 60 seconds. The locations in *italics* are also highlighted as junctions with increases in delay in 2034 (see Table 10.3) and the omission of the A658 Harrogate Road/New Line junction is down to the NLP delay increasing, and the additional WLP impact not being as high.
- 10.4.1.4 Increased delay forecast for the two city centre junctions (nodes 12059 and 12274) are linked to development at City Village and illustrate the need to control car ownership within the development to levels below that included in the WYTM.

Table 10.4: Nodes with increase in average delay of more than 60 seconds - 2043

Node	Location	District	Time period	NLP delay (s)	WLP delay (s)	Delay diff (s)
11783	<i>A658 Harrogate Rd/ Apperley Rd/ Parkin La</i>	<i>Bradford</i>	<i>PM</i>	57.8	247.9	190.1
12059	John St/Darley St/North Parade	Bradford	AM	13.1	166.8	153.7
12274	Bridge St/Vicar La	Bradford	AM	27.9	115.3	87.4
12284	Shipley-Airedale Rd/ Barkerend Rd	Bradford	PM	120.2	212.3	92.1
16474	<i>Apperley Rd/Apperley La</i>	<i>Bradford</i>	<i>AM</i>	225.3	485.3	260.0
17518	A658 Harrogate Rd/Fieldgate Rd	Bradford	AM	5.4	104.3	98.9

41418	Apperley Station access road	Bradford	PM	162.7	648.2	485.5
45115	Otley Rd/Bradford Rd (Guiseley)	Leeds	PM	92.0	159.1	67.1
45154	A6120 Leeds ORR/Rodley La	Leeds	PM	352.2	488.4	136.2

10.4.1.5 Table 10.5 shows that the nodes where R19 Local Plan allocations push the V/C above 100% are different in 2043 when compared to 2034. The two junctions highlighted in Table 10.2 will be in excess of 100% V/C in the NLP scenario and, hence, not deemed to be notably worse following completion of the R19 Local Plan.

10.4.1.6 The greatest increase in V/C is expected at the Apperley Station access junction, and this is a junction that has already been identified for mitigation in 2034. Additional junctions in Yeadon (Leeds), Queensbury, Silsden and Keighley will also need to be monitored and considered for longer term mitigation.

Table 10.5: Nodes with V/C >100% in WLP Scenario - 2043

Node	Location	District	Time period	NLP V/C	WLP V/C
41418	Apperley Station access road	Bradford	PM	88.1	111.7
41354	A658 Harrogate Rd/Bayton La, Yeadon	Leeds	AM	96.4	106.0
13014	A644/High St, Queensbury	Bradford	AM	96.0	101.8
12892	A629, Silsden roundabout	Bradford	PM	98.5	100.9
12705	A650 Hard Ings Rd/Lawkhholme La, Keighley	Bradford	AM	98.8	100.3

10.4.2 2043 Turns Analysis

- 10.4.2.1 In the longer term to 2043, the criterium for turn delays is extended to 120 seconds given the level of uncertainty in modelling R19 Local Plan development and infrastructure improvements so far into the future.
- 10.4.2.2 Table 10.6 highlights 20 individual nodes/junctions at which delay for individual turning movements increase by more than 120 secs between the NLP and WLP scenarios. Of those, 8 (in italics) are also included in Table 10.3 and will be addressed through mitigation needs identified for 2034. The junction of A58 Leeds Road/A649 Wakefield Road (node 21560) is also directly linked to the adjacent A58 Leeds Road/A644 Brighouse Road junction (node 21559, Table 10.3)
- 10.4.2.3 A further 6 junctions were also included in Table 10.6, showing junctions with increases in overall average delay of more than 60 seconds, and these will be monitored and reviewed for longer term mitigation.
- John St/Darley St/North Parade
 - Apperley Rd/Apperley La
 - Shipley Airedale Rd/Barkerend Rd & Barkerend Rd/Otley Rd
 - Bridge St/Vicar La
 - A6120 Leeds ORR/Rodley La
- 10.4.2.4 The remaining 5 locations towards the bottom of the table will also be added to the monitoring list for possible future mitigation.
- A65 New Road/Henshaw Lane
 - A629 Keighley Rd/Per La/Cow Hill Gate Lane (Calderdale)
 - A658 Apperley La/Micklefield Lane, Rawdon
 - B6153 Park Rd/Back La, Guiseley
 - A629 Skipton Rd; Crosshills roundabout
- 10.4.2.5 Overall, the 2043 analysis has identified a number of additional junctions that will be subject to monitoring.

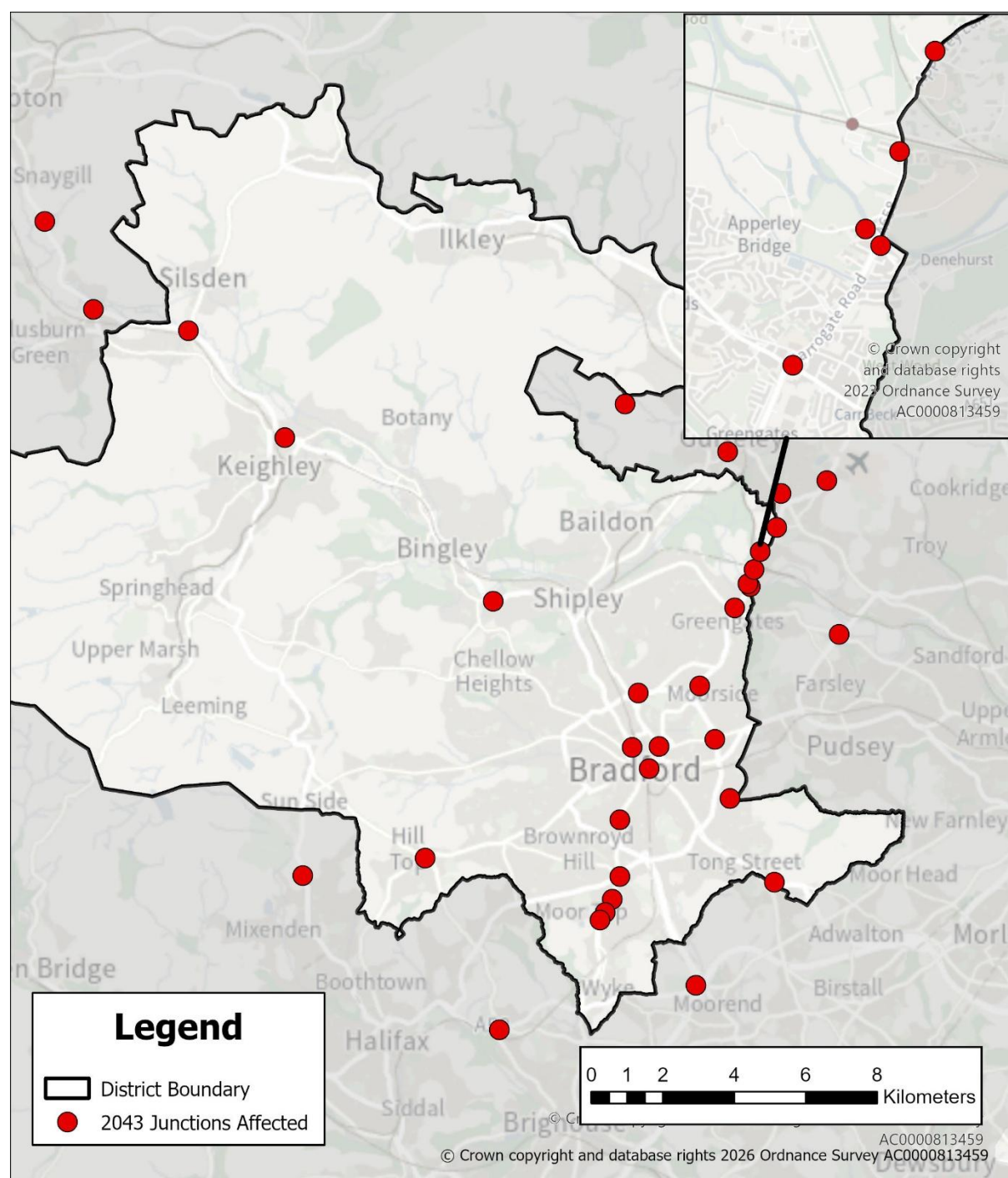
Table 10.6: Nodes with increase in turn flow delay of more than 60 seconds - 2043

Node	Location	Approach arm	Time period	Ave. NLP delay (sec)	Ave. WLP delay (sec)	Ave, delay diff (sec)
<i>41418</i>	<i>Apperley station access road</i>	<i>Station access</i>	<i>PM</i>	<i>24</i>	<i>905</i>	<i>881</i>
<i>11783</i>	<i>A658 Harrogate Rd/Apperley Rd/Parkin La</i>	<i>Harrogate Rd S</i>	<i>PM</i>	<i>17</i>	<i>500</i>	<i>484</i>
<i>41418</i>	<i>Apperley station access road</i>	<i>Apperley Rd N</i>	<i>PM</i>	<i>203</i>	<i>643</i>	<i>440</i>
12059	John St/Darley St/North Parade	John St	AM	22	407	385

Node	Location	Approach arm	Time period	Ave. NLP delay (sec)	Ave. WLP delay (sec)	Ave, delay diff (sec)
16475	A658 Harrogate Rd/Apperley La	Apperley La	PM	556	875	318
17518	A658 Harrogate Rd/Fieldgate Rd	Harrogate Rd S	AM	3	290	287
11755	A658 Harrogate Rd/New Line	New Line E	AM	534	807	273
16474	Apperley Rd/Apperley La	Apperley Rd W	AM	354	602	248
12284	Shipley-Airedale Rd/Barkerend Rd	Shipley-Airedale Rd S	PM	208	449	240
11783	A658 Harrogate Rd/Apperley Rd/Parkin La	Apperley Rd	PM	381	619	238
17509	A658 Apperley Rd, n of Esholt	side road	AM	185	389	204
31541	Chain Bar Rbt: Bradford Rd (Kirklees)	Bradford Rd	PM	590	794	204
13116	A650 Bradford Rd/Mercure Hotel	Mercure Hotel exit	AM	634	829	194
12274	Bridge St/Vicar La	Vicar Lane N	AM	40	227	188
41353	A65 New Rd/Henshaw La	Henshaw La	AM	64	222	158
45154	A6120 Leeds ORR /Rodley La	Ring Road N	PM	473	628	155
12291	Barkerend Rd/Otley Rd	Barkerend Rd E	PM	16	168	152
24887	A629 Keighley Rd/Per La/Cow Hill Gate La (Calderdale)	Keighley Rd N	AM	54	198	144
42945	A658 Apperley La/Micklefield La	Apperley La N	AM	67	201	134
42937	B6153 Park Rd/Back La	Park Rd E	PM	203	332	128
75092	A629 Skipton Rd; Crosshills rbt	Skipton Rd S	AM	313	439	126
21560	A58 Leeds Rd/A649 Wakefield Rd	Wakefield Rd	PM	556	676	121

10.4.2.6 Figure 10.6 expands on Figure 10.3 to also include additional junctions where operation is currently predicted to be worse in the WLP scenario by 2043.

Figure 10.6: Nodes/junctions for potential longer-term mitigation - 2043



10.5 Road Collisions

- 10.5.1.1 As part of the assessment, we have identified Killed and Seriously Injured (KSI) clusters in the District, with results provided in Chapter 5.
- 10.5.1.2 A comparison between WLP and NLP indicates that at the junctions identified within Chapter 5, flows would only typically increase within a range of 0% to 3% in 2034. Corresponding increase in two-way link flows are within a range of 0% to 4%. We would therefore not expect a significant increase in the risk of collisions with early delivery of the R19 Local Plan.
- 10.5.1.3 By 2043, the impact of additional traffic is greater, but the increase in junction and link flows remains within a range of 0% to 6%.
- 10.5.1.4 Having identified these increases in flow in cluster sites, future studies would be required to look at specific measures to improve road safety and monitor the impact of any implemented demand management measures.

10.6 Additional Junctions

- 10.6.1.1 As noted in Chapter 5, the Council's Highways team have identified 6 junctions where congestion and/or safety will be monitored as delivery of the R19 Local Plan progresses. These are:
 - A6177 Sticker Lane/Bowling Back Lane
 - Dick Lane/New Lane
 - Little Horton Lane/Horton Park Avenue
 - A657 Leeds Road/Thackley Road/Town Lane
 - A6037 Canal Road/Frizinghall Road/Gaisby Lane
 - A629 Halifax Road/Haworth Road
- 10.6.1.2 Although locations with existing congestion issues, the forecast change in demand between the WLP and NLP is a maximum of +2% by 2034, rising to +5% in 2043. While these increases in flow associated with the R19 Local Plan are unlikely to increase congestion significantly, each should again be monitored and considered for upgrade as part of the Council's ongoing road maintenance programme of works.

10.7 Strategic Road Network

- 10.7.1.1 In Bradford district, the Strategic Road Network (SRN) is represented by the M606, which connects to parts of the M62 either side of the M606 junction at Chain Bar.
- 10.7.1.2 The effect of additional 'with Local Plan' (WLP) traffic on the SRN has been assessed in two ways:
 - Link capacity analysis

- o Modelled demand across all Bradford's SRN links and adjoining links has been compared to theoretical link capacity, based on the number of lanes available to traffic (1800 vph per lane). Links with a derived volume to capacity ratio (V/C) greater than 85% in either the 'no Local Plan' (NLP) or WLP scenario have been identified.
- Merge/diverge analysis
 - o Motorway merging and diverging diagrams are taken from "CD 122 Geometric design of grade separated junctions (version 1.1.1)". These diagrams set the recommended layout standard for a given combination of mainline and merging/diverging traffic flows (vph) and are included at Appendix D.
 - o The recommended standard layout is then compared to the current layout and any change in recommendation between the NLP and WLP scenarios is also identified.

10.7.2 Review of 2034 network conditions

2034 Link capacity analysis

- 10.7.2.1 Of 45 links identified as forming the SRN within the Bradford district, 9 links have a derived V/C in excess of 85% in either the WLP or in both NLP and WLP scenarios.
- 10.7.2.2 As shown in Figure 10.7 there are 3 links in the AM peak and 3 in the PM peak where the V/C is slightly worse in the WLP. The M606 southbound is most affected, with a maximum increase in demand of +97 vehicles in the AM peak hour between Junction 2 and Junction 1.
- 10.7.2.3 Where a WLP increase in V/C is predicted, the link is expected to continue to operate within capacity.
- 10.7.2.4 Any SRN link that is showing a V/C in excess of 100% in the NLP scenario by 2034 is expected to be made no worse in the WLP scenario.

Figure 10.7: Link capacity analysis - 2034

Link No	Description	No of lanes	Assumed link capacity - vehs	2034 NLP (vehs)		2034 WLP (vehs)		WLP-NLP (vehs)		2034 NLP (VoC)		2034 WLP (VoC)	
				AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	M606 J3 NB off-slip	2	3600	1228.10	1395.42	1215.89	1436.66	-12.21	41.24	34%	39%	34%	40%
2	M606 J3 SB on-slip	2	3600	1723.54	2336.79	1769.62	2270.27	46.08	-66.53	48%	65%	49%	63%
3	M606 J2-J3 NB mainline	3	5400	2446.59	2535.12	2414.50	2617.62	-32.10	82.51	45%	47%	45%	48%
4	M606 J3-J2 SB mainline	2	3600	3035.37	3821.86	3122.46	3735.58	87.09	-86.28	84%	106%	87%	104%
5	M606 J2 SB off-slip	2	3600	184.92	55.20	181.68	54.50	-3.24	-0.71	5%	2%	5%	2%
6	M606 J2 NB off-slip	2	3600	609.51	204.98	585.41	219.39	-24.10	14.41	17%	6%	16%	6%
7	M606 J2 SB on-slip	2	3600	280.78	208.43	287.19	269.02	6.41	60.59	8%	6%	8%	7%
8	M606 J2 NB through mainline	3	5400	2446.59	2535.12	2414.50	2617.62	-32.10	82.51	45%	47%	45%	48%
9	M606 J2 SB through mainline	2	3600	2850.44	3766.66	2940.77	3681.08	90.33	-85.58	79%	105%	82%	102%
10	M606 J1-J2 NB mainline	3	5400	3056.11	2740.09	2999.90	2837.02	-56.20	96.93	57%	51%	56%	53%
11	M606 J2-J1 SB mainline	2	3600	3131.22	3975.09	3227.97	3950.10	96.75	-24.99	87%	110%	90%	110%
12	M606 J1 NB on-slip from roundabout	2	3600	2003.52	1762.23	1966.14	1871.03	-37.38	108.81	56%	49%	55%	52%
13	M606 J1 NB from M62W	2	3600	1052.59	977.86	1033.77	965.99	-18.82	-11.87	29%	27%	29%	27%
14	M606 J1 SB off-slip direct to M62E	1	1800	1699.24	1872.41	1708.06	1875.04	8.81	2.63	94%	104%	95%	104%
15	M606 J1 SB off-slip to roundabout	2-3	3600	545.50	1086.19	620.46	1076.23	74.96	-9.96	15%	30%	17%	30%
16	M606 J1 SB between off-slips	2	3600	1431.98	2102.66	1519.91	2075.06	87.93	-27.60	40%	58%	42%	58%
17	M606 J1 SB to M62W	2	3600	886.48	1016.48	899.45	998.85	12.96	-17.63	25%	28%	25%	28%
18	J26 circ. M606 NB on to M606 SB off	3	5400	1512.05	1724.18	1512.78	1818.29	0.73	94.11	28%	32%	28%	34%
19	J26 circ. M606 SB off to M62 WB off slip	3	5400	896.31	1220.13	965.35	1274.22	69.04	54.09	17%	23%	18%	24%
20	J26 circ. M62 WB off to A58E off	3	5400	2649.38	3097.27	2724.18	3166.65	74.80	69.38	49%	57%	50%	59%
21	J26 circ. A58E off to A638 off	4	7200	2232.64	2571.30	2310.01	2622.35	77.37	51.05	31%	36%	32%	36%
22	J26 circ. A638 off to M62 WB on slip	4	7200	2406.71	2603.98	2497.01	2653.98	90.30	50.00	33%	36%	35%	37%
23	J26 circ. M62 WB off to M62 EB on	4	7200	3057.06	3262.24	3160.78	3288.50	103.72	26.26	42%	45%	44%	46%
24	J26 circ. M62 EB on to A58W off	4	7200	3434.48	3820.01	3559.14	3843.24	124.66	23.23	48%	53%	49%	53%
25	J26 circ. A58W off to A58W on	4	7200	2882.18	3015.92	2855.95	3042.75	-26.23	26.83	40%	42%	40%	42%
26	J26 circ. A58W on to M606 NB on	4	7200	3487.94	3433.56	3449.01	3660.07	-38.93	226.51	48%	48%	48%	51%
27	M62 J26 EB slip on slip from roundabout	1	1800	1161.23	1590.25	1167.90	1620.30	6.67	30.05	65%	88%	65%	90%
28	M62 J26 EB slip direct from M606	2	3600	1699.24	1872.41	1708.06	1875.04	8.81	2.63	47%	52%	47%	52%
29	M62 J26 EB merge no.1	1	1800	1156.52	1586.95	1163.38	1617.63	6.87	30.67	64%	88%	65%	90%
30	M62 J26 EB merge no.2	2-1	1800	1703.96	1875.71	1712.57	1877.70	8.61	1.99	95%	104%	95%	104%
31	M62 EB mainline E of J26	3	5400	5868.75	6732.35	5886.12	6764.89	17.37	32.54	109%	125%	109%	125%
32	M62 WB mainline E of J26	4	7200	5494.36	6430.38	5509.29	6454.63	14.93	24.25	76%	89%	77%	90%
33	M62 WB off slip to J26	2-3	3600	1753.08	1877.15	1758.83	1892.44	5.76	15.29	49%	52%	49%	53%
34	M62 EB through J26	3	5400	3008.27	3269.69	3010.17	3269.56	1.90	-0.13	56%	61%	56%	61%
35	M62 WB through J26	3	5400	3741.29	4553.24	3750.45	4562.21	9.16	8.97	69%	84%	69%	84%
36	M62 J26 WB on slip from roundabout	2	3600	394.57	403.59	387.60	418.93	-6.97	15.34	11%	11%	11%	12%
37	M62 J26 WB after merge from roundabout	2	3600	1281.05	1420.06	1287.04	1417.77	5.99	-2.29	36%	39%	36%	39%
38	M62 J26 WB merge no.1	1	1800	0.00	0.31	0.00	0.24	0.00	-0.07	0%	0%	0%	0%
39	M62 J26 WB merge no.2	1	1800	1281.05	1419.74	1287.04	1417.53	5.99	-2.21	71%	79%	72%	79%
40	M62 WB mainline W of J26	4	7200	5022.35	5973.30	5037.50	5979.98	15.15	6.68	70%	83%	70%	83%
41	M62 EB mainline W of J26	4	7200	4438.28	4805.33	4442.31	4790.29	4.02	-15.04	62%	67%	62%	67%
42	M62 EB off slip to J26	2	3600	1430.02	1535.63	1432.13	1520.72	2.12	-14.91	40%	43%	40%	42%
43	M62 EB off slip to J26 roundabout	2	3600	377.41	557.78	398.37	554.73	20.95	-3.04	10%	15%	11%	15%
44	M606 N of J3 SB mainline	2	3600	1311.83	1485.07	1352.84	1465.32	41.01	-19.75	36%	41%	38%	41%
45	M606 N of J3 NB mainline	2	3600	1218.49	1139.68	1198.60	1180.96	-19.90	41.28	34%	32%	33%	33%

2034 Merge/diverge analysis

10.7.2.5 The slip road and mainline flows included in Table 10.8 have been extracted from the Bradford SATURN model. Combinations of merge flow / upstream mainline flows and diverge flows / downstream mainline flows are located within the appropriate diagrams in Appendix D and the recommended merge/diverge layout recorded. This is compared to the current layout, and we also identify any change in recommendation between the NLP and WLP scenarios.

10.7.2.6 As illustrated in Table 10.7 and Table 10.8, the analysis shows that a number of merge/diverge slips are expected to be operating below recommended standard, by 2034, in the NLP scenario.

10.7.2.7 The difference in merging and diverging flows between the NLP and WLP scenarios is relatively low and there are no locations where the WLP demand is such that an improvement over the NLP layout is recommended.

Table 10.7: Merge/diverge analysis – 2034 AM Peak

Description	Existing Type	AM NLP			AM WLP		
		Slip vph	ML vph	Standard	Slip vph	ML vph	Standard
M606 J3 NB off-slip	Diverge, 3C2	1228	1218	C	1216	1199	C
M606 J3 SB on-slip	Merge, 2B2	1724	1312	E	1770	1353	E
M606 J2 SB off-slip	Diverge, 2A2	185	2850	A	182	2941	A
M606 J2 NB off-slip	Diverge, 3A3	610	2447	A	585	2414	A
M606 J2 SB on-slip	Merge, 2A2	281	2850	A	287	2941	A
M606 J1 NB on-slip from roundabout	Merge, 2E3	2004	1053	E	1966	1034	E
M606 J1 SB off-slip direct to M62E	Diverge, 2A2	1699	1432	D	1708	1520	D
M606 J1 SB off-slip to roundabout	Diverge, 2A2	545	886	A	620	899	A
M62 J26 slip direct from M606	Merge, 2D3	1699	1161	E	1708	1168	E
M62 J26 EB merge 1	Merge, 3E4	(1157	3008	D	(1163	3010	D
M62 J26 EB merge 2	Merge, 3E4	(1704	3008	E	(1713	3010	E
M26 WB off-slip to J26	Diverge, 4D3	1753	3741	D	1759	3750	D
M62 J26 WN on-slip from roundabout	Merge, 2B2	395	886	A	388	899	A
M62 J26 WB merge 1	Merge, 3E4	(0	3741	A	(0	3750	A
M62 J26 WB merge 2	Merge, 3E4	(1281	3741	B	(1287	3750	B
M62 EB off-slip to J26	Diverge, 4E3	1430	3008	D	1432	3010	D
M62 EB off-slip to J26 roundabout	Diverge, 2A2	377	1053	A	398	1034	A

Table 10.8: Merge/diverge analysis – 2034 PM Peak

Description	Existing Type	AM NLP			AM WLP		
		Slip vph	ML vph	Standard	Slip vph	ML vph	Standard
M606 J3 NB off-slip	Diverge, 3C2	1395	1140	D	1437	1181	D
M606 J3 SB on-slip	Merge, 2B2	2337	1485	F	2270	1465	F
M606 J2 SB off-slip	Diverge, 2A2	55	3767	A	54	3681	A
M606 J2 NB off-slip	Diverge, 3A3	205	2535	A	219	2618	A
M606 J2 SB on-slip	Merge, 2A2	208	3767	A	269	3681	A
M606 J1 NB on-slip from roundabout	Merge, 2E3	1762	978	E	1871	966	E
M606 J1 SB off-slip direct to M62E	Diverge, 2A2	1872	2103	D	1875	2075	D
M606 J1 SB off-slip to roundabout	Diverge, 2A2	1086	1016	C	1076	999	C
M62 J26 slip direct from M606	Merge, 2D3	1872	1590	E	1875	1620	E
M62 J26 EB merge 1	Merge, 3E4	(1587	3270	E	(1618	3270	E
M62 J26 EB merge 2	Merge, 3E4	(1876	3270	E	(1878	3270	E
M26 WB off-slip to J26	Diverge, 4D3	1877	4553	D	1892	4562	D
M62 J26 WN on-slip from roundabout	Merge, 2B2	404	1016	A	419	999	A
M62 J26 WB merge 1	Merge, 3E4	(0	4553	A	(0	4562	A
M62 J26 WB merge 2	Merge, 3E4	(1420	4553	E	(1418	4562	E
M62 EB off-slip to J26	Diverge, 4E3	1536	3270	D	1521	3270	D
M62 EB off-slip to J26 roundabout	Diverge, 2A2	558	978	A	555	966	A

10.7.3 Review of 2043 network conditions

2043 Link capacity analysis

- 10.7.3.1 Of 45 links identified as forming the SRN within the Bradford district, the number of links which have a derived V/C in excess of 85% in either the WLP or in both NLP and WLP scenarios increases to 12 between 2034 and 2043.
- 10.7.3.2 Figure 10.8 shows that for 9 of the 12 links where V/C is greater than 85% in either scenario, the WLP forecasts are worse. Although the majority of those 9 links identify worsening WLP conditions in the AM peak hour, it is actually the PM peak hour which is expected to experience the main capacity constraints by 2043. Conditions in 2043 are expected to be worst in the M606 southbound direction, with a notable exception of the M62 mainline, eastbound from Junction 26 towards Leeds.

Figure 10.8: Link capacity analysis - 2043

Link No	Description	No of lanes	Assumed link capacity - vehs	2034 NLP (vehs)		2034 WLP (vehs)		WLP-NLP (vehs)		2034 NLP (VoC)		2034 WLP (VoC)	
				AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	M606 J3 NB off-slip	2	3600	1371.35	1537.90	1325.98	1631.30	-45.38	93.40	38%	43%	37%	45%
2	M606 J3 SB on-slip	2	3600	1885.02	2721.47	1997.37	2649.75	112.35	-71.72	52%	76%	55%	74%
3	M606 J2-J3 NB mainline	3	5400	2718.86	2772.98	2627.47	2947.22	-91.39	174.24	50%	51%	49%	55%
4	M606 J3-J2 SB mainline	2	3600	3275.62	4429.93	3512.34	4323.75	236.72	-106.18	91%	123%	98%	120%
5	M606 J2 SB off-slip	2	3600	186.34	48.29	185.41	53.91	-0.93	5.62	5%	1%	5%	1%
6	M606 J2 NB off-slip	2	3600	610.66	200.51	580.73	276.39	-29.93	75.88	17%	6%	16%	8%
7	M606 J2 SB on-slip	2	3600	337.13	30.35	390.48	115.85	53.35	85.50	9%	1%	11%	3%
8	M606 J2 NB through mainline	3	5400	2718.86	2772.98	2627.47	2947.22	-91.39	174.24	50%	51%	49%	55%
9	M606 J2 SB through mainline	2	3600	3089.28	4381.64	3326.92	4269.84	237.65	-111.80	86%	122%	92%	119%
10	M606 J1-J2 NB mainline	3	5400	3329.51	2973.49	3208.19	3223.62	-121.32	250.13	62%	55%	59%	60%
11	M606 J2-J1 SB mainline	2	3600	3426.41	4411.97	3717.41	4385.68	291.00	-26.29	95%	123%	103%	122%
12	M606 J1 NB on-slip from roundabout	2	3600	2135.01	1892.54	2034.79	2110.97	-100.21	218.43	59%	53%	57%	59%
13	M606 J1 NB from M62W	2	3600	1194.51	1080.96	1173.40	1112.65	-21.11	31.69	33%	30%	33%	31%
14	M606 J1 SB off-slip direct to M62E	1	1800	1788.98	2088.84	1835.52	2075.38	46.54	-13.46	99%	116%	102%	115%
15	M606 J1 SB off-slip to roundabout	2-3	3600	639.18	1069.28	844.70	1090.37	205.51	21.09	18%	30%	23%	30%
16	M606 J1 SB between off-slips	2	3600	1637.43	2323.13	1881.89	2310.31	244.46	-12.83	45%	65%	52%	64%
17	M606 J1 SB to M62W	2	3600	998.26	1253.86	1037.18	1219.94	38.93	-33.91	28%	35%	29%	34%
18	J26 circ. M606 NB on to M606 SB off	3	5400	1717.48	1952.25	1716.83	2122.55	-0.65	170.30	32%	36%	32%	39%
19	J26 circ. M606 SB off to M62 WB off slip	3	5400	913.50	1381.52	1089.68	1518.35	176.19	136.83	17%	26%	20%	28%
20	J26 circ. M62 WB off to A58E off	3	5400	2860.91	3499.43	3044.97	3675.50	184.06	176.08	53%	65%	56%	68%
21	J26 circ. A58E off to A638 off	4	7200	2425.59	2855.24	2610.54	2962.16	184.95	106.92	34%	40%	36%	41%
22	J26 circ. A638 off to M62 WB on slip	4	7200	2685.88	2895.26	2914.51	2977.72	228.63	82.46	37%	40%	40%	41%
23	J26 circ. M62 WB off to M62 EB on	4	7200	3361.05	3538.43	3644.65	3578.84	283.59	40.42	47%	49%	51%	50%
24	J26 circ. M62 EB on to A58W off	4	7200	3811.10	4253.70	4132.16	4271.03	321.05	17.33	53%	59%	57%	59%
25	J26 circ. A58W off to A58W on	4	7200	3192.89	3440.68	3055.39	3470.64	-137.50	29.96	44%	48%	42%	48%
26	J26 circ. A58W on to M606 NB on	4	7200	3831.50	3812.50	3727.08	4216.26	-104.42	403.76	53%	53%	52%	59%
27	M62 J26 EB slip on slip from roundabout	1	1800	1443.16	1640.01	1471.85	1694.55	28.68	54.54	80%	91%	82%	94%
28	M62 J26 EB slip direct from M606	2	3600	1788.98	2088.84	1835.52	2075.38	46.54	-13.46	50%	58%	51%	58%
29	M62 J26 EB merge no.1	1	1800	1368.79	1596.36	1399.10	1641.12	30.30	44.75	76%	89%	78%	91%
30	M62 J26 EB merge no.2	2-1	1800	1863.35	2132.48	1908.29	2128.82	44.94	-3.66	104%	118%	106%	118%
31	M62 EB mainline E of J26	3	5400	6705.06	7269.58	6791.90	7311.86	86.84	42.28	124%	135%	126%	135%
32	M62 WB mainline E of J26	4	7200	5945.52	7121.10	6010.63	7180.66	65.11	59.56	83%	99%	83%	100%
33	M62 WB off slip to J26	2-3	3600	1947.41	2117.91	1955.28	2157.15	7.87	39.24	54%	59%	54%	60%
34	M62 EB through J26	3	5400	3472.92	3540.73	3484.53	3541.94	11.61	1.20	64%	66%	65%	66%
35	M62 WB through J26	3	5400	3998.10	5003.20	4055.35	5023.50	57.24	20.30	74%	93%	75%	93%
36	M62 J26 WB on slip from roundabout	2	3600	411.21	422.52	384.93	448.31	-26.28	25.79	11%	12%	11%	12%
37	M62 J26 WB after merge from roundabout	2	3600	1409.47	1676.37	1422.12	1668.26	12.65	-8.12	39%	47%	40%	46%
38	M62 J26 WB merge no.1	1	1800	0.09	0.28	0.23	0.40	0.13	0.13	0%	0%	0%	0%
39	M62 J26 WB merge no.2	1	1800	1409.38	1676.10	1421.89	1667.86	12.51	-8.23	78%	93%	79%	93%
40	M62 WB mainline W of J26	4	7200	5407.57	6679.58	5477.46	6691.77	69.89	12.19	75%	93%	76%	93%
41	M62 EB mainline W of J26	4	7200	5117.48	5336.96	5145.44	5346.78	27.96	9.81	71%	74%	71%	74%
42	M62 EB off slip to J26	2	3600	1644.56	1796.24	1660.91	1804.84	16.35	8.60	46%	50%	46%	50%
43	M62 EB off slip to J26 roundabout	2	3600	450.05	715.28	487.51	692.19	37.46	-23.09	13%	20%	14%	19%
44	M606 N of J3 SB mainline	2	3600	1390.60	1708.46	1514.96	1674.00	124.37	-34.46	39%	47%	42%	46%
45	M606 N of J3 NB mainline	2	3600	1347.50	1235.08	1301.48	1315.92	-46.02	80.84	37%	34%	36%	37%

2043 Merge/diverge analysis

10.7.3.3 Again, the recommended layout standard is established for a given combination of mainline and merging/diverging traffic flows (vph).

10.7.3.4 As illustrated in Table 10.9 and Table 10.10, a small number of additional merge/diverge locations are expected to be operating below recommended standard by 2043.

10.7.3.5 In most cases, the recommended standard will be the same in the NLP and WLP scenarios apart from 2 specific locations in the AM peak only:

- M606 Junction 2 southbound on-slip merge
- M606 Junction 1 southbound off-slip to the roundabout

Table 10.9: Merge/diverge analysis – 2043 AM Peak

Description	Existing Type	AM NLP			AM WLP		
		Slip vph	ML vph	Standard	Slip vph	ML vph	Standard
M606 J3 NB off-slip	Diverge, 3C2	1371	1347	D	1326	1301	C
M606 J3 SB on-slip	Merge, 2B2	1885	1391	E	1997	1515	E
M606 J2 SB off-slip	Diverge, 2A2	186	3089	A	185	3327	A
M606 J2 NB off-slip	Diverge, 3A3	611	2719	A	581	2627	A
M606 J2 SB on-slip	Merge, 2A2	337	3089	A	390	3327	D
M606 J1 NB on-slip from roundabout	Merge, 2E3	2135	1195	E	2035	1173	E
M606 J1 SB off-slip direct to M62E	Diverge, 2A2	1789	1637	D	1836	1882	D
M606 J1 SB off-slip to roundabout	Diverge, 2A2	639	998	A	845	1037	C
M62 J26 slip direct from M606	Merge, 2D3	1789	1443	E	1836	1472	E
M62 J26 EB merge 1	Merge, 3E4	(1369	3473	E	(1399	3485	E
M62 J26 EB merge 2	Merge, 3E4	(1863	3473	E	(1908	3485	E
M26 WB off-slip to J26	Diverge, 4D3	1947	3998	D	1955	4055	D
M62 J26 WN on-slip from roundabout	Merge, 2B2	411	998	A	385	1037	A
M62 J26 WB merge 1	Merge, 3E4	(0	3998	A	(0	4055	A
M62 J26 WB merge 2	Merge, 3E4	(1409	3998	!	(1422	4055	E
M62 EB off-slip to J26	Diverge, 4E3	1645	3473	D	1661	3485	D
M62 EB off-slip to J26 roundabout	Diverge, 2A2	450	1195	A	488	1173	A

Table 10.10: Merge/diverge analysis – 2043 PM Peak

Description	Existing Type	AM NLP			AM WLP		
		Slip vph	ML vph	Standard	Slip vph	ML vph	Standard
M606 J3 NB off-slip	Diverge, 3C2	1538	1235	D	1631	1316	D
M606 J3 SB on-slip	Merge, 2B2	2721	1708	F	2650	1674	F
M606 J2 SB off-slip	Diverge, 2A2	48	4382	A	54	4270	A
M606 J2 NB off-slip	Diverge, 3A3	201	2773	A	276	2947	A
M606 J2 SB on-slip	Merge, 2A2	30	4382	A	116	4270	A
M606 J1 NB on-slip from roundabout	Merge, 2E3	1893	1081	E	2111	1113	E
M606 J1 SB off-slip direct to M62E	Diverge, 2A2	2089	2323	D	2075	2310	D
M606 J1 SB off-slip to roundabout	Diverge, 2A2	1069	1254	C	1090	1220	C
M62 J26 slip direct from M606	Merge, 2D3	2089	1640	F	2075	1695	F
M62 J26 EB merge 1	Merge, 3E4	(1596	3541	E	(1641	3542	E
M62 J26 EB merge 2	Merge, 3E4	(2132	3541	F	(2129	3542	F
M26 WB off-slip to J26	Diverge, 4D3	2118	5003	D	2157	5024	D
M62 J26 WN on-slip from roundabout	Merge, 2B2	423	1254	A	448	1220	A
M62 J26 WB merge 1	Merge, 3E4	(0	5003	A	(0	5024	A
M62 J26 WB merge 2	Merge, 3E4	(1676	5003	E	(1668	5024	E
M62 EB off-slip to J26	Diverge, 4E3	1796	3541	D	1805	3542	D
M62 EB off-slip to J26 roundabout	Diverge, 2A2	715	1081	A	692	1113	A

- 10.7.3.6 At the M606 Junction 2 southbound merge, the recommended layout increases from Layout A to Layout D, despite a relatively small change in merge and mainline vehicle demand. It is also noted that Layout A is also expected to continue to accommodate PM peak hour demands by 2043.
- 10.7.3.7 At the M606 Junction 1 southbound diverge towards the M62 roundabout, the recommended layout in the AM peak hour increases from Layout A to Layout C. Again, this change in recommendation results from a small change in downstream mainline demand (+39 vph) and it is also noted that Layout C would already be required in the PM peak hour in the NLP scenario.
- 10.7.3.8 The merge and diverge layouts referred to above are illustrated in Figure 10.9 and Figure 10.10 respectively.

Figure 10.9: Merge Layouts A and D

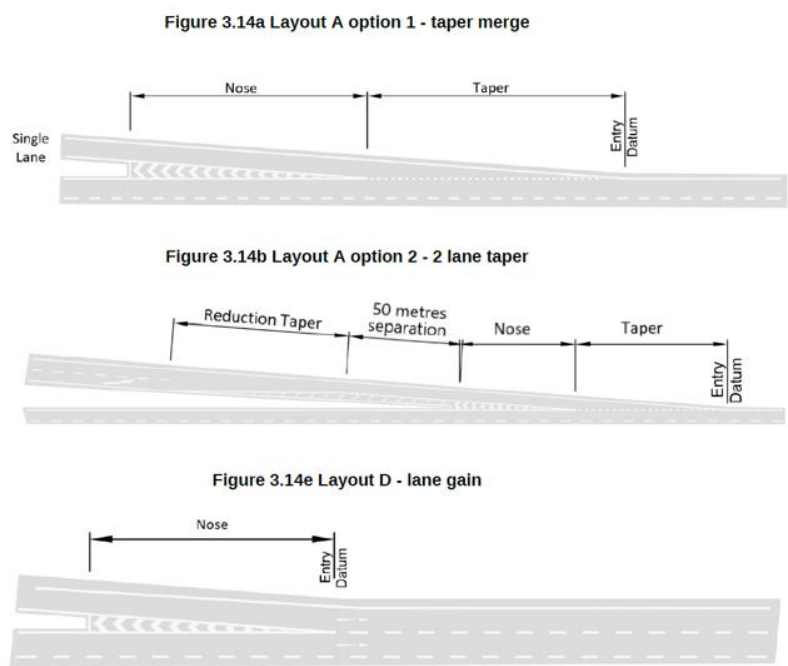
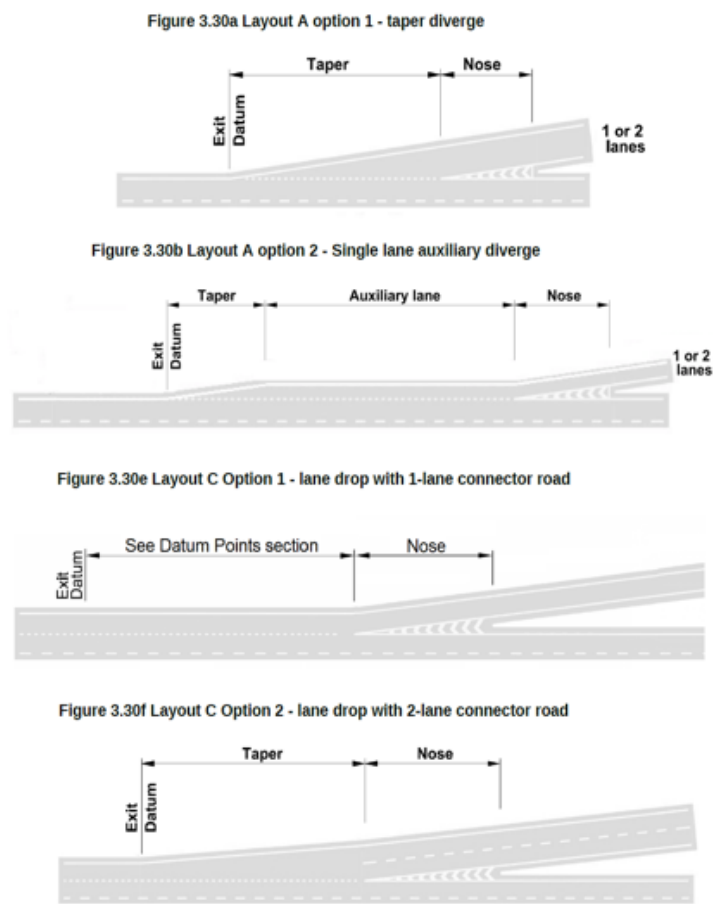


Figure 10.10: Diverge Layouts A and C



11 Proposed Mitigation

11.1 Introduction

- 11.1.1.1 This section of the report outlines the proposed mitigation following the assessment of the impacts arising from the Reg 19 Local Plan.

11.2 Rail, Bus and Active Travel

- 11.2.1.1 As set out in Chapter 9, the potential impact of growth associated with the Reg 19 Local Plan is expected to have very minimal impact on the public transport network by 2034. Therefore, no short-term mitigation is proposed.
- 11.2.1.2 The impact by 2043 is expected to comprise additional rail and bus passengers, with three rail links experiencing over-capacity services during AM and PM peaks. As described in Chapter 9, this service is expected to be at or over capacity by 2043 even in the NLP scenario, so it is not considered necessary to plan for mitigation specifically due to the Reg 19 Local Plan growth. The projected increase in crowding has been shared with the Rail Operator (Northern) for consideration.
- 11.2.1.3 As set out in Chapter 2, Reg 19 Local Plan policy TR2 requires new developments to provide a Transport Statement/Transport Assessment and Travel Plan, within which the developer must provide details on how the site will promote active travel and the use of public transport. It is envisioned that conditions will be attached to each consent to ensure delivery of these proposals.
- 11.2.1.4 A number of Reg 19 Local Plan sites already have planning permission in place, with conditions attached to the planning consents in a number of cases. Planning conditions which are relevant to the accessibility of Local Plan sites by public transport and active modes have therefore been factored into the analysis of necessary mitigation measures.
- 11.2.1.5 In combination with the Local Infrastructure Plan and this TA, bespoke mitigation measures will be developed for the vicinity of each site in an effort to encourage access of Reg 19 Local Plan sites by public transport and active travel once developments have been delivered.
- 11.2.1.6 In some cases, mitigation measure may impact on several sites simultaneously i.e. those located along a proposed bus route. In such scenarios it is envisaged that this would strengthen the strategic need for a mitigation measure to be delivered, whilst also increasing the amount of Section 106 funding that could be secured in order to fund such improvements.

- 11.2.1.7 The proposed mitigation measures have not been costed at this stage. However, given the relatively small scale of the measures proposed, it is envisaged that the majority of measures will be fundable through Section 106 contributions.

11.3 Highways

11.3.1 Mitigation in the Short-Term (2034)

- 11.3.1.1 Short-term mitigation will focus on those junctions identified in the assessment of forecast traffic conditions in 2034. These are listed in Table 11.1, along with the current junction type.

Table 11.1: Junctions identified for short-term mitigation by 2034

Node	Location	District	Potential mitigation
11755	A658 Harrogate Rd/New Line	Bradford	TBC: the station access is improved to provide access to the Esholt employment site and the feasibility of providing 2 continuous northbound lanes between the New Line junction and Esholt to be explored
11783	A658 Harrogate Rd/Apperley Rd/Parkin La	Bradford	
16475	A658 Harrogate Rd/Apperley La	Bradford	
41418	A658 Harrogate Rd/Apperley Station access	Bradford	
16474	Apperley Rd/Apperley La	Bradford	
11727	A658 Harrogate Rd/Leeds Rd	Bradford	TBC: potential for 2 lanes in each direction on A658 between Leeds Rd junctions
11553	A641 Huddersfield Rd/Rooley Ave	Bradford	Update of this section of the A641 corridor is expected to be delivered through the Transforming City Regions fund – including Active Travel connections between A641 and Low Moor station and NCN66
11469	A641 Huddersfield Rd/ Netherlands Ave	Bradford	
11470	A641 Huddersfield Rd/Common Rd	Bradford	
11476	A641 Huddersfield Rd/Abb Scott La/New Works Rd	Bradford	
41235	Hillings La/Bingley Rd S	Leeds	TBC in consultation with Leeds: potential change in priority in favour of the movement between two Bingley Rd approaches

Node	Location	District	Potential mitigation
13116	A650 Bradford Rd/Mercure Hotel	Bradford	TBC: combination of traffic signal optimisation and widening of hotel exit to 2 lanes
11714	A6177 Killinghall Rd/Leeds Old Rd	Bradford	TBC
11648	Cutler Heights La/Broad La/Tyersal La	Bradford	Signalisation of the Cutler Heights Lane/Broad Lane/Tyersal Lane has been agreed in relation to nearby Tyersal Lane housing site (Leeds Planning, 26/00217/OT)
11465	A641 Manchester Rd/St Stephens Rd/Ransdale Rd	Bradford	TBC
31541	M62/M606; Bradford Rd approach	Kirklees	Form of mitigation to be agreed between the Land at NuFarm developer and Kirklees/National Highways when the planning application is considered
21559	A58 Leeds Rd/A644 Brighouse Rd (Calderdale)	Calderdale	TBC in consultation with Calderdale: small increase in traffic in WLP scenario

11.3.1.2 Where delivery of the R19 Local Plan is forecast to increase congestion at junctions in neighbouring boroughs, appropriate mitigation will be sought through consultation.

11.3.1.3 Resilience will be built in if any of the above junctions continue to appear on the list of junctions identified in the analysis of traffic conditions in 2043.

11.3.2 Mitigation in the Longer Term (2043)

11.3.2.1 The exact form of mitigation that might be required at other junctions by 2043 is more difficult to predict. It is proposed that traffic levels at each of the locations in Table 11.2 is monitored as developments are brought forward.

11.3.2.2 The Council will commit to a programme of bi-annual surveys at each location and, as above, monitoring of neighbouring junctions will be agreed through appropriate consultation.

Table 11.2: Junctions identified for longer term monitoring

Node	Location	Comments
12059	John St/Darley St/North Parade	Update of the John Street/Darley Street junction will be included in the Bradford City Village Phase 1 works, for which the Council is currently seeking Transforming City Regions funding
12274	Bridge St/Vicar La	-
12284	Shipley-Airedale Rd/ Barkerend Rd	-
12291	Barkerend Rd/Otley Rd	-
13014	A644/High St, Queensbury	-
12892	A629, Silsden roundabout	The council is seeking Transforming City Region funding for improvements at the A629 Silsden roundabout; including Active Travel solutions between Steeton and Silsden
12705	A650 Hard Ings Rd/ Lawkholme La, Keighley	-
45115	Otley Rd/Bradford Rd (Guiseley)	Leeds district
45154	A6120 Leeds ORR/Rodley La	Leeds district
41354	A658 Harrogate Rd/Bayton La, Yeadon	Leeds district
41353	A65 New Rd/Henshaw La	Leeds district
42945	A658 Apperley La/Micklefield La	Leeds district
42937	A6038 Hollins Hill/B6153 Park Rd	Leeds district
24887	A629 Keighley Rd/Per La/Cow Hill Gate La	Calderdale district
75092	A629 Skipton Rd; Crosshills rbt	North Yorkshire

11.3.3 Developer Contributions

- 11.3.3.1 As developments pass through the planning system and are approved for construction, some will be required to contribute to the wider mitigation requirements of the R19 Local Plan, in addition to their own access arrangements.
- 11.3.3.2 Select link analysis of affected junctions and turning movements has been used to identify those zones, and the R19 Local Plan allocations within those zones, that make the greatest contribution to the difference between NLP and WLP conditions.
- 11.3.3.3 However, this approach has not led to the identification of a link between mitigation and individual allocation sites as only the cumulative impacts of developments have been assessed at specific years, not necessarily at the time that individual sites will come forward. Although it is not unreasonable to assume that the Esholt site contributes to impacts seen on the A658 Harrogate Road, it has not been possible to isolate the contributions of other sites in the north-east of the District. At other locations, it has not been possible at this stage to draw conclusions on possible developer contributions and any contributions would need to be appropriate.
- 11.3.3.4 Funding for works will be agreed and secured in part via Section 106/278 contributions following review of individual Transport Assessments submitted as part of the planning application for each site.

11.4 Strategic Road Network Mitigation

11.4.1 Short-term

- 11.4.1.1 Any mitigation proposals focus on changes in traffic conditions in 2034. Furthermore, it is assumed that traffic levels in the NLP scenario have previously been committed and that only those links or slip roads made worse in the WLP scenario will be considered for mitigation.
- 11.4.1.2 By 2034, it is forecasted that there will be 3 links associated with the M606 that will have increases in V/C over 85% in the AM peak and 3 links associated with the M62 in the PM peak. Despite increased V/C on M606 links in the WLP scenario, the traffic levels remain below those in the NLP scenario in the PM peak hour, which are expected to be operating in excess of 100%. On the M62 links, although the predicted V/C in the WLP are increased, they remain no higher than 90%.
- 11.4.1.3 The difference in merging and diverging flows between the NLP and WLP scenarios is relatively low and there are no locations where the WLP demand is such that an improvement over the NLP layout is recommended.
- 11.4.1.4 As such, no mitigation on the SRN network is proposed by 2034.

11.4.2 Longer term

- 11.4.2.1 By 2043, vehicular traffic flows are expected to continue to increase and, particularly in the southbound direction on the M606, more links are expected to operate above theoretical capacity in the AM peak.
- 11.4.2.2 We have also noted that there are 2 locations on the M606 network where the recommended merge/diverge layout differs between the NLP and WLP scenarios in 2043.
- 11.4.2.3 In each case, this is partly a function of the R19 Local Plan including more residential sites, and associated workers, than jobs by 2043 leading to 'out commuting' from Bradford. Depending on the location of residential sites, and the proximity to public transport hubs, this is likely to result in an increase in demand for car travel.
- 11.4.2.4 Given the level of uncertainty in forecast traffic conditions by 2043, linked both to housing locations and potential delivery of Bradford's new railway station and West Yorkshire's mass transit proposals, it is difficult to predict the exact form of mitigation on the SRN that is likely to be required.
- 11.4.2.5 Conditions will be monitored in the longer term and, particularly, as development applications are registered that are expected to impact on the SRN. Ongoing review and modelling will provide more certainty on mitigation requirements as delivery of the R19 Local Plan takes shape.

12 Carbon Impact and Air Quality

12.1 Introduction

12.1.1.1 This chapter looks at carbon impacts and air quality impacts as a result of the R19 Local Plan growth.

12.2 Carbon Impacts

12.2.1.1 The approach for estimating and quantifying the Carbon Impacts of the Bradford R19 Local Plan uses the Department for Transport (DfT) Vehicle Emissions Carbon Tool (VECAT).

12.2.1.2 This approach has been chosen for a number of reasons:

- The spreadsheet-based tool has been developed by DfT and is widely used across project appraisal.
- It is simple to use and easily links to the SATURN model

12.2.1.3 VECAT undertakes emissions calculations drawing on a range of assumptions (defined in the DfT TAG data book) relating to:

- Change in vehicle fleet composition through time
- Emissions factors by vehicle type (petrol, diesel) and engine size
- Ratio of OGV 1 / OGV 2 (sub-categories of heavy goods vehicles depending on number of axles)

12.2.1.4 The key outputs (for each year in the 60-year appraisal period) are as follows:

- Annual vehicle kilometres travelled, VKT, (without scheme, with scheme, differences) by vehicle type, fuel type, time period
- Annual Emissions (without scheme, with scheme, differences) by vehicle type, fuel type, time period

12.2.1.5 Two scenarios have been run through the Bradford SATURN Model (BSTM) to provide the required inputs to VECAT:

- 'No Local Plan' – 2034 and 2043
- 'With Local Plan' – 2034 and 2043

12.2.1.6 Outputs are provided for vehicle kilometres travelled (within Bradford), tonnes CO₂ emitted (within Bradford) for all vehicles, cars, light vehicles and heavy vehicles separately. Buses account for less than 1% of total vehicles so are not presented separately.

12.2.1.7 Figures are provided for 2034 and 2043, and the full 60-year appraisal period (2034 to 2093) as shown in the below tables.

Table 12.1: All vehicles - emissions and VKT

	Vehicle Kilometres (000s)			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
No LP	2,857,392	3,064,185	182,865,084	381,023	270,625	15,370,924
With LP	2,872,610	3,131,745	186,657,074	382,042	272,982	15,475,544
Diff (with)	15,219	67,560	3,791,990	1,019	2,357	104,620
% diff (with)	0.5%	2.2%	2.1%	0.3%	0.9%	0.7%

Table 12.2: Cars - emissions and VKT

	Vehicle Kilometres (000s)			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
No LP	2,426,767	2,595,250	154,913,598	205,133	105,543	5,668,979
With LP	2,444,168	2,666,502	158,919,549	206,796	108,768	5,823,386
Diff (with)	17,402	71,251	4,005,951	1,663	3,225	154,408
% diff (with)	0.7%	2.7%	2.6%	0.8%	3.1%	2.7%

Table 12.3: LGV - emissions and VKT

	Vehicle Kilometres (000s)			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
No LP	219,151	250,389	14,870,766	29,179	22,438	1,262,977
With LP	218,031	248,702	14,772,357	29,047	22,328	1,256,813
Diff (with)	-1,120	-1,687	-98,409	-131	-110	-6,164
% diff (with)	-0.5%	-0.7%	-0.7%	-0.4%	-0.5%	-0.5%

Table 12.4: HGV - emissions and VKT

	Vehicle Kilometres (000s)			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
No LP	186,574	193,798	11,594,481	128,677	124,604	7,369,897
With LP	185,527	191,810	11,479,893	128,149	123,779	7,322,526
Diff (with)	-1,047	-1,988	-114,588	-529	-825	-47,371
% diff (with)	-0.6%	-1.0%	-1.0%	-0.4%	-0.7%	-0.6%

Table 12.5: Cars as % of total emissions and VKT

	Vehicle Kilometres (000s)			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
No LP	84.9%	84.7%	84.7%	53.8%	39.0%	36.9%
With LP	85.1%	85.1%	85.1%	54.1%	39.8%	37.6%

12.2.1.8 In summary:

- Over a 60-year period, the R19 Local Plan is forecast to increase vehicle kilometres by around 2% and transport generated CO₂ emissions by around 0.7% - this difference is due to the fact that whilst the majority of the VKT change is due to additional car trips, car trips produce much lower emissions per kilometres (compared to LGVs and HGVs in particular) resulting in a lesser increase in emissions.
- At a user class level, there is forecast to be small (less than 1%) decreases in LGV and HGV vehicle kilometres travelled and transport generated CO₂ emissions over a 60-year period, balanced by a 2.5% increase in car VKT and emissions over the 60-year period
- Through time, the car contribution to VKT remains broadly similar (85%) however the car contribution to emissions declines from 54% (2034) to around 37% for the whole appraisal period (and 30% in 2094 – end of 60 yr appraisal period) due to the car fleet having a faster rate of transition from ICEs to hybrid and electric vehicles compared to LGVs and HGVs.

12.2.1.9 A copy of the Carbon Impact technical note, produced by WYCA on behalf of the Council, is included at Appendix E.

12.3 Air Quality

- 12.3.1.1 An in-depth air quality assessment (provided as Appendix F) demonstrates that the implementation of the R19 Local Plan is likely to result in limited impacts on air quality within the district in 2034, however by 2043 there will be more substantial impacts. These findings should be considered in the context of continuing reductions in vehicle emissions and the likelihood that overall air quality will improve compared with current conditions.
- 12.3.1.2 In 2034, the R19 Local Plan is not predicted to cause large air quality impacts. Traffic volume changes across the vast majority of the district road network remain well below the 1,000 AADT screening threshold, and changes within the CAZ and AQMAs are minor. Where traffic changes exceed the IAQM screening threshold, these locations may warrant further assessment as individual developments come forward or when any future strategic transport solutions are being developed, particularly where sensitive receptors are present.
- 12.3.1.3 In 2043, cumulative R19 Local Plan-related growth across the district results in more extensive traffic increases, with several key corridors exceeding the screening thresholds. However, the R19 Local Plan also introduces traffic reductions on some links, which will deliver meaningful air quality benefits to sensitive receptors. The results identify locations where air quality considerations may need to be incorporated into future transport planning and project-level assessments, allowing any necessary mitigation measures to be identified and implemented.

13 Conclusions

13.1 Introduction

13.1.1.1 This chapter provides a summary of the Transport Assessment's conclusions in relation to the cumulative impact of the projected population and jobs growth outlined within Bradford's the R19 Local Plan. The assessed impacts, using an evidence-based approach, include those on the highway and public transport network and intend to demonstrate that the R19 Local Plan is sound and justified. The R19 Local Plan's proposals have been assessed against national and local planning policies.

13.2 Study Approach

13.2.1.1 The Transport Assessment involved:

- Analysis of the existing public transport, active travel and highways network.
- Update and integration of the Bradford Transport Model and West Yorkshire Transport Model.
- Creation of the “No Local Plan” scenario and “With Local Plan”, providing different levels of growth to be tested by the traffic model.
- Assessment of growth impacts across both scenarios for interim year 2034 and final year 2043.
- Analysis of potential mitigation in the short term (2034) and long term (2043) across the different transport networks.

13.3 Public transport networks assessment

13.3.1.1 The growth from the R19 Local Plan was found to have a minimal impact on the public transport network. In 2034 there was a growth in bus and rail passengers which could be absorbed into the existing network capacity.

13.3.1.2 In 2043 it was noted that R19 Local Plan growth was likely to increase rail passenger numbers in the AM and PM peak to exceed capacity (100%+) on a single rail link in the AM and PM peak, though this exceedance of capacity was projected to take place even in the NLP scenario. These figures have been shared with the relevant rail operator for their forward planning.

13.4 Highway network assessment

13.4.1.1 In the short term to 2034, the modelling has identified that the main nodes affected by additional R19 Local Plan traffic demand are located close to the major development site planned at Esholt, Apperley Bridge. There is also a cluster of junctions along A641 Huddersfield Road, near Low Moor, where additional delay is expected and it is in these parts of the network where some form of mitigation will be focussed.

13.4.1.2 Other notable locations where a significant increase in delay is forecast, and where mitigation will need to be considered, are:

- A650 Bradford Road/Mercure Hotel junction, west of Saltaire
- A6177 Killinghall Road/Leeds Old Road junction
- Cutler Heights Lane/Broad Lane/ Tyersal Lane junction
- A641 Manchester Rd/St Stephen's Rd/Ransdale Rd junction
- A58 Leeds Rd/A644 Brighouse Rd, Calderdale

- 13.4.1.3 By 2043, other areas of the District will start to experience increases in delay both with and without impact of additional R19 Local Plan allocations and resilience will be built into the mitigation of any of the above junctions to accommodate continued growth in demand by 2043.
- 13.4.1.4 As set out in Chapter 10, the exact form of mitigation that might be required at other junctions by 2043 is more difficult to predict. It is proposed that traffic levels at each of the following locations is monitored as developments are brought forward. The Council will commit to a programme of bi-annual surveys at each location and monitoring of junctions in neighbouring authorities will be agreed through appropriate consultation.

13.4.2 Strategic Road Network

- 13.4.2.1 By 2034, no mitigation is proposed for the SRN. By 2043, vehicular traffic flows are expected to continue to increase and, particularly in the southbound direction on the M606, more links are expected to operate above theoretical capacity in the AM peak. There are also 2 locations on the M606 network where the recommended merge/diverge layout differs between the NLP and WLP scenarios in 2043.
- 13.4.2.2 Given the level of uncertainty in forecast traffic conditions by 2043, it is difficult to predict the exact form of mitigation on the SRN that is likely to be required. Ongoing review and modelling will provide more certainty on mitigation requirements as delivery of the R19 Local Plan takes shape.

13.5 Carbon Impacts and Air Quality

- 13.5.1.1 By the end of the R19 Local Plan period there is expected to be a slight reduction in emissions from commercial vehicles, largely a result of changes in vehicle fleet composition over time and a move towards use of less polluting vehicles. A small increase in car emissions by 2043 is, however, predicted from an increase in car vehicle kms travelled by journeys made to/from new R19 Local Plan sites.
- 13.5.1.2 An in-depth assessment of Air Quality demonstrates that growth associated with the R19 Local Plan is likely to result in limited impacts on air quality within the district in 2034, however by 2043 there will be more substantial impacts.

Appendices

Appendix A - 2023 Bradford highway traffic model (BTM) update and model validation

Bradford SATURN Model Development

Background

The existing Bradford highway assignment model (SATURN) had a Base Year of 2018. The Council sought to update the model to represent traffic conditions in Spring 2023 which would, primarily:

- be consistent with the WYCA Mass Transit model (WYTM) base year,
- represent the City Centre network prior to completion of the Transforming Cities Fund (TCF) works, and
- form the basis for the Bradford Local Plan Regulation 19 assessment.

Data sources

The following data sources have been used to inform update of the Bradford model:

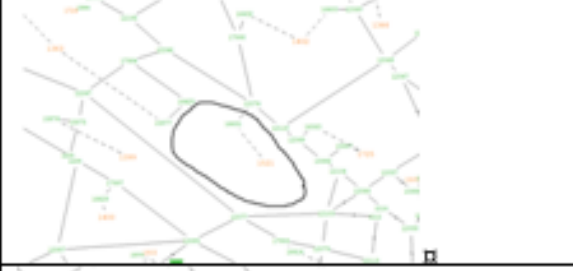
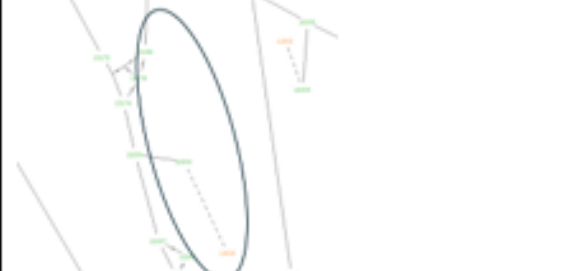
- 2018 Bradford Strategic Traffic Model (BSTM) network
 - It is noted that the WYTM covers the whole of West Yorkshire and incorporates the 2018 coding for Bradford
- WYCA 2023 demand matrices (highways)
- WYCA 2023 traffic counts
 - A combination of automatic traffic count (ATC) and manual classified turning count (MCTC) data, from Spring 2023
- Other miscellaneous counts
 - Annual Bradford City Centre cordon surveys (AM/PM peak only)
 - Keighley Transport Study surveys (May 2024)
 - DfT WebTris
 - Other ad hoc surveys
- WYCA 2023 journey time data

Network development

The updated base network is derived from the 2018 BSTM network. The network has undergone a thorough check on coding and expanded, where necessary, to include changes to the network that have been introduced between 2018 and 2023.

Zoning and connections

Following review, relatively few changes to base year zoning/connections have been made. The 6 changes are summarised below.

	Zone-1366-and-1725 —City-Centre-north.¶ Connections-both-amended-to-better-reflect-access-north-and-south-of-Drewton-Road.▯
	Zone-1521 —Chain-Street-area.¶ A-new-spigot-off-Sunbridge-Road-has-been-added-to-represent-the-Wigan-Street-connection-to-this-area.▯
	Zone-1312 —area-around-Valley-Parade.¶ A-new-spigot-off-Manningham-Lane-has-been-added-to-represent-a-connection-at-Cornwall-Road.▯
	Zone-1406 —car-showrooms, east-of-Canal-Road.¶ Coding-has-been-amended-to-reflect-actual-connection-further-north-to-Kings-Road.▯
	Zone-1478 —large-Undercliffe-zone.¶ Revised-coding-to-reflect-connection-to-Undercliffe-Lane-only, rather-than-also-connecting-north-of-A658.▯

Checks on junction coding

Detailed checks on the coding of network junctions have focussed on key areas of the District such as Bradford (city centre and surrounding areas), Shipley, Keighley, Bingley and the Wharfedale corridor.

The majority of changes made were relatively minor and reflect updates to coding of elements such as lane use and flare lengths, plus changes associated with the revised zoning indicated above.

The most significant changes can be summarised as:

- Change Valley Road to northbound operation only and associated recoding of the junction with Queen's Rd/Bolton La,
- Change to coding of A658 Harrogate Road/A657 New Line junction to include the new southbound connection between Harrogate Road and New Line,
- Update to coding of M62/M606 Chain Bar junction to include 3-lane approach on slip road to roundabout from M62 westbound and revision to southbound slip road length at M606 Junction 2,
- Coding the new cut-through at the A650 Wakefield Road/New Hey Lane roundabout,
- Change coding of Leeds Road/Buck Street to allow all moves,
- Change to mini-roundabout at the junction of Sunbridge Road with City Road,
- Change to mini-roundabout at the junction of Mill Lane with Nelson Street,
- Change coding of the entrance to the Airedale Centre Car Park in Keighley, and
- Change to signal control at the junction of Ferncliffe Rd and Main Street, in Bingley.

Checks on link lengths

A check has been carried out to confirm that all links are coded with the same length in each direction of travel. No errors were found.

Checks on HGV restrictions

A total of 24 heavy vehicle restrictions were included in the 2018 network and each has been checked to confirm that the restriction remains in place in 2023.

The only change made relates to a rural road to the south of Tong village where a combination of three localised closures resulted in access for HGVs to a zone being restricted as a result of the network definition in that area. The restriction on Tong Lane, between New Lane and Bradford Road, has been lifted (in the model) to overcome the fatal error reported.

20 mph zones

Since 2018, a 20mph zone has been introduced in Shipley, and the model has been updated with a change to free flow speeds (to 32kph) and CI for all links affected.

Routes to the south of Keighley Town Centre have also been recoded to reflect the posted 20mph speed limit.

Bus route information

The coding of bus routes in the model network has been reviewed in terms of location, route definition and frequency of service. All services operating entirely outside the

Bradford district boundary have been retained as coded in the 2018 network. As such, detailed checks are only carried out on Bradford routes.

For services operating in Bradford, a check on routing has been carried out against latest 2025 service mapping, with additional adjustments made to reflect older routing through the City Centre prior to the Transforming Cities Fund works (completed late 2023). Service frequency has also been checked against each time period and updated where appropriate.

Additional updates

For consistency with WYTM, the following adjustments have also been made.

- The PM peak has been changed from 17:00-18:00 to 16:30-17:30.
 - Note: this is not only for compliance with the WYTM but is also supported by analysis of Bradford's annual cordon count data.
- VoT/VoC parameters have been updated to 2023 values in accordance with values adopted for the WYTM.

Matrix Development

The WYTM 2023 highway demand matrices have 2055 zones, covering the whole of West Yorkshire and beyond. There are 3 time periods (AM, IP, PM) and 5 user classes (Car – business, Car – commuting, Car – other, LGV and HGV).

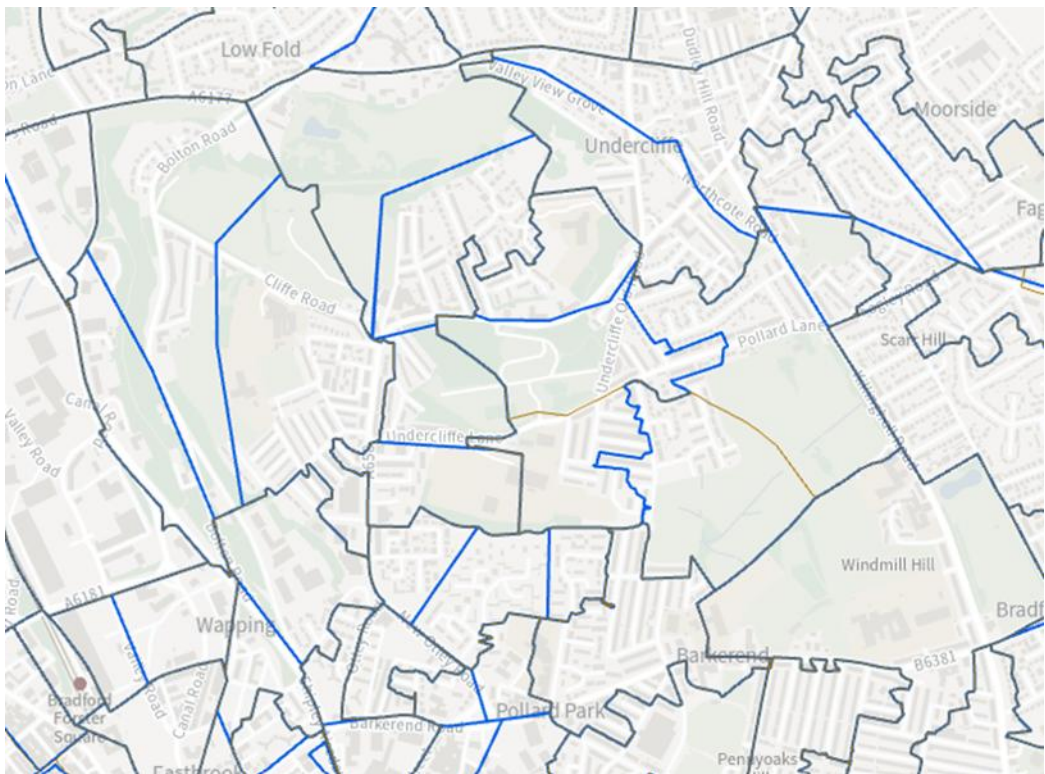
The Bradford model (BSTM) has only 1100 zones, so a conversion was required. Although the zoning in some parts of the district is more detailed within the Bradford model, the difference in the total number of zones largely relates to WYTM having greater zone detail in Leeds, Halifax, Huddersfield and Wakefield.

Each WYTM zone has been reviewed and either allocated to a specific Bradford zone (1-1 or amalgamation of WYTM zones) or identified for zone splitting. A total of 204 WYTM zones are split into multiple BSTM zones.

For each split zone, the proportion of trips to and from that zone are allocated to each relevant BSTM zone. The percentage has been estimated by eye, based on the distribution of activity within a zone, rather than an adopting an automated process based on area alone.

The same process for conversion between WYTM and BSTM zones has been followed for both the base year matrices and subsequent future year matrices, with and without Local Plan.

Figure 1: Example showing mix of WYTM zones (brown) and Bradford zones (blue)



Performance of the Prior Matrix

The prior matrix used to upgrade the BSTM has been provided by WYCA and is consistent with the prior matrix used in development of their 2023 WYTM and as the basis for current WY Mass Transit forecasts.

Following conversion from 2055 zones (WYTM) to 1100 zones (BSTM) this prior matrix has been assigned to Bradford’s highway network using SATURN and assigned traffic volumes have been compared to observed count data across cordons and screenlines (defined previously) and at miscellaneous additional locations across the district. It should be noted that, trips between external zones to the south and west of West Yorkshire (i.e. Manchester, Sheffield, South Yorkshire) which would not pass through the Bradford network have been masked from the demand matrix prior to assignment.

The TAG criterion for total screenline flows, as a check on the validity of the trip matrices, is that total modelled flows on all links crossing a screenline should be within 5% of the observed totals.

Table 1 and Table 2 provide summary results of total screenline flow comparisons for Cars and All Vehicles respectively.

Table 1: Summary Screenline Flow Comparisons - prior matrix – Cars

Cars: Modelled v Observed	AM Peak		PM Peak	
	No. of screenlines	% of screenlines	No. of screenlines	% of screenlines
<5% difference	9	39%	10	43%
<10% difference	16	70%	17	74%
<20% difference	20	87%	20	87%
Total Screenlines	23		23	

Table 2: Summary Screenline Flow Comparisons - prior matrix – All vehicles

All Vehicles: Modelled v Observed	AM Peak		PM Peak	
	No. of screenlines	% of screenlines	No. of screenlines	% of screenlines
<5% difference	12	52%	13	57%
<10% difference	19	83%	17	74%
<20% difference	22	96%	21	91%
Total Screenlines	23		23	

Although these results are better than often achieved by a prior matrix, they do demonstrate that the 5% difference criterion is not met for cars or all vehicles in either the AM or PM peak and still falls short of the 85% target for flow differences less than 10%. A small number of screenlines also have a flow difference in excess of 20%.

TAG criterion further suggests that 85% of all available counts within the model should meet GEH of flow criteria.

Table 3 provides a summary of the individual count performances used in the development of the highway model for each time period for cars and total vehicles.

Table 3: Summary of individual link count comparisons, modelled v observed – prior matrix

Measure	AM Peak		
	Total Link Counts	Cars	All Vehicles
No. of links meeting GEH or flow criterion	549	313	287
% of links meeting GEH or flow criterion		57%	52%
Measure	PM Peak		
	Total Link Counts	Cars	All Vehicles
No. of links meeting GEH or flow criterion	549	303	289

% of links meeting GEH or flow criterion		55%	53%
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Again, although better than often achieved by a prior matrix, the results indicate that TAG criteria are not met, with only 53-57% of links meeting the GEH or flow criterion in either peak.

These initial results demonstrate that the overall screenlines and individual count performances do not sufficiently meet required TAG criteria for the AM or PM Peak time periods and that further refinements to the matrix to match flows across the network is required.

Refinements to the Prior Matrix

Aside from the masking of external trips discussed earlier, the only adjustment made to the WYCA prior matrices has been to factor trips into and out of specific zones where the zone represents an arm of a junction for which a classified turning count is available. This affects only 8 out of 1100 zones in the modelled area.

These represent minor adjustments only which is reflected in Table 4 which provides totals for the Prior and adjusted matrix by user class for each of the AM and PM peak.

Table 4: Matrix totals, by class, before and after manual prior matrix adjustments

User Class	User Class Definition	AM Peak			PM Peak		
		Initial Prior	Adjusted Prior	%diff	Initial Prior	Adjusted Prior	%diff
UC1	Car business	39265	39305	0.1%	47346	47402	0.1%
UC2	Car commute	259171	259490	0.1%	225841	226204	0.2%
UC3	Car Other	214668	215879	0.6%	296706	297886	0.4%
	All cars	513104	514674	0.3%	569893	571491	0.3%
UC4	LGV	63881	63985	0.2%	54370	54468	0.2%
UC5	HGV	68498	68491	0.0%	40542	40551	0.0%
	Total	645483	647150	0.3%	664805	666511	0.3%

Matrix Estimation (ME)

After reviewing the performance of the prior matrix, the trip matrices have been subject to a process of matrix estimation whereby adjustments are made such that the resulting assigned flows better represent observed traffic conditions.

Matrix estimation in SATURN (SATPIJA/SATME2) has been run over 6 loops with paths from adjusted matrices at the end of each loop used to refine the matrix in subsequent loops. Traffic count data has been segmented into cars, LGVs and HGVs and matrix estimation has been performed separately on each vehicle class.

Default SATURN parameters have been used to limit the extent to which trip patterns in the prior matrix can be distorted in the matrix estimation process and acceptability guidelines for the extent to which the resulting matrix should correspond with the prior matrix are set out in TAG and repeated here.

- Matrix cell values Slope (0.98-1.02), intercept near zero, R2 >0.95
- Matrix trip ends Slope (0.99-1.01), intercept near zero, R2 >0.98
- Trip length distributions Means <5%, standard deviations <5%

Although there is no guidance on the sale of change resulting from matrix estimation, Table 5 does provide a summary comparison of demand totals prior and post-ME for each user class.

Table 5: Matrix totals, by class, before and after matrix estimation

User Class	User Class Definition	AM Peak			PM Peak		
		Prior	Post-ME	%diff	Prior	Post-ME	%diff
UC1	Car business	39305	38473	- 2.1%	47402	46769	-1.3%
UC2	Car commute	259490	257440	- 0.8%	226204	225886	-0.1%
UC3	Car Other	215879	216953	0.5%	297886	299185	0.4%
	All cars	514674	512867	- 0.3%	571491	571841	0.1%
UC4	LGV	63985	63175	-1.3%	54468	53752	-1.3%
UC5	HGV	68491	67949	- 0.8%	40551	40283	-0.7%
	Total	647150	643991	- 0.5%	666511	665876	-0.1%

Table 5 shows relative differences as a result of the matrix estimation process with the biggest change being a modest switch from 'Car business' to 'Car Commute' in each of the AM and PM peak models.

Changes in trip patterns

Comparing individual matrix cell values provides a check on the extent that trip patterns in the post-ME matrix remain consistent with patterns in the prior matrix.

Regression statistics are presented in Table 6 for all cells, excluding intrazonal movements. As indicated above, the guidance states that the regression trendline should have a gradient between 0.98 and 1.02, an intercept close to zero and a R2 value greater than 0.95.

The regression statistics for matrix cell values shown in Table 6 demonstrate that trip patterns post-ME remain consistent with the prior matrix.

Table 6: Matrix estimation – changes in matrix cell values

User Class	Metric	AM Peak	PM Peak
UC1	Gradient	1.000	1.000
	Intercept	0.001	0.001
	R ²	1.000	1.000
UC2	Gradient	1.000	1.000
	Intercept	0.002	0.001
	R ²	1.000	1.000
UC3	Gradient	1.000	1.000
	Intercept	-0.001	0.000
	R ²	1.000	1.000
Cars (UC1-UC3)	Gradient	1.000	1.000
	Intercept	0.001	0.001
	R ²	1.000	1.000
LGV (UC4)	Gradient	1.000	1.000
	Intercept	0.001	0.001
	R ²	1.000	1.000
HGV (UC5)	Gradient	1.000	1.000
	Intercept	0.000	0.000
	R ²	1.000	1.000

Changes in trip ends

Similar comparisons have been between the trip ends of the prior and post-ME matrices. Again, the guidance states that the regression trendline should have a gradient between 0.99 and 1.01, an intercept close to zero and a R2 value greater than 0.95.

The regression statistics presented in Table 7 show a relatively good fit with both the gradient and R2 close to 1.00 as well and low intercept values for most user classes. The highest intercept is shown for car trips in each time period, particularly for UC3 (Car – Other) trips ends.

Table 7: Matrix estimation – changes in matrix trip ends

User Class	Trip End	Metric	AM Peak	PM Peak
UC1	Origin	Gradient	1.012	1.011
		Intercept	0.228	0.272
		R ²	1.000	1.000
	Destination	Gradient	1.014	1.014
		Intercept	0.275	0.144
		R ²	1.000	1.000
UC2	Origin	Gradient	1.002	1.002
		Intercept	1.502	0.082

			R ²	1.000	1.000
		Destination	Gradient	1.003	1.002
			Intercept	1.209	0.087
UC3			R ²	1.000	1.000
		Origin	Gradient	1.004	1.009
			Intercept	-1.772	-3.147
			R ²	1.000	1.000
		Destination	Gradient	1.004	1.007
			Intercept	-1.669	-2.455
Cars (UC1-UC3)			R ²	1.000	1.000
		Origin	Gradient	1.003	1.006
			Intercept	0.097	-2.255
			R ²	1.000	1.000
		Destination	Gradient	1.004	1.006
			Intercept	-0.276	-2.114
LGV (UC4)			R ²	1.000	1.000
		Origin	Gradient	1.001	1.003
			Intercept	0.671	0.626
			R ²	1.000	1.000
		Destination	Gradient	1.003	1.003
			Intercept	0.570	0.619
HGV (UC5)			R ²	1.000	1.000
		Origin	Gradient	1.003	1.000
			Intercept	0.285	0.287
			R ²	1.000	1.000
		Destination	Gradient	1.001	1.003
			Intercept	0.428	0.134
			R ²	0.999	1.000

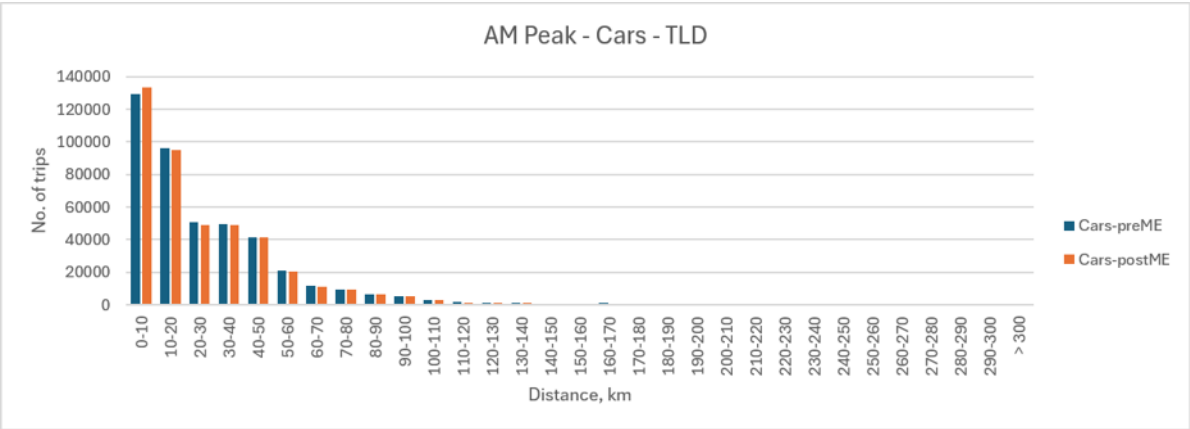
Trip Length Distribution

Trip Length Distribution presents a measure of the extent to which the length of trips has been affected by the matrix estimation process.

A series of plots have been produced comparing the trip length distribution for the pre and post estimated matrices for all user classes which illustrate that there is relatively little change in the trip length distribution and therefore that the effects of matrix estimation on trip length distributions are minimal for cars, LGVs and HGVs.

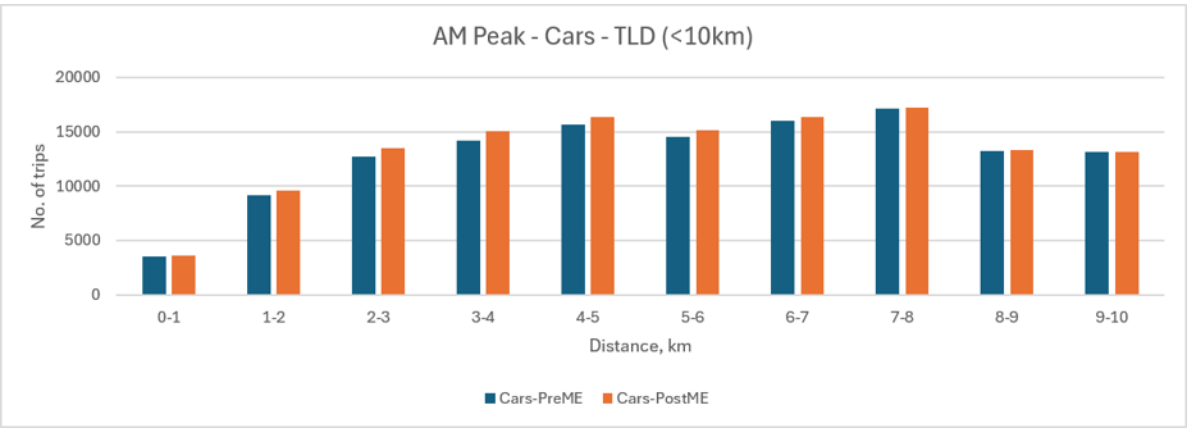
The biggest changes resulting from the matrix estimation process, as illustrated in the AM peak example at Figure 2, are for short distance car trips of less than 10km. This largely relates to known weakness with mobile network data, used by WYCA to generate the prior matrix, which is not able to accurately record short distance trip movements. As such, an increase in the number and proportion of short distance trips in the post-ME matrix is to be expected.

Figure 2: Sample Trip Length Distribution graph – AM Peak, Cars



Further analysis of the change in distribution of trips less than 10km in length is presented in Figure 3. There are relatively few trips >1km, and it can be seen that the majority of changes are for trips between 2-6km. Above that, the changes are relatively slight.

Figure 3: Sample Trip Length Distribution graph – AM Peak, Cars <1km



Assignment Calibration

Demand matrices generated by the matrix estimation are then re-assigned to the network and modelled flows again compared to observed flows across all count sites and at screenlines across the Bradford district.

These results can be compared to the performance of the prior matrix to demonstrate the level of improvement in model ‘fit’ that has been achieved within the BSTM update.

Table 8 provides a summary of the performance of all individual counts for each time period for cars and total vehicles. A total of 549 link counts has been used to develop the 2023 base year model.

Table 8: Summary of individual link count comparisons, modelled v observed – post matrix estimation

Measure	AM Peak		
	Total Link Counts	Cars	All Vehicles
No. of links meeting GEH or flow criterion	549	480	458
% of links meeting GEH or flow criterion		87%	83%
Measure	PM Peak		
	Total Link Counts	Cars	All Vehicles
No. of links meeting GEH or flow criterion	549	457	453
% of links meeting GEH or flow criterion		83%	83%

The TAG criterion suggests that 85% of all available counts within the model should meet GEH of flow criteria. Although the criterion is not met in full, a clear improvement over the prior matrix is seen with 87% and 83% of car trips achieving the criterion in the AM and PM peak respectively, with slightly lower achievement for all vehicles of 83% in both peaks.

A similar improvement in flow calibration across screenlines is also presented in Table 9 and Table 10 for Cars and All Vehicles respectively.

Table 9: Summary Screenline Flow Comparisons - post matrix estimation – Cars

Cars: Modelled v Observed	AM Peak		PM Peak	
	No. of screenlines	% of screenlines	No. of screenlines	% of screenlines
<5% difference	17	74%	16	70%
<10% difference	23	100%	22	96%
<20% difference	23	100%	23	100%
Total Screenlines	23		23	

Table 10: Summary Screenline Flow Comparisons - post matrix estimation – All vehicles

All Vehicles: Modelled v Observed	AM Peak		PM Peak	
	No. of screenlines	% of screenlines	No. of screenlines	% of screenlines
<5% difference	18	78%	15	65%
<10% difference	21	91%	21	91%
<20% difference	23	100%	23	100%
Total Screenlines	23		23	

Table 11 and Table 12 show the individual screenline performance for each time period for All Vehicles. The tables show that although the % of screenlines meeting the 5% difference criterion is below 85% in each peak time period, a number of additional screenlines only just fail and are within 7.5%.

Table 11: Individual screenline performance – post matrix estimation – AM peak

Screenline/Cordon	Dir	No. Sites	Count (pcus)	Model (pcus)	Flow diff	% Flow diff	TAG 5% criterion
Bradford Inner	IB	24	14237	13529	-708	-5.0%	Near
Bradford Inner	OB	24	11673	10858	-815	-7.0%	Near
Bradford North	NB	12	5506	5489	-17	-0.3%	Pass
Bradford North	SB	12	6784	6664	-120	-1.8%	Pass
Bradford Outer	IB	29	16749	16572	-176	-1.1%	Pass
Bradford Outer	OB	29	12735	11856	-879	-6.9%	Near
Leeds-Bradford	EB	9	12347	11779	-568	-4.6%	Pass
Leeds-Bradford	WB	9	11683	11221	-462	-4.0%	Pass
Rail: Halifax-Shipley	EB	27	19277	18809	-468	-2.4%	Pass
Rail: Halifax-Shipley	WB	26	17776	17152	-623	-3.5%	Pass
Rail: Shipley-Leeds	NB	10	6432	6131	-301	-4.7%	Pass
Rail: Shipley-Leeds	SB	10	7090	6900	-190	-2.7%	Pass
Shipley	IB	9	6438	6370	-68	-1.1%	Pass
Shipley	OB	9	5290	5258	-33	0.6%	Pass
West of Bradford	EB	4	2126	1840	-286	-13.4%	Fail
West of Bradford	WB	4	1372	1249	-123	-8.9%	Fail
East of Bradford	EB	4	2646	2635	-11	-0.4%	Pass
East of Bradford	WB	4	2740	2726	-14	-0.5%	Pass
Chain Bar	IB	5	13752	14360	608	4.4%	Pass
Chain Bar	OB	5	14937	14542	-395	-2.6%	Pass

Silsden roundabout	IB	4	4141	4125	-15	-0.4%	Pass
Silsden roundabout	OB	4	4141	4086	-55	-1.3%	Pass
Keighley	IB	9	4814	4249	-565	-11.7%	Fail

Table 12: Individual screenline performance – post matrix estimation – PM peak

Screenline/Cordon	Dir	No. Sites	Count (pcus)	Model (pcus)	Flow diff	% Flow diff	TAG 5% criterion
Bradford Inner	IB	24	11840	11023	-817	-6.9%	Near
Bradford Inner	OB	24	14181	13303	-877	-6.2%	Near
Bradford North	NB	12	6875	6676	-199	-2.9%	Pass
Bradford North	SB	12	5555	5493	-63	-1.1%	Pass
Bradford Outer	IB	29	12551	12479	-73	-0.6%	Pass
Bradford Outer	OB	29	16443	15925	-518	3.2%	Pass
Leeds-Bradford	EB	9	11189	10614	-575	-5.1%	Near
Leeds-Bradford	WB	9	12426	12030	-396	-3.2%	Pass
Rail: Halifax-Shipley	EB	27	20592	20210	-382	-1.9%	Pass
Rail: Halifax-Shipley	WB	26	17665	16388	-1277	-7.2%	Near
Rail: Shipley-Leeds	NB	10	6879	6538	-341	-5.0%	Pass
Rail: Shipley-Leeds	SB	10	6664	6571	-93	-1.4%	Pass
Shipley	IB	9	5306	5218	-88	-1.7%	Pass
Shipley	OB	9	5828	5847	19	0.3%	Pass
West of Bradford	EB	4	1493	1262	-231	-15.5%	Fail
West of Bradford	WB	4	1836	1668	-168	-9.1%	Fail
East of Bradford	EB	4	2703	2780	77	2.9%	Pass
East of Bradford	WB	4	2939	2789	-149	5.1%	Near
Chain Bar	OB	5	13613	13883	270	2.0%	Pass
Chain Bar	OB	5	14326	14211	-115	0.8%	Pass
Silsden roundabout	IB	4	4321	4289	-32	-0.7%	Pass
Silsden roundabout	OB	4	4321	4289	-32	-0.7%	Pass
Keighley	IB	9	4933	4387	-546	-11.1%	Fail

Model convergence

Both AM and PM peak models converge well against parameters, ISTOP = 98.5%, NISTOP = 4 and STPGAP = 0.05. Table 13 provides details on the number of assignment loops required to reach convergence, the last 4 convergence % and the % Gap achieved.

Table 13: Base Year model convergence summary

Time period	No of loops	Last 4 iterations	%GAP
AM peak	35	99.08 / 99.10 / 98.93 / 98.71	0.035
PM peak	49	98.51 / 98.65 / 98.84 / 98.95	0.027

Journey time validation

Journey time data used in the calibration of the WYTM has been used to compare against modelled times in the BSTM.

Journey times within the model were checked by comparing the modelled times against the observed times along selected routes. TAG advises that the total modelled journey time from start to finish should be within 15% of the time, and that this should ideally be the case for 85% of all journey time routes. In addition, we also look at the comparison between modelled and observed times along each route.

A total of 11 journey time routes, in each direction, have been included for comparison. Table 14 provides a summary of validation across all routes and Table 15 provides more detail on a route by route basis.

Table 14: Summary journey time validation

Time Period	Number of Routes	Number of routes within 15%	Total % of routes meeting criteria
AM	22	14	64%
PM	22	14	64%

Although these summary results suggest that journey time validation falls short of target, Table 15 shows that a number of additional routes have similar observed v modelled times.

Table 15: Journey time validation – individual routes

Route Description	Direction	AM Peak journey time (mins)			PM Peak journey time (mins)		
		Obs.	Model	%diff	Obs.	Model	%diff
100: Ring Road	Anti c/w	45.65	43.65	-4%	56.04	47.16	-16%
	C/w	44.44	46.97	6%	56.90	46.85	-18%
101: Shipley to Bradford, via A650	N to S	14.66	17.79	21%	15.27	16.88	11%
	S to N	14.12	15.90	13%	17.69	16.51	-7%
102: Shipley to Bradford, via A6037	N to S	12.81	12.49	-2%	11.49	10.61	-8%
	S to N	10.81	11.42	6%	12.57	12.18	-3%
104 (part): Yeadon to Bradford	N to S	11.38	12.16	7%	9.28	12.06	30%
	S to N	10.55	16.37	55%	10.99	15.08	37%
105: Thornbury to Bradford, via Barkerend	E to W	11.17	11.04	-1%	11.17	10.81	-3%
	W to E	10.19	12.11	19%	11.52	13.94	21%
107: Thornbury to Bradford, via Bowling Back Lane	E to W	10.66	12.29	15%	11.55	11.58	0%
	W to E	9.61	11.97	25%	13.26	13.60	3%
108 (part): Bradford to Farnley	E to W	17.94	13.48	-25%	13.14	13.93	6%
	W to E	11.08	11.96	8%	14.90	12.48	-16%

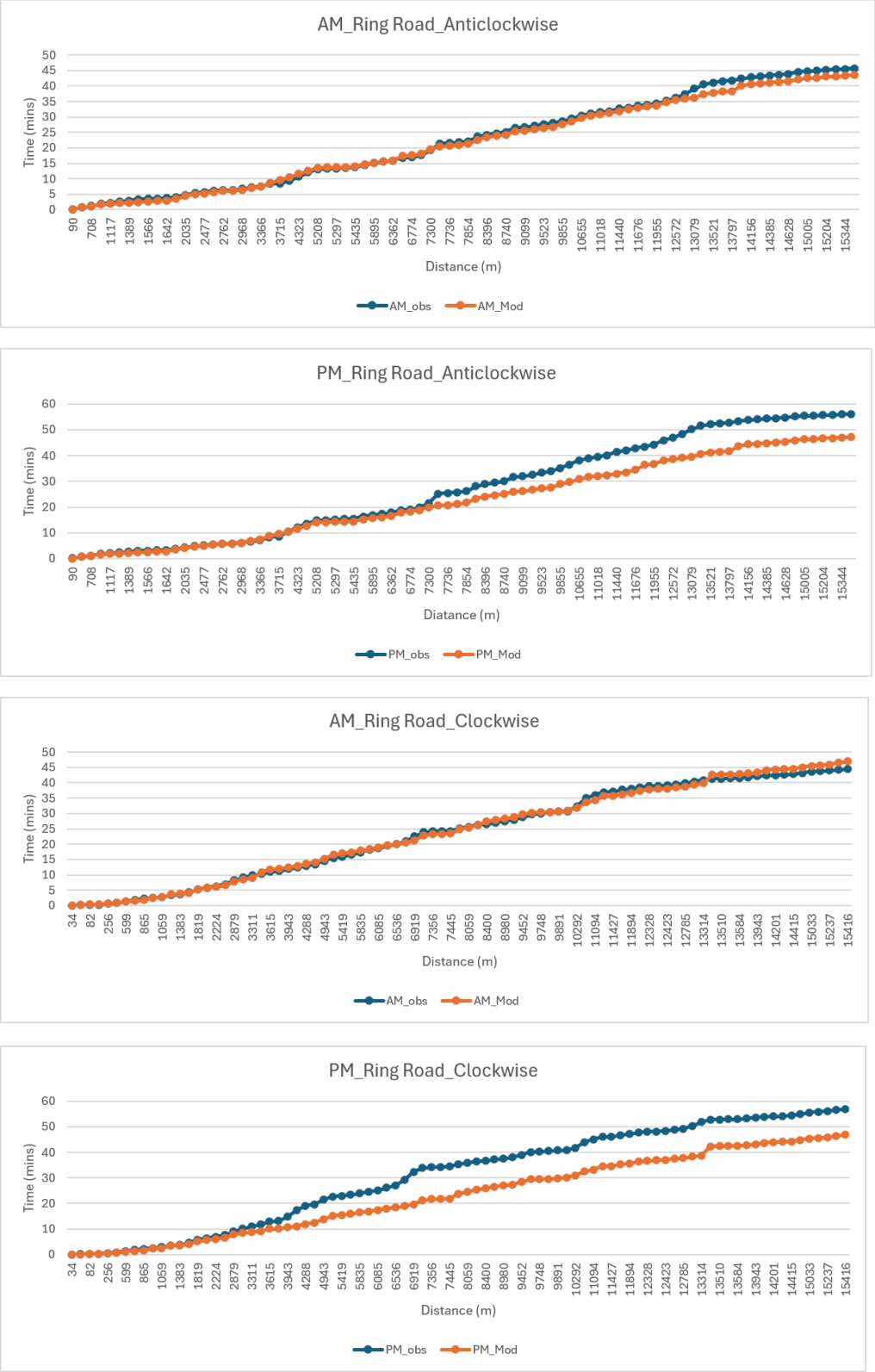
110 (part): Brighouse to Bradford	N to S	14.73	15.44	5%	18.51	17.95	-3%
	S to N	19.21	16.79	-13%	15.24	15.65	3%
111 (part): Halifax to Bradford	N to S	17.85	16.65	-7%	23.24	21.10	-9%
	S to N	18.74	20.18	8%	17.94	16.11	-10%
112: Queensbury to Great Horton	E to W	10.09	10.65	6%	10.19	13.55	33%
	W to E	10.38	13.86	33%	9.52	10.30	8%
114: Denholme to Bradford	E to W	17.50	18.83	8%	21.67	25.21	16%
	W to E	20.22	24.00	19%	18.10	18.44	2%

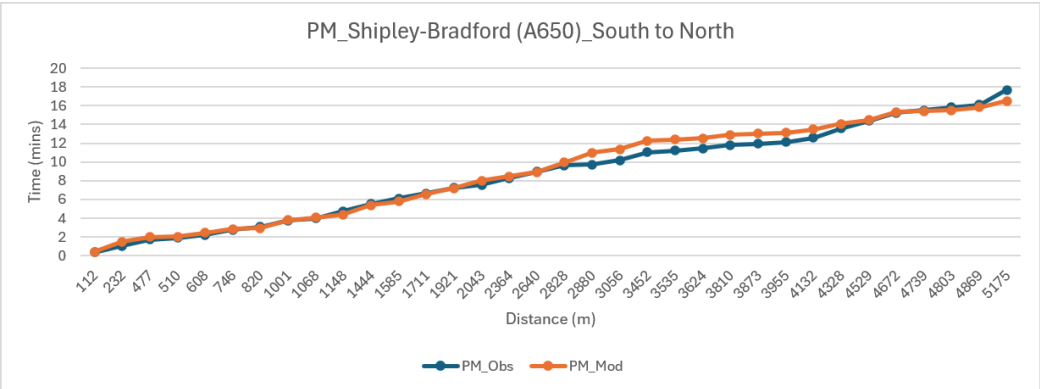
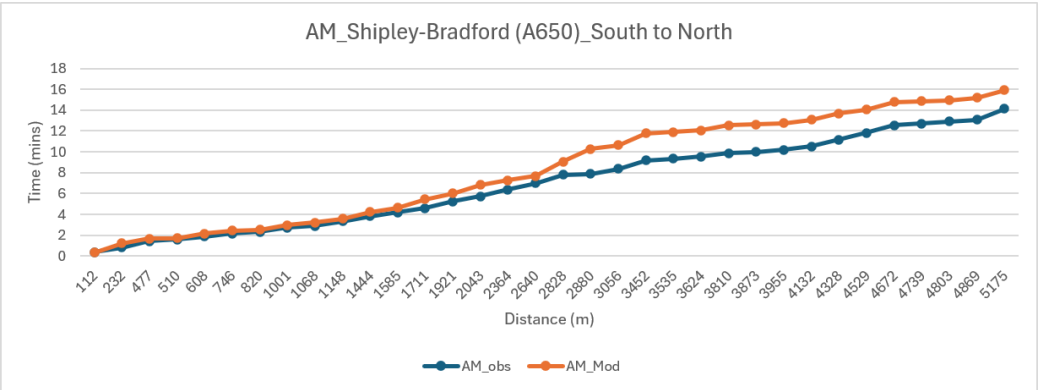
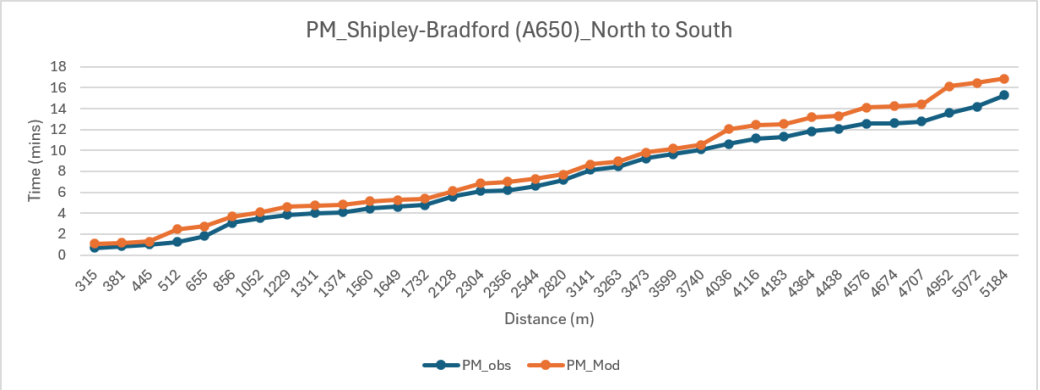
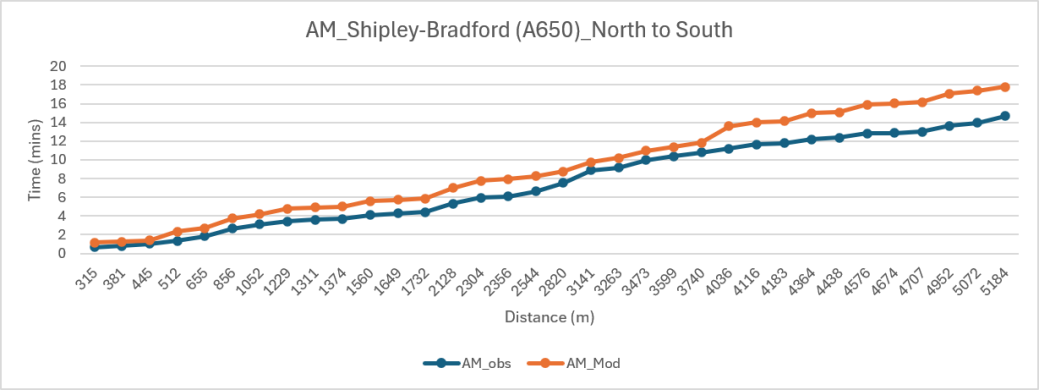
Observed journey time data is derived from INRIX data and was purchased from DfT (by WYCA) for the period corresponding with the overall traffic data collection exercise.

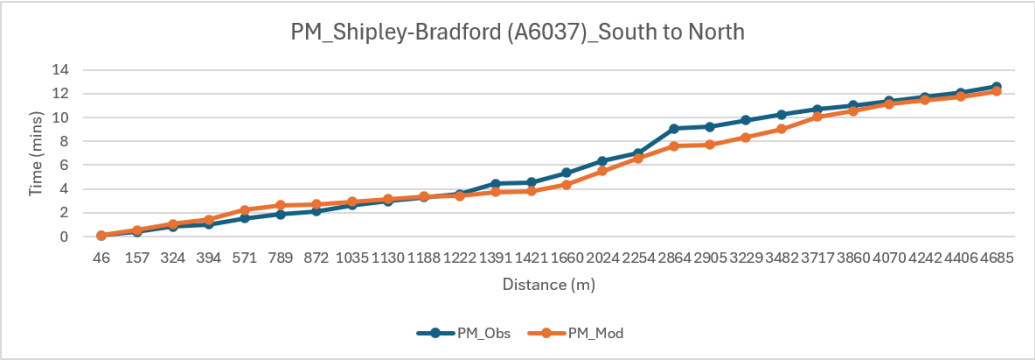
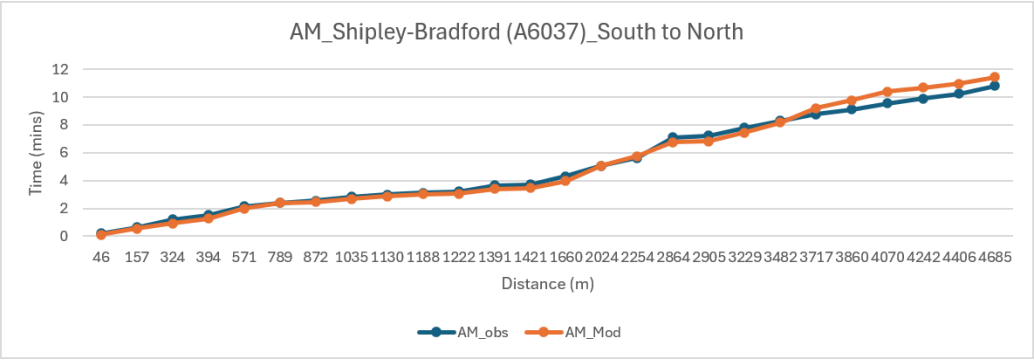
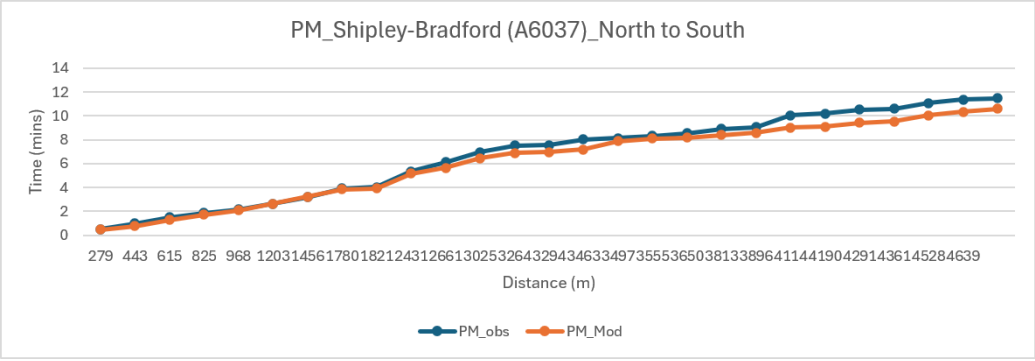
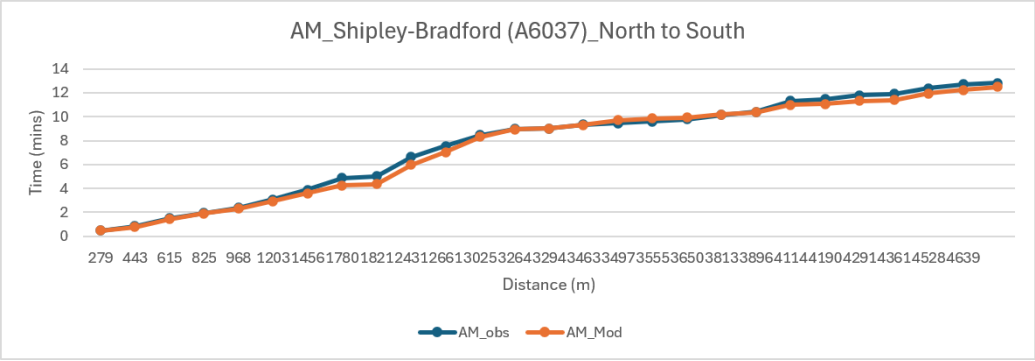
Journey time graphs for all routes, AM and PM peak, are included in Appendix A2.

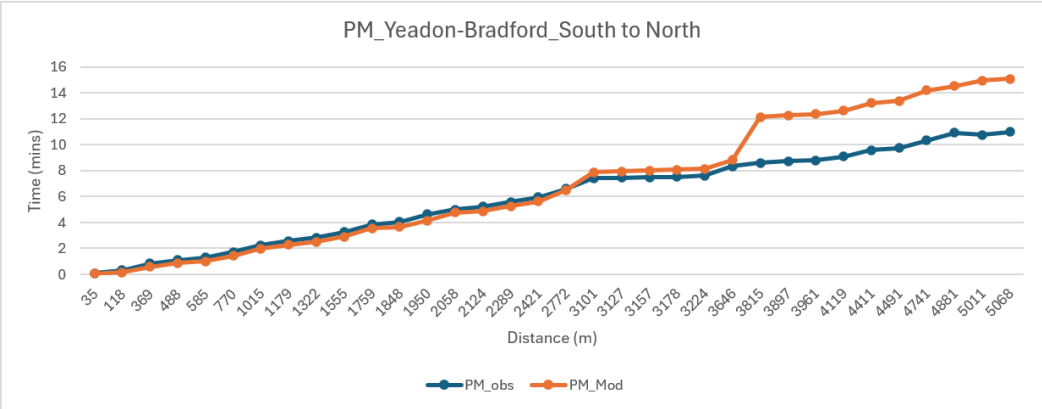
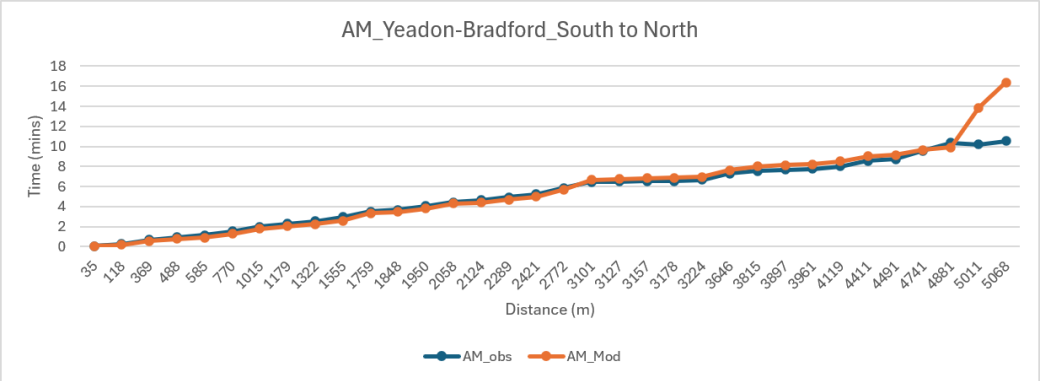
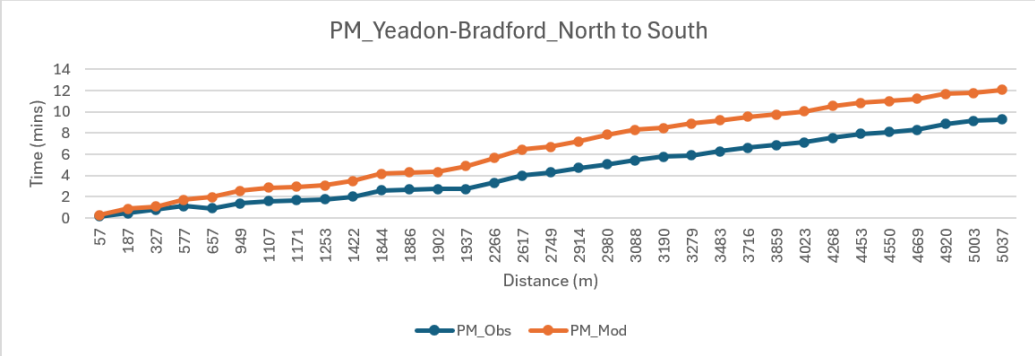
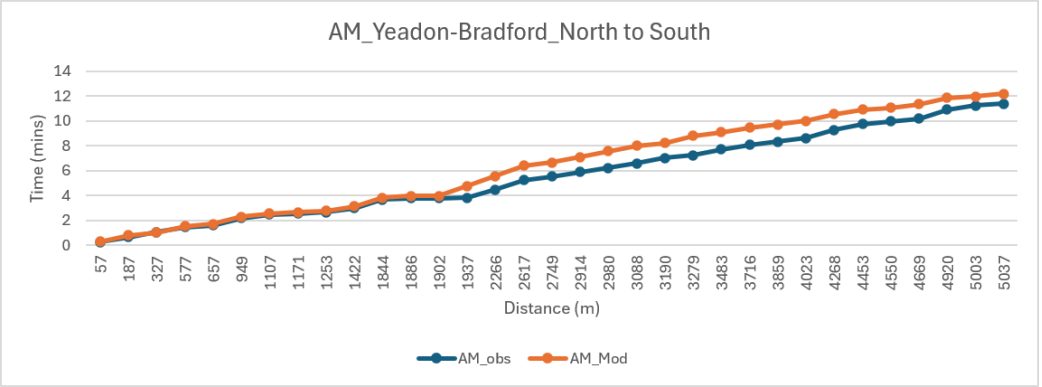
It is noted that a record was kept of where roadworks took place during the period that the observed journey time data was acquired. The records did not identify any works that would affect routes through Bradford.

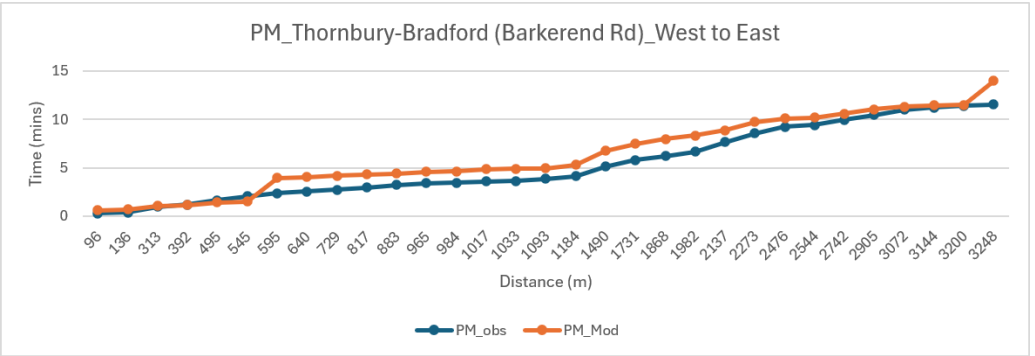
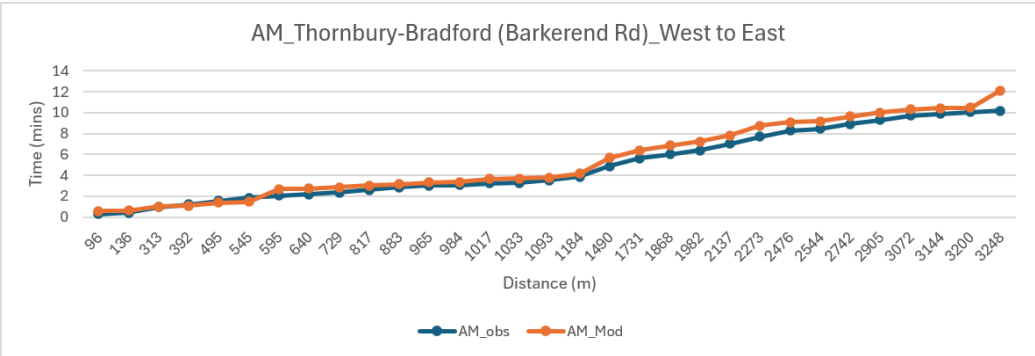
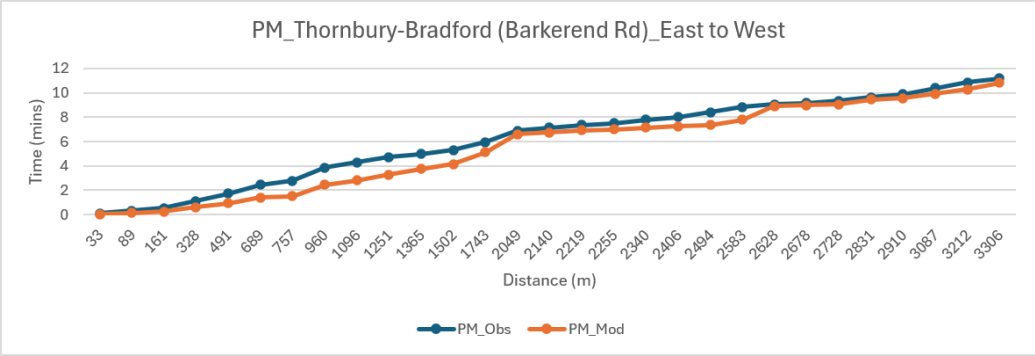
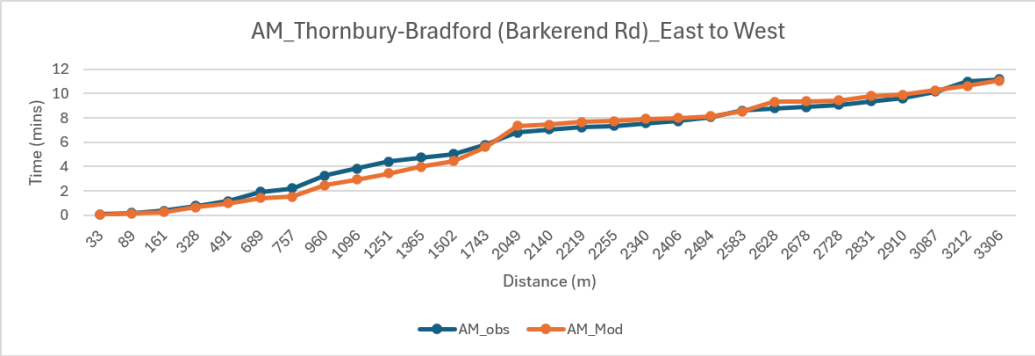
Appendix A2 - 2023 Bradford highway traffic model (BTM) update – Journey Time validation

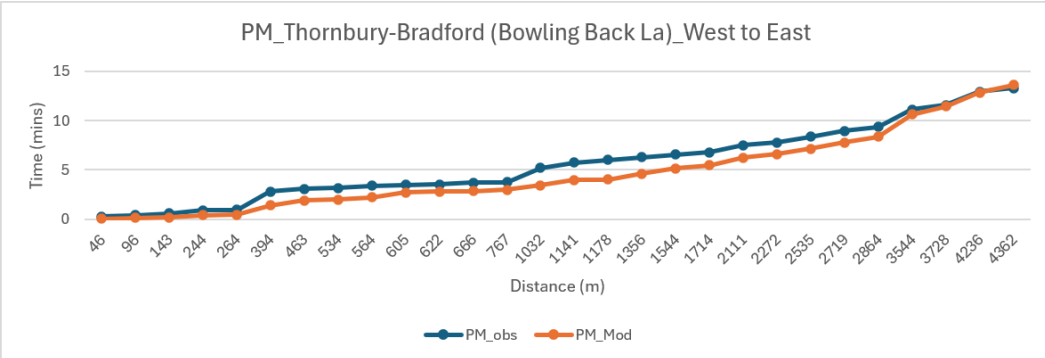
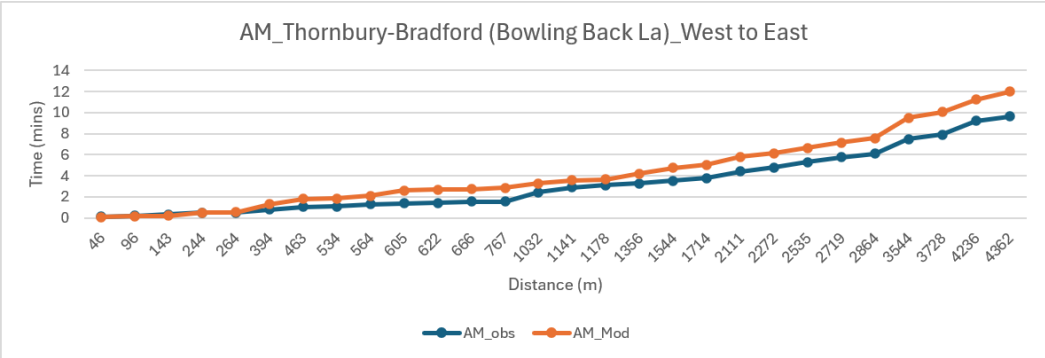
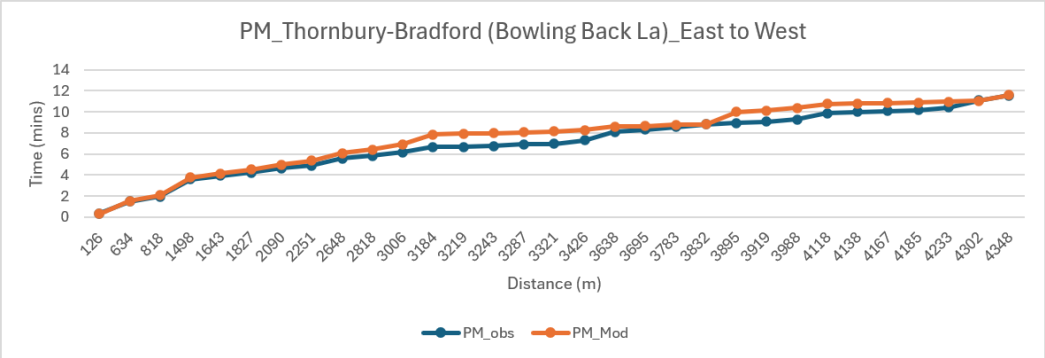
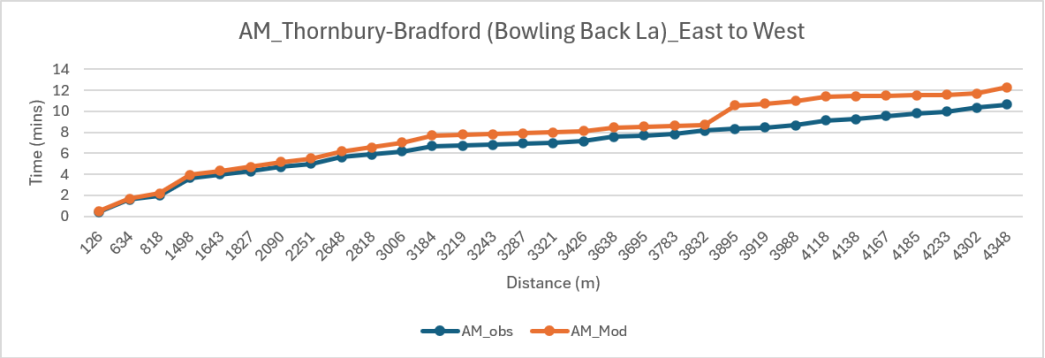


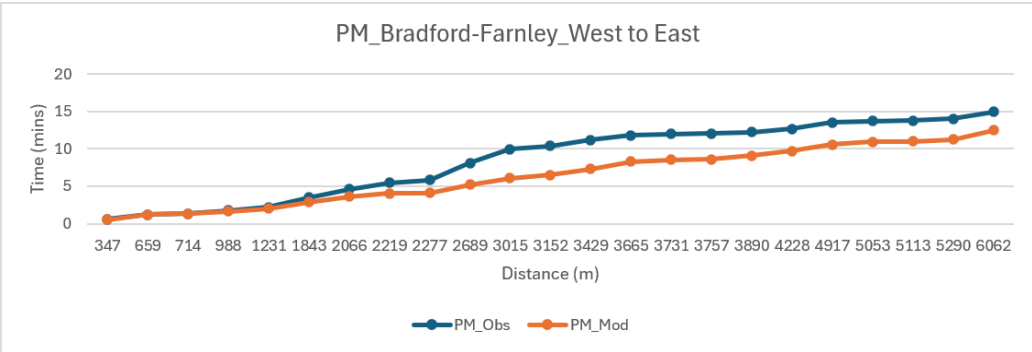
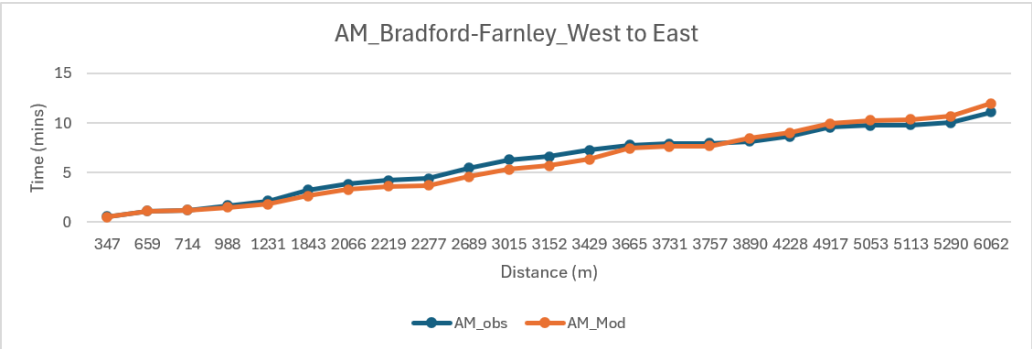
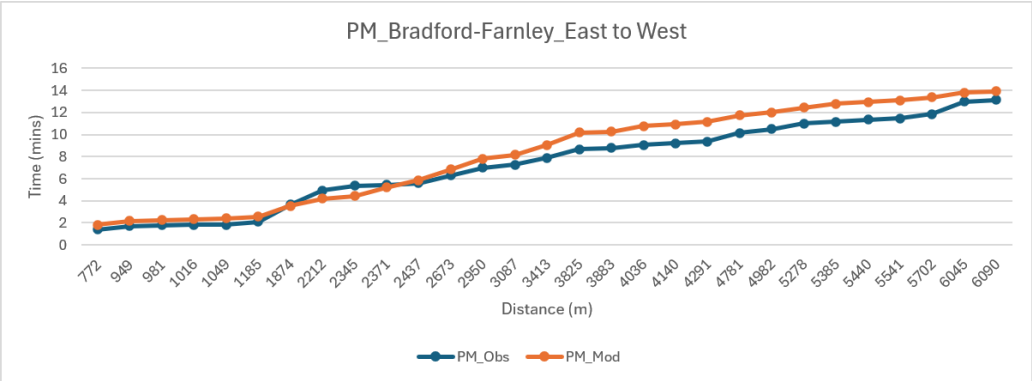
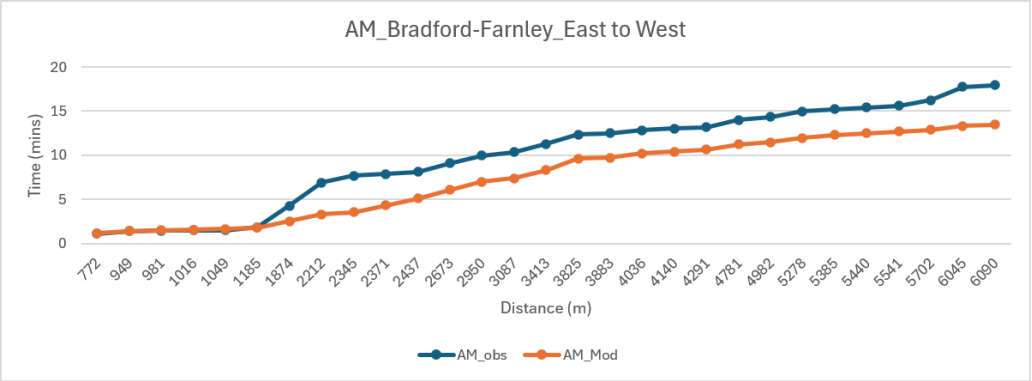


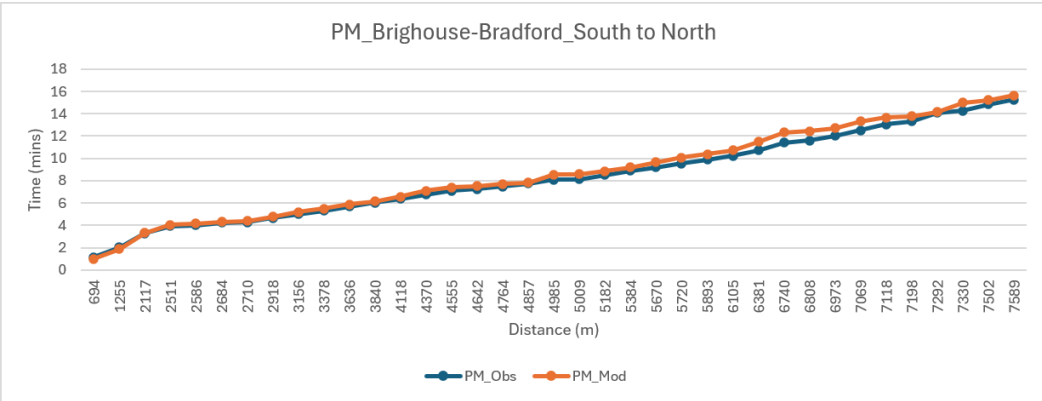
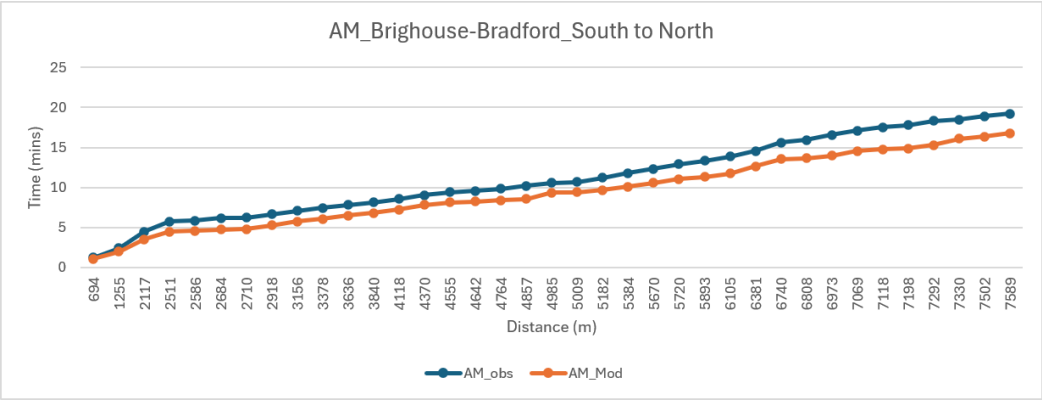
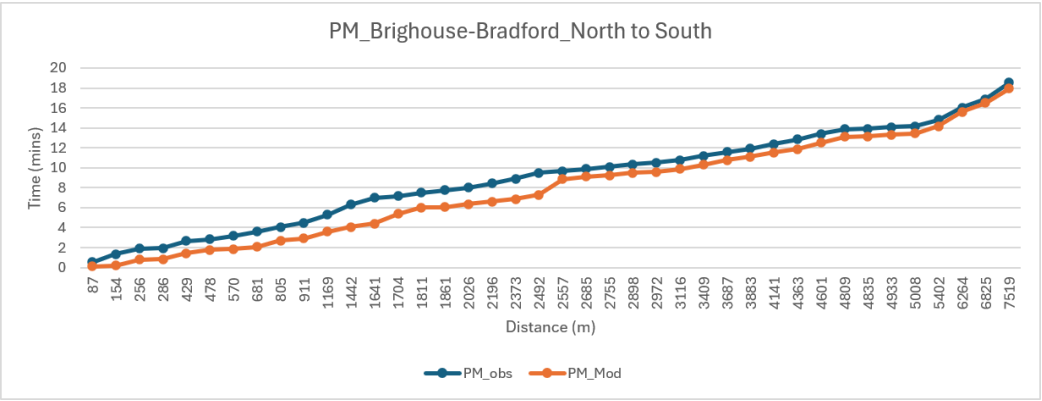
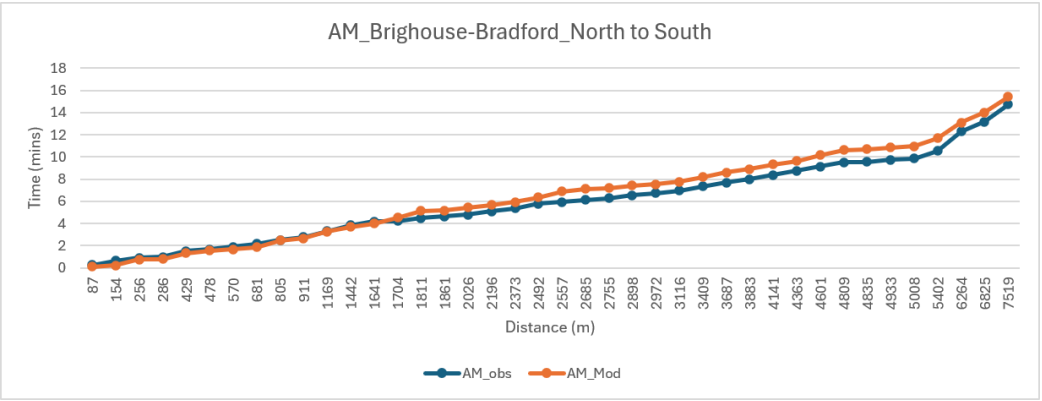


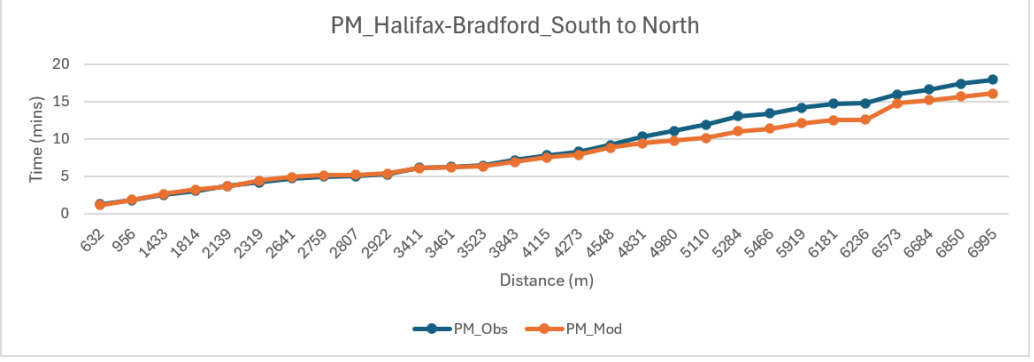
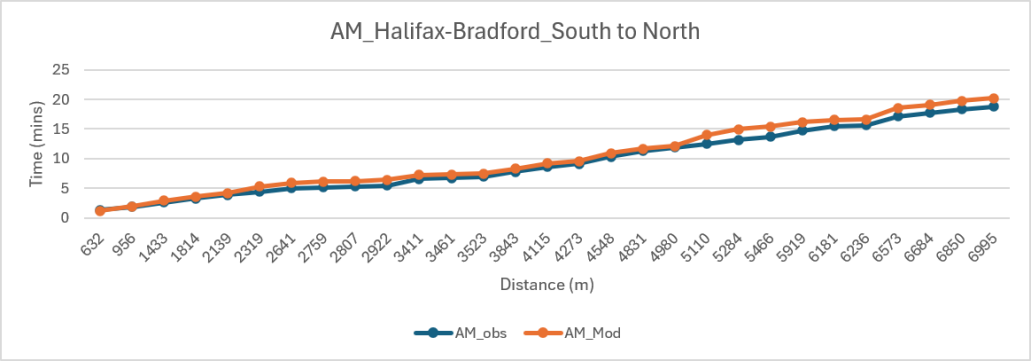
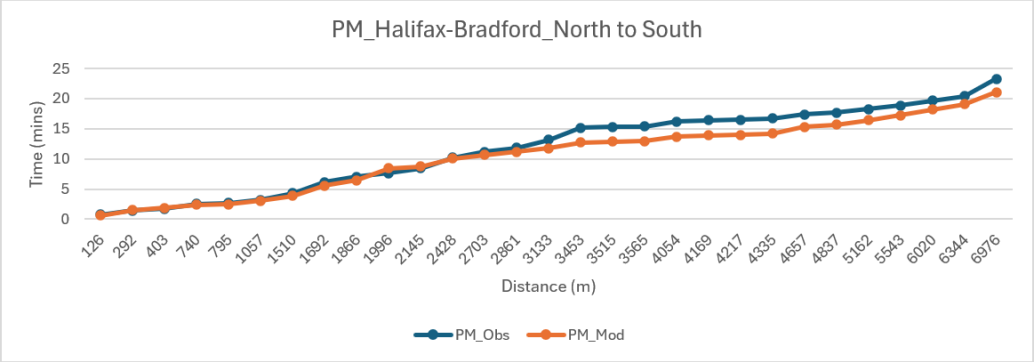
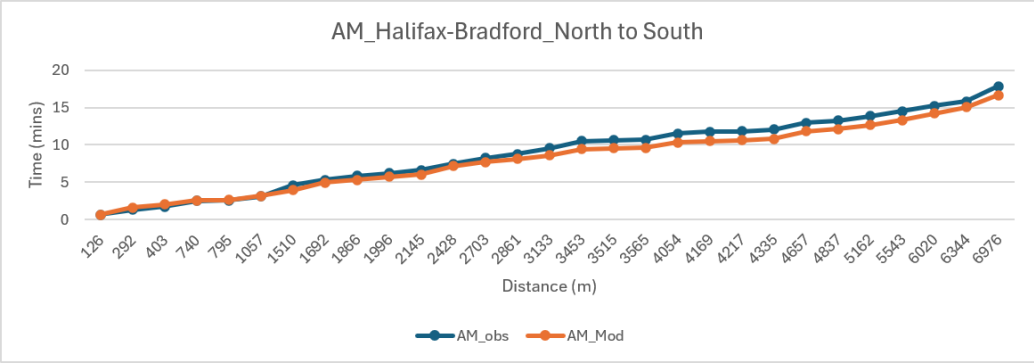


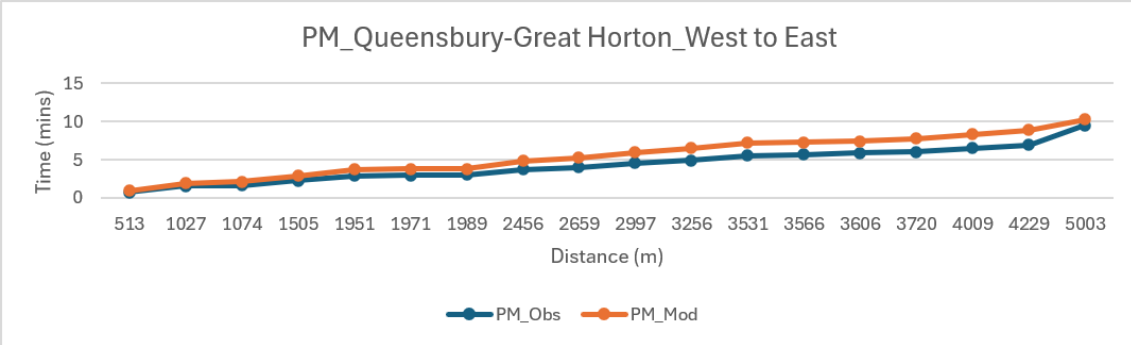
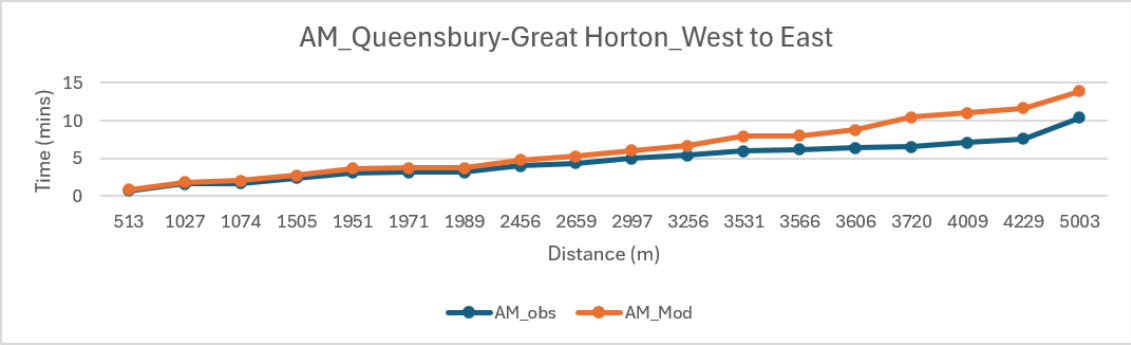
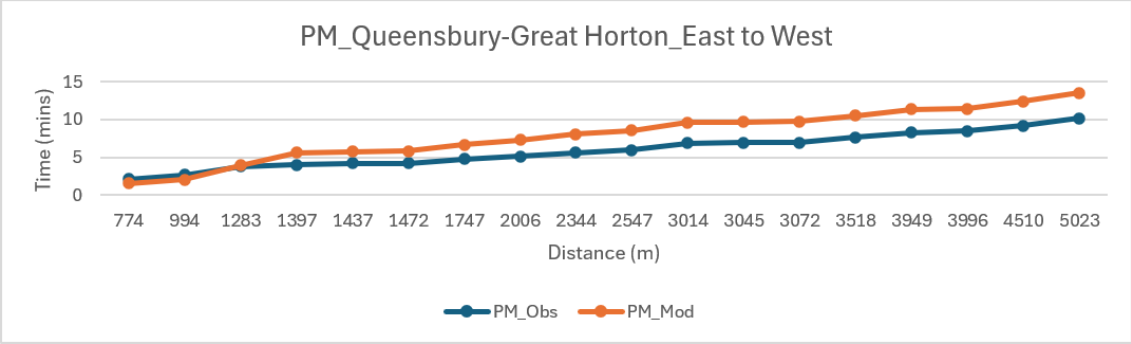
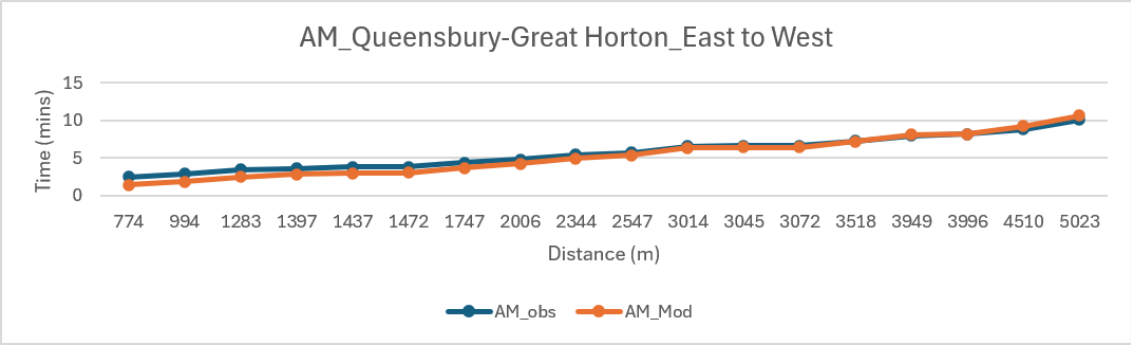


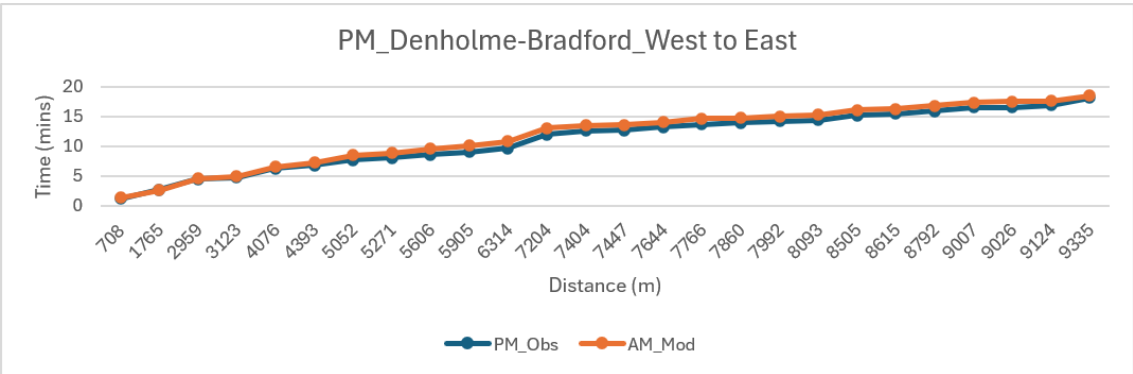
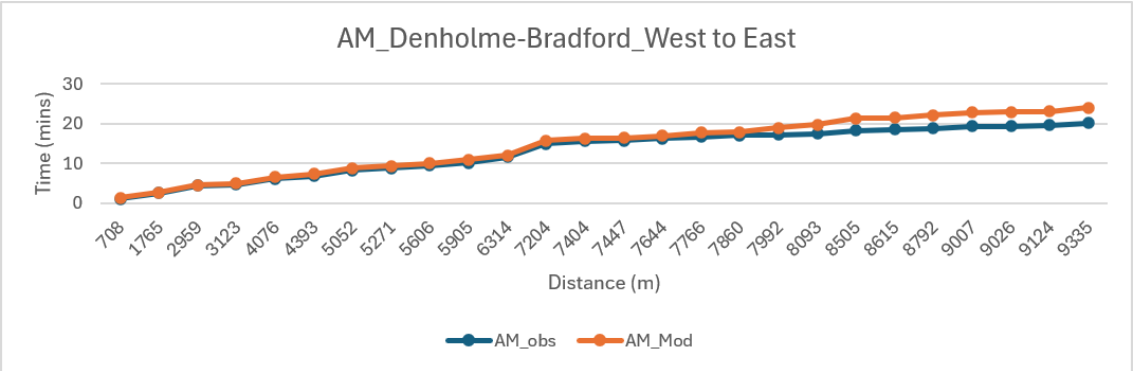
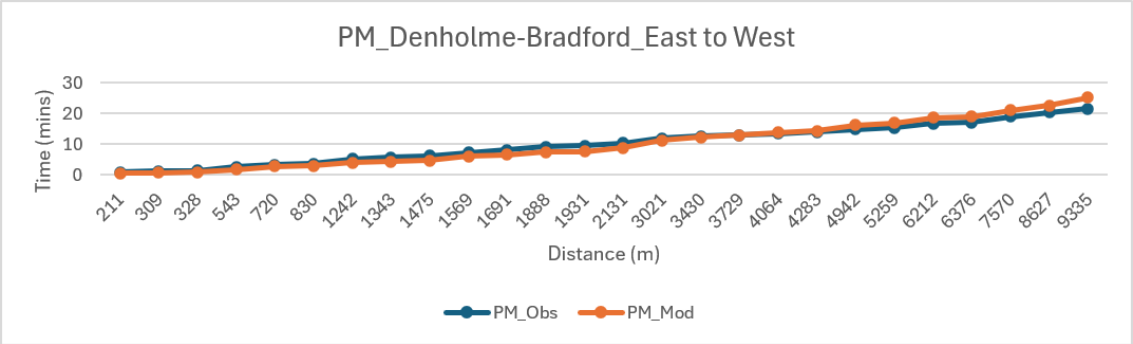
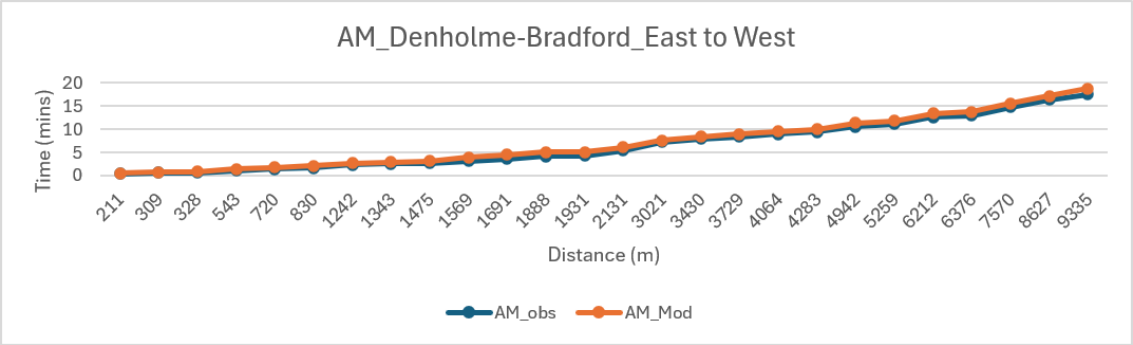












Appendix B – R19 Local Plan Allocations – Housing Sites

PLP ref	SHLAA ref	Reg 18 ref	HLR/other ref	Site Address	Settlement Area	Total Plan Number	Yield 2023-2034	Yield 2035-2043
H11	AD/013		SS/148	Bolton Road	Addingham	33	33	0
H17	AD/020		SS/024	Turner Lane / Silsden Road	Addingham	44	0	44
H20	AD/001	AD1/H		Turner Lane	Addingham	9	9	0
H21	AD/002D	AD2/H		Parsons Lane	Addingham	12	12	0
H22	AD/004 part	AD3/H		Main Street / Addingham Bypass (East)	Addingham	62	62	0
H23	AD/004 part	AD4/H		Main Street / Addingham Bypass (West)	Addingham	51	51	0
H24	AD/012	AD6/H		Moor Lane	Addingham	27	27	0
H26	AD/022	AD8/H		Church Street / Main Street	Addingham	8	0	8
H28	BA/003			West Lane	Baildon	11	11	0
H67	BA/008B	BA3/H		Cliffe Lane West	Baildon	23	23	0
H1565	BA/011	BA4/H		Green Lane	Baildon	39	39	0
H77	BI/024		5646	Sheriff Lane (1)	Bingley	3	3	0
H105	BI/008	BI2/HC		Sty Lane	Bingley	420	80	340
H106	BI/011	BI3/H		Greenhill Barn, Lady Lane	Bingley	25	25	0
H1558	NE/152			Land at Friars Industrial Estate, Idle	Bradford North East	146	0	146
H262	CR/004	CR1/H	476	Bolton Road	Bradford North East	16	0	16
H265	CR/036	CR6/H		North Bolton Hall Road	Bradford North East	30	30	0
H266	CR/037	CR7/H	586	Thornhill Avenue	Bradford North East	17	17	0
H585	NE/004	Commitment	595	Roundwood Avenue	Bradford North East	130	120	10
H594	NE/022	NOT ALLOCATED	565	Doctor Hill, Idle	Bradford North East	13	0	13
H597	NE/030			Wapping Road	Bradford North East	23	0	23
H598	NE/034			Exmouth Place	Bradford North East	100	100	0
H599	NE/035	NE7/H		Barkerend Mill, Barkerend Road	Bradford North East	132	0	132
H636	NE/140	NE19/H		Land east of Harrogate Road, Greengates	Bradford North East	32	0	32
H666	NE/189		UCS	Highfield Works, off Highfield Rd	Bradford North East	17	0	17
H670	NE/193		UCS	Lister Lane	Bradford North East	11	0	11
H673	NE/047	NE10/H		Ravenscliffe Avenue, Ravenscliffe	Bradford North East	16	0	16
H674	NE/055B	NE11/H		Harrogate Rd, Greengates	Bradford North East	49	0	49
H675	NE/081	NE13/H	1453	Rawson Avenue, Thornbury	Bradford North East	52	52	0
H680	NE/123	NE18/H		Rimswell Holt, Ravenscliffe	Bradford North East	7	0	7
H681	NE/013A	NE2/H	585	Westfield Lane (Rear Kingsway) Wrose	Bradford North East	57	57	0
H683	NE/031	NE5/H	901	Prospect Road	Bradford North East	22	0	22
H685	NE/045	NE8/H		Old Park Road, Thorpe Edge	Bradford North East	18	0	18
H588	NE/013a part	Commitment	585	Westfield Lane	Bradford North East	31	1	30
H719	NW/066	NW22/H	892	Alton Grove, Frizinghall	Bradford North West	9	0	9
H720	NW/067	COMMITMENT	3369	Saffron Drive	Bradford North West	9	0	9
H726	NW/074	COMMITMENT	5159	Hill Top Lane	Bradford North West	5	5	0
H706	NW/038	COMMITMENT	421	Allerton Lane	Bradford North West	9	9	0
H760	NW/138			Allerton Rd west	Bradford North West	13	13	0
H694	NW/020		SS/061	Haworth Road, Sandy Lane	Bradford North West	155	155	0
H699	NW/026A	COMMITMENT	518	Ivy Lane	Bradford North West	99	99	0
H704	NW/036	COMMITMENT	4916	Whitburn Way	Bradford North West	16	16	0
H753	NW/128		SS/062	Emmfield Drive	Bradford North West	12	0	12
H761	NW/139			Woodward Court, Kirklees rd, Allerton	Bradford North West	27	0	27
H772	NW/024	NW10/H		Allerton Road, Prune Park Lane	Bradford North West	162	0	162
H773	NW/026B	NW11/H		North Parade, Allerton	Bradford North West	64	64	0
H774	NW/030C	NW12/H		Lynfield Drive, Daisy Hill	Bradford North West	13	0	13
H775	NW/031B	NW13/H		Millmoor Close	Bradford North West	62	0	62
H776	NW/040	NW15/H	735	Merrivale Road, Allerton	Bradford North West	41	41	0
H779	NW/046	NW18/H	100	Haworth Road, Playing fields, Heaton	Bradford North West	98	0	98
H780	NW/049	NW19/H		Bingley Road/Long Lane, Heaton	Bradford North West	392	160	232
H781	NW/002	NW2/H	323/496	Drummond Trading Estate, Lumb Lane	Bradford North West	114	0	114
H782	NW/052	NW20/H		Carlisle Road	Bradford North West	48	0	48
H784	NW/080	NW24/H	8	Rayner Mount Allerton	Bradford North West	8	8	0
H787	NW/099	NW28/H		Patent Street, Manningham	Bradford North West	61	0	61
H788	NW/007	NW3/HC	5357	Spring Bank Place	Bradford North West	9	9	0
H789	NW/125	NW32/H		Allerton Mills	Bradford North West	200	0	200
H790	NW/129	NW34/H	60	Lister Mill and Surrounds / Velvet Mill	Bradford North West	86	0	86
H794	NW/013A	NW6/H		Priestman Street	Bradford North West	37	0	37
H795	NW/015	NW7/H		Acacia Drive, Sandy Lane	Bradford North West	98	98	0
H796	NW/018	NW8/H		High Ash Farm, Allerton Road, Allerton	Bradford North West	68	68	0
H797	NW/023	NW9/H		Wilsden Road/West Avenue, Sandy Lane	Bradford North West	22	0	22
H1562	NW/041A	NW16/H & NW17/H		Allerton Lane/Chevet Mount	Bradford North West	51	51	0

PLP ref	SHLAA ref	Reg 18 ref	HLR/other ref	Site Address	Settlement Area	Total Plan Number	Yield 2023-2034	Yield 2035-2043
H975	SE/001	SE1/H	731	Highbridge Terrace, West Bowling	Bradford South East	42	42	0
H1564	SE/003, SE/115, SE/055 and SE/137			Ned Lane, Holmewood	Bradford South East	190	160	30
H994	SE/005	SE3/H		Cleckheaton Road	Bradford South East	16	0	16
H879	SE/014B	SE4/H		Spen View Lane / Shetcliffe Lane, Bierley	Bradford South East	59	59	0
H1001	SE/015B	SE5/H		Upper Castle Street	Bradford South East	20	0	20
H883	SE/029			Kesteven Dr, Holmewood	Bradford South East	21	21	0
H1003	SE/030	SE7/H		Landscope Ave, Holmewood	Bradford South East	19	0	19
H1004	SE/031	SE8/H		Greyswood Dr, Holmewood	Bradford South East	46	0	46
H1005	SE/032	SE9/H		Stonyhurst Sq, Holmewood	Bradford South East	11	0	11
H976	SE/033	SE10/H		Land at Muirhead Fold, Holmewood	Bradford South East	19	0	19
H979	SE/046	SE13/H		Ned Lane, Holmewood	Bradford South East	76	0	76
H1557	SE/048 and SE/079			Albert Terrace and Furnace Road, Oakenshaw	Bradford South East	59	0	59
H1555	SE/050		SS/063	Proctor Street, Tong Street	Bradford South East	67	67	0
H983	SE/054	SE17/HC	5358	Kesteven Road / Heysham Drive, Holmewood	Bradford South East	11	11	0
H997	SE/060	SE45/H		Harper Gate Farm, Tyersal Lane	Bradford South East	68	68	0
H984	SE/062		SS/071	Holme Lane / Raikes Lane, Holmewood	Bradford South East	32	0	32
H897	SE/066			Wilson Road, Wyke	Bradford South East	98	98	0
H987	SE/076	SE21/H PART		New Lane, Laisterdyke	Bradford South East	35	0	35
H902	SE/077		SS/009	Summer Hall Ing, Delf Lane	Bradford South East	78	0	78
H989	SE/089	SE23/H	450	Tennis Avenue	Bradford South East	12	0	12
H911	SE/100 PART	SE46/H, SE47/H & SE19/H		Raikes Lane East	Bradford South East	1011	280	731
H990	SE/102	SE25/H		Grayswood Dr, Holmewood	Bradford South East	20	0	20
H991	SE/111	SE27/H		Mead View, Holmewood(1)	Bradford South East	31	0	31
H992	SE/114	SE28/H		Somerton Dr, Holmewood	Bradford South East	14	14	0
H920	SE/116			Broadstone Way	Bradford South East	12	0	12
H993	SE/118	SE29/H		Kaycell Street, Bierley	Bradford South East	18	18	0
H924	SE/126			Hudson View	Bradford South East	138	120	18
H931	SE/142	COMMITMENT		Flockton Rd	Bradford South East	34	34	0
H932	SE/143	COMMITMENT	4235	Flockton Rd	Bradford South East	20	20	0
H946	SE/172			Westgate Terrace	Bradford South East	13	13	0
H956	SE/185	COMMITMENT	5201	Land South of Titan District Centre	Bradford South East	9	0	9
H960	SE/189		SS/065	Copgrove Road	Bradford South East	20	20	0
H961	SE/190		SS/064	Copgrove Rd	Bradford South East	13	0	13
H962	SE/191		SS/??	St Lukes Church Dane Hill Drive	Bradford South East	11	11	0
H1554				Tong Academy and Yorkshire Martyrs	Bradford South East	228	160	68
H1248	SW/002	SW1/H		Back Fold, Clayton	Bradford South West	49	0	49
H1357	SW/004		SS/130	Holts Lane, Clayton	Bradford South West	34	34	0
H1266	SW/006	SW3/H		Ferndale, Clayton	Bradford South West	56	0	56
H1276	SW/007	SW4/H		Brook Lane, Clayton	Bradford South West	35	0	35
H1548	SW/010A PART	SW5/H part		Langberries, Clayton Heights	Bradford South West	210	160	50
H1144	SW/010B		SS/137	Highgate Grove, Clayton Heights	Bradford South West	117	117	0
H1281	SW/013	SW7/H		Theakston Mead/Thirsk Grove	Bradford South West	34	0	34
H1282	SW/017	SW8/H		Frensham Drive	Bradford South West	26	26	0
H1283	SW/021B	SW9/H		Woodlands Road	Bradford South West	13	0	13
H1249	SW/022	SW10/H		Stocks Lane, Old Dolphin, Clayton Heights	Bradford South West	26	0	26
H1252	SW/034A	SW14/H		Ferwick Drive, Woodside	Bradford South West	198	0	198
H1254	SW/043	SW17/H		Briggella Mills and Little Horton Lane	Bradford South West	200	0	200
H1255	SW/045	SW18/H		Fall Top Farm, Brook Lane, Clayton	Bradford South West	137	0	137
H1163	SW/047	SW47/E		Between Clayton Lane and Lister Arms	Bradford South West	24	24	0
H1553	SW/048			West of Manchester Road	Bradford South West	204	160	44
H1164	SW/049	commitment	1830	Park Road, Little Horton	Bradford South West	390	0	390
H1257	SW/052	SW20/H		Quaker Lane, Southfield Lane	Bradford South West	20	0	20
H1258	SW/057	SW21/H		Thornton Road, Leavenhorpe	Bradford South West	62	62	0
H1259	SW/059	SW22/H		Baldwin Lane, Clayton	Bradford South West	54	0	54
H1260	SW/060	SW23/H		Northside Road Girdlington	Bradford South West	55	55	0
H1262	SW/065	SW25/H		Lingdale Road, Woodside	Bradford South West	19	0	19
H1263	SW/066	SW26/H		Abb Scott Lane, Low Moor	Bradford South West	173	173	0
H1173	SW/068	commitment	1605	Iegrans Lane	Bradford South West	15	0	15
H1265	SW/088	SW28/H		Abb Scott Lane, Low Moor	Bradford South West	46	46	0
H1267	SW/108	SW30/H		Brafferton Arbor, Buttershaw	Bradford South West	16	16	0
H1270	SW/124	SW33/H		Land off Buckingham Crescent, Clayton	Bradford South West	310	0	310
H1272	SW/139	SW35/H		All Saints Road	Bradford South West	52	0	52
H1273	SW/142	SW36/HC	4502	Highgate Road	Bradford South West	5	5	0
H1274	SW/148	SW37/H		Cousen Road	Bradford South West	14	14	0
H1275	SW/155	SW39/H		Bowman Road, Wibsey	Bradford South West	35	35	0

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H1277	SW/157	SW41/HC		Blamires St	Bradford South West	15	15	0
H1225	SW/158	SW42/HC		Reevy Road west/The Crescent, Buttershaw	Bradford South West	40	40	0
H1227	SW/161			Former Hare and Hounds pub, Great Horton Rd	Bradford South West	20	0	20
H1243	SW/177		UCS	Canterbury Youth Centre, Dawnay Rd, Canterbury	Bradford South West	22	22	0
H1556	SW/178 and SW/160			Bell House, Southfield Lane	Bradford South West	23	0	23
H119	BU/015			Great Pasture Lane	Burley	200	160	40
H171	CC/114	CC29/H	5626	Buildings at Bradford College, Great Horton Rd	City Centre	156	156	0
H127	CC/003	commitment	5341	Ham Strasse	City Centre	105	0	105
H1349	CC/162			Kirkgate Centre, Darley Street, City Village	City Centre	400	320	80
H217	CC/001	CC1/H		Fulton Street/Sunbridge Rd	City Centre	135	120	15
H218	CC/027	CC10/H		Land and buildings south of Sunbridge Rd	City Centre	153	0	153
H219	CC/037	CC11/H		Wigan/Chain Street, City Village	City Centre	97	97	0
H220	CC/038	CC12/H		Top of Town, City Village	City Centre	503	320	183
H221	CC/039	CC13/H		George Street B	City Centre	276	0	276
H223	CC/045	CC16/H		North Brook Street/Valley Rd	City Centre	339	160	179
H229	CC/095	CC23/H		Land west of Wharf Street	City Centre	129	0	129
H230	CC/096	CC24/HC		Cathedral Quarter Phase 1	City Centre	189	0	189
H231	CC/113	CC28/H		Land and buildings east of Grattan Rd	City Centre	60	0	60
H232	CC/011A and	CC3/H PART		Listerhills Road	City Centre	237	185	52
H233	CC/018	CC4/H		Cathedral Quarter B	City Centre	90	0	90
H234	CC/020	CC5/H		Sun Street	City Centre	96	0	96
H235	CC/022	CC6/H		Midland Mills, Valley Road	City Centre	258	0	258
H238	CC/026	CC9/H		Tetley Street	City Centre	75	60	15
H151	CC/074			Sunwin House, Godwin St	City Centre	118	118	0
H1559	CC/076	CC21/H		Burnett Street	City Centre	120	0	120
H249	CO/002	CO1/H		Marchcote Lane	Cottingley	155	155	0
H1348	CU/016 part			Hallas Lane	Cullingworth	85	85	0
H279	CU/013	CU3/H		Cullingworth Rd / Doll La	Cullingworth	23	0	23
H284	DH/007			Hill Top Farm	Denholme	129	0	129
H292	DH/019			Old Road	Denholme	10	10	0
H282	DH/005			Old Road	Denholme	58	58	0
H1110	EM/012		SS/107	Carr Lane	East Morton	28	0	28
H306	EM/007	EM1/H		High Stead, Street Lane	East Morton	7	7	0
H354	HR/006			Long Lane	Harden	43	0	43
H311	HA/010	HA6/H	1518	Ivy Bank Lane	Haworth	30	30	0
H339	HA/003	HA2/H	838	Lees Lane, Crossroads	Haworth	27	0	27
H340	HA/004	HA3/H		Lees Lane, Crossroads	Haworth	30	0	30
H341	HA/008	HA5/H		Ashtar Close	Haworth	10	10	0
H383	IL/009	IL1/H		Wheatley Grove	Ilkley	125	125	0
H385	IL/014	IL3/H		Coutances Way	Ilkley	200	0	200
H386	IL/033	IL4/H		Stockheld Road	Ilkley	12	0	12
H1547	IL/016			Hadfield Farm, Skipton Road west	Ilkley	450	320	130
H1354	KY/003			Hollins Lane	Keighley	62	62	0
H388	KY/002		SS/119	Hollins Lane, Utley	Keighley	107	0	107
H393	KY/008	Commitment	529	Shann Lane	Keighley	26	0	26
H420	KY/044		SS/181	Bradford Road, Riddlesden	Keighley	105	0	105
H522	KY/191		SS/053	Airedale House Funeral Director (field), Skipton Rd	Keighley	49	0	49
H528	KY/197		ucs	Marlborough Street	Keighley	16	0	16
H533	KY/202		CHECK UCS	Holmewood Residential, Fell Lane	Keighley	43	43	0
H539	KY/029B	KY13/H	SS/160	Keighley Road, Exley Head (2)	Keighley	79	0	79
H541	KY/047	KY16/H		Carr Bank, Riddlesden	Keighley	18	18	0
H543	KY/054	KY18/H		Moss Carr Road, Long Lee, Keighley	Keighley	103	103	0
H544	KY/056	KY19/H		Moss Carr Road, Long Lee	Keighley	40	0	40
H545	KY/009A	KY2/H		Black Hill Lane	Keighley	29	0	29
H546	KY/059	KY21/HC	736	Parkwood Rise	Keighley	23	23	0
H550	KY/069A	KY25/H		Hainworth Road	Keighley	12	12	0
H551	KY/070/071	KY26/H		Hainworth Wood Road	Keighley	73	0	73
H554	KY/081 Part	KY29/H		Woodhouse Road, Keighley	Keighley	36	36	0
H555	KY/012	KY3/H	645	Whinfield Drive	Keighley	56	56	0
H559	KY/125	KY34/H		Former Branshaw School	Keighley	23	23	0
H560	KY/134A	KY36/H		Long Lee Lane	Keighley	8	8	0
H563	KY/015	KY4/H		Braithwaite Avenue	Keighley	126	126	0
H564	KY/159A	KY40/H		The Bungalow, Harden Road, Long Lee	Keighley	7	7	0
H565	KY/167	KY43/H		Grange Street	Keighley	17	0	17
H566	KY/172	KY44/H		Parson Street, Keighley	Keighley	22	0	22

PLP ref	SHLAA ref	Reg 18 ref	HLR/other ref	Site Address	Settlement Area	Total Plan Number	Yield 2023-2034	Yield 2035-2043
H567	KY/017	KY5/H		North Dean Road	Keighley	19	0	19
H568	KY/021B	KY7/H	SS/143	Wheathead Lane	Keighley	27	0	27
H569	KY/022	KY8/H		Higher Wheathead Farm	Keighley	30	30	0
H570	KY/024B	KY9/H		Former Bronte School Playing Fields	Keighley	32	32	0
H508	KY/176			Aire Valley Business Centre, Lawkholme Lane	Keighley	107	107	0
H538	KY/029			Keighley Road, Exley Head (1)	Keighley	61	61	0
H577	ME/013		SS/135	Otley Road	Menston	75	75	0
H798	OA/001		SS/147	Providence Farm, Providence Lane	Oakworth	43	0	43
H818	OA/002	OA1/H		Pasture Avenue	Oakworth	33	0	33
H832	OX/020			Land on Harry Lane	Oxenhope	17	0	17
H833	OX/003	OX1/H		Crossfield Road	Oxenhope	9	9	0
H834	OX/014	OX2/H part		Cross Lane	Oxenhope	25	8	17
H1358	QB/004			Old Mill Dam Lane	Queensbury	23	23	0
H837	QB/011		SS/136	Sharket Close	Queensbury	53	53	0
H866	QB/050		SS/083	Queensbury Golf Course	Queensbury	282	0	282
H868	QB/001	QB1/H		Albert Road / Denholme Rd	Queensbury	22	0	22
H869	QB/002	QB2/H		Albert Road	Queensbury	47	47	0
H870	QB/007	QB4/H		Brighouse Road	Queensbury	45	45	0
H871	QB/010	QB5/H		Jackson Hill Lane / Brighouse Road	Queensbury	41	0	41
H873	QB/014A/B PART	QB7/H		Old Guy Road / Fleet Lane (1)	Queensbury	295	240	55
H874	QB/036	QB8/H		Long Lane (2)	Queensbury	22	22	0
H604	NE/053			Station rd Water treatment works	Rural	150	150	0
H1044	SH/014	SH1/H		West Victoria Street	Shipley	27	0	27
H1011	SH/019	SH2/H		Carr Lane	Shipley	50	0	50
H1563	SH/022			Wycliffe Road and Thompson Road	Shipley	8	0	8
H1059	SH/027	SH5/H	SS/114	Bingley Road, Nab Wood	Shipley	136	136	0
H1061	SH/042B	SH7/H part		Queens Road/Ferncliffe Road - Saltaire	Shipley	42	42	0
H1056	SH/056	SH22/H		Browfoot/Wrose Brow Road	Shipley	16	0	16
H1055	SH/057	SH21/H		Wrose Brow Road, Windhill	Shipley	90	0	90
H1047	SH/061	SH13/H		Regent House	Shipley	93	93	0
H1052	SH/067A and SH/067B			Land between Leeds Road and Dock Lane	Shipley	32	0	32
H1030	SH/075		SS/035A	Shipley Hospital	Shipley	11	11	0
H1037	SH/082		PRE APP	Old Mill House, Dockfield Rd	Shipley	75	75	0
H1080	SI/027	SI8/H	5627	Dradishaw Road	Silsden	7	0	7
H1085	SI/032		5746	Stone Lodge, 134 Skipton Rd	Silsden	6	6	0
H1087	SI/001	SI1/H		North Dene Road	Silsden	43	0	43
H1089	SI/008	SI3/H		Woodside Road	Silsden	146	0	146
H1090	SI/013	SI4/H		Sykes Lane	Silsden	149	120	29
H1091	SI/023	SI6/H		Aire View Infants School, Elliot Street	Silsden	22	22	0
H1092	SI/024	SI7/H		Hothfield Junior School, Norton Street	Silsden	25	25	0
H1064	SI/003			Brown Bank Lane	Silsden	72	72	0
H1118	ST/007			The Croft, Lyon Road	Steeton	22	0	22
H1135	ST/002	ST2/H		Aireburn Avenue	Steeton	22	0	22
H1136	ST/010B	ST3/HC		West of Green Lane	Steeton	41	41	0
H1353	ST/001	ST1/H	SS/158	Summerhill Lane	Steeton	147	147	0
H1297	TH/018	TH7/H	5742	Old Road	Thornton	12	12	0
H1311	TH/035		SS/145	Thornton Road	Thornton	63	0	63
H1316	TH/002A	TH1/HC		Hill Top Road (2) (masterplan)	Thornton	16	0	16
H1317	TH/033A	TH10/H		Hill Top Road, near Ring O' Bells (masterplan)	Thornton	27	0	27
H1318	TH/033B	TH11/H		South of Hill Top Road and East of Close Head Lane	Thornton	30	30	0
H1320	TH/006	TH3/H		Thornton Road (2)	Thornton	15	0	15
H1321	TH/009	TH4/H		Hill Top Road (1) (masterplan)	Thornton	16	0	16
H1323	TH/012	TH6/H		Dole and Prospect Mills	Thornton	37	0	37
H1324	TH/029	TH9/H		Hill Top Road / Close Head Drive (masterplan)	Thornton	60	0	60
H1351	TH/003	TH2/H		Thornton Road (1) (masterplan)	Thornton	91	0	91
H1301	TH/022		SS/176	North Cliffe Lane	Thornton	62	62	0
H1325	WI/001		SS/085	Bents Lane	Wilsden	100	100	0
H1326	WI/003			Crack Lane north	Wilsden	21	21	0
H1338	WI/020		SS/047	Manor House Road	Wilsden	12	0	12
H1341	WI/005B	WI2/H		Crack Lane	Wilsden	47	0	47
H1342	WI/013	WI3/H		Moorside Farm	Wilsden	80	0	80
H1575				Former Football Ground- Hollingwood Mount	Bradford South West	26	26	0
H1576				Worstead Rd	Haworth	141	0	141

Appendix C – R19 Local Plan Allocations – Employment Sites

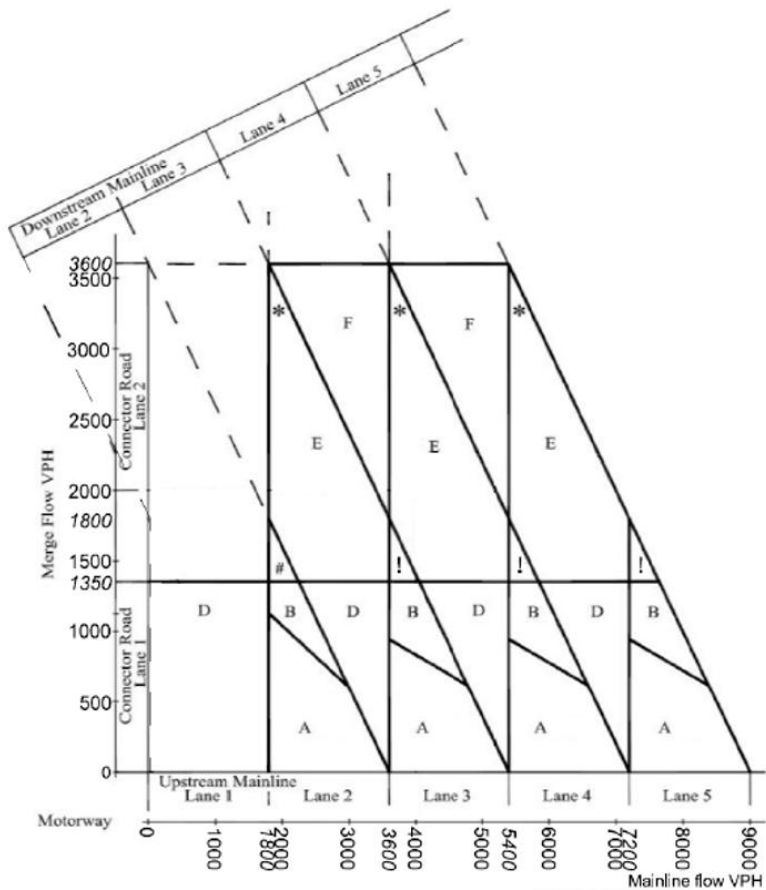
Site Details								Decision for Reg 5 (set 1st April 2020)	Delivery					Land Use (Ha)							
PLP Reference	Reg 5 Local Plan Ref/Status	SLA Reference	BLA Ref	Site Address/Name	Greenfield/POL	Gross Site Area (ha)	Net Site Area (ha)		2020-2030	2030-2035	2035-2040	2040-2045	DQ Received?	Phasing Justification	2023-2034 Reg 5 (1-5/5/18)	2023-2034 82	2023-2034 85	2035-2043 Reg 5 (1-5/5/18)	2035-2043 82	2035-2043 85	
E35	SE44E	SLN/02/70	0	Land At Whitecliffe Business Centre Whitecliffe Lane Bradford West Yorkshire	Greenfield	0.46	0.46	Allocate						Currently has planning permission		0.46					
E40		SLN/02/80	0	Former Site Of The Bradmet Centre Upper Green Bradford West Yorkshire SD16 7DS	POL	0.36	0.36	Allocate						Currently has planning permission	0.36						
E76		SLN/02/84	0	Land At Eccleside Road Former Roadworks Works Bradford West Yorkshire BD7 2JX	POL	0.24	0.24	Allocate						Currently has planning permission	0.24						
E75		SLN/02/87	0	Former Site Of Clutton House Newell Street Bradford West Yorkshire	POL	0.37	0.37	Allocate						Currently has planning permission	0.37						
E96		SLN/02/05	0	Allotment Gardens Kensington Street Netherley West Yorkshire	Greenfield	0.20	0.20	Allocate						Currently has planning permission	0.20						
E14	SE32E	SLN/02/06	0	Land At M20 Junction 2 To M20 Southbound Bradford West Yorkshire	Greenfield	0.46	0.46	Allocate						Currently has planning permission	0.05	0.21	0.21				
E136	KV49E	KV/177	0	Beechcliffe	Greenfield - 100%	3.30	1.66	Allocate					Yes	Being promised by the council as part of the Towns Fund. The app submitted for access.	0.17	0.74	0.74				
E139	KV50E	KV/050	0	Beafield Road	Greenfield - 100%	0.80	0.80	Allocate					Yes	DQ received and being promised.	0.09	0.36	0.36				
E55	SE34E	SE/022	0	Land East of Bicken Lane	Greenfield - 100%	1.36	1.36	Allocate					0	No DQ received.				0.14	0.61	0.61	
E56	SE35E	SE/023 & 9K/131	0	Land Adjacent Lower Lane, Pargy Lane and Bicken Lane	POL - 40% Greenfield - 60%	0.76	0.76	Allocate					Yes	DQ received. Owner confirms site can be delivered in shorter term.	0.09	0.35	0.35				
E57	SE37E	0	0	North of Westgate Hill and West of Tong Lane	Greenfield - 100%	9.06	5.44	Allocate					Yes	DQ received. Some interest from commercial developers. No one signed up. Will determine after outline permission is agreed. One land owner not willing to agree. Address to 2020/2021 due to outline application intention	0.18	0.82	0.82	0.36	1.63	1.63	
E59	SE39E	SE/151	0	Neville Road Lower Lane	POL - 60% Greenfield - 20%	1.57	1.57	Allocate					Yes	DQ received and starts 1-2 years.	0.16	0.71	0.71				
E61	SE41E	SE/152	0	Westgate Hill Street	Greenfield - 100%	1.90	1.90	Allocate					0	No DQ received.				0.15	0.68	0.68	
E65	SW49E	SW/120	0	Ingley Road	POL - 10% Greenfield - 90%	3.25	2.90	Allocate					0	No DQ received.				0.29	1.32	1.32	
E8	SE10E	SE/057	0	John Bonhill Road	0	0.30	0.30	Allocate					Yes	DQ Received.	0.05	0.23	0.23				
E14	CC33E	0	0	Exchange Court/ Vicar Lane	0	0.86	0.86	Allocate					0	Part of site on disposal list. Remaining site is an active car park.				0.09	0.39	0.39	
E63	SE43E	SE/140	0	Dick Lane	0	0.55	0.55	Allocate					Yes	DQ received and site is available but no time scales given. As to be allocated and done the RUP, delivery added to middle of plan period.				0.06	0.25	0.25	
E100	SE/036	SE/124	H976	Cordingley Street, Holmewood	0	0.87	0.87	Allocate					0	Site has planning permission (agreed 13.12.2021)	0.09	0.38	0.38				
E161	0	0	0	Former site of Agripoint Works	POL - 100%	2.85	2.93	Allocate					0	The app in 2022 but probably can't use?	0.25	1.14	1.14				
E152	0	SE/155	0	Southgate Lane	Greenfield - 100%	8.89	4.95	Allocate					Yes	Currently RUP allocation	0.43	1.96	1.96				
E157	SE39E	SE/146	EH114	Land at Nuffam	Greenfield - 100%	36.67	20.36	Allocate						Site being promised by owner and agent as part of larger site (E156).	0.78	3.50	3.50	1.56	7.01	7.01	
E136	NE22E and NE23E	NE/151 and NE/051b	0	Apperley Bridge / Bishals (former Filter Beds - Water Treatment Works) Strategic Employment Area and Walsall Farm, Apperley Lane	POL = 90% Greenfield = 10%	60.41	32.59	Allocate													
E159	SH124H	SH/060	0	Craig Road	Greenfield = 100%	4.96	1.34	Allocate								1.09	4.89	4.89	2.17	9.78	9.78

Appendix D – Merge and Diverge Diagrams

Source: CD 122 Geometric design of grade separated junctions (version 1.1.1)

Motorway merging diagram

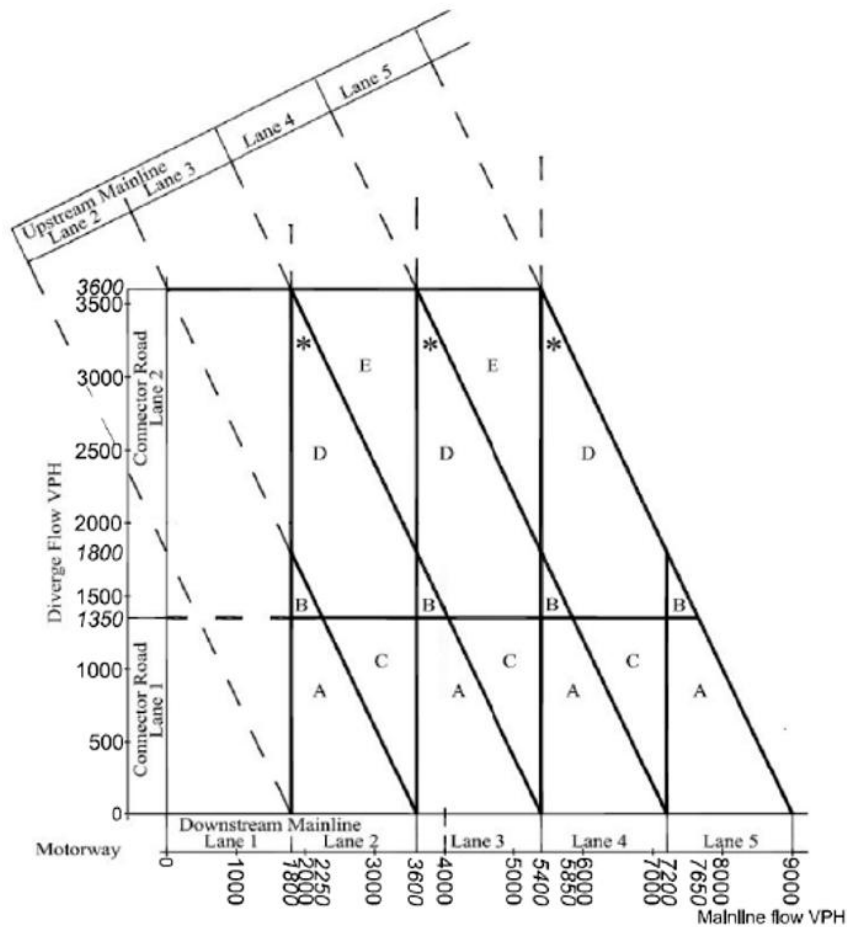
Figure 3.12b Motorway merging diagram



- NOTE 1 As an example of how to use Figures 3.12a and 3.12b, if the merge flow is 2000 vph and the upstream mainline flow is 4000 vph, this would give a Type E layout with 3 lanes upstream and 4 lanes downstream.
- NOTE 2 On Figures 3.12a and 3.12b, the # symbol indicates areas of uncertainty and the choice depends on the upstream and downstream provision and the ability for the mainline to accept the flows from the merge.
- NOTE 3 On Figures 3.12a and 3.12b, the ! symbol indicates that the minimum layout to be provided is:
- 1) Layout C for rural roads; or,
 - 2) Layout A Option 2 for urban roads.

Motorway diverging diagram

Figure 3.26b Motorway diverging diagram



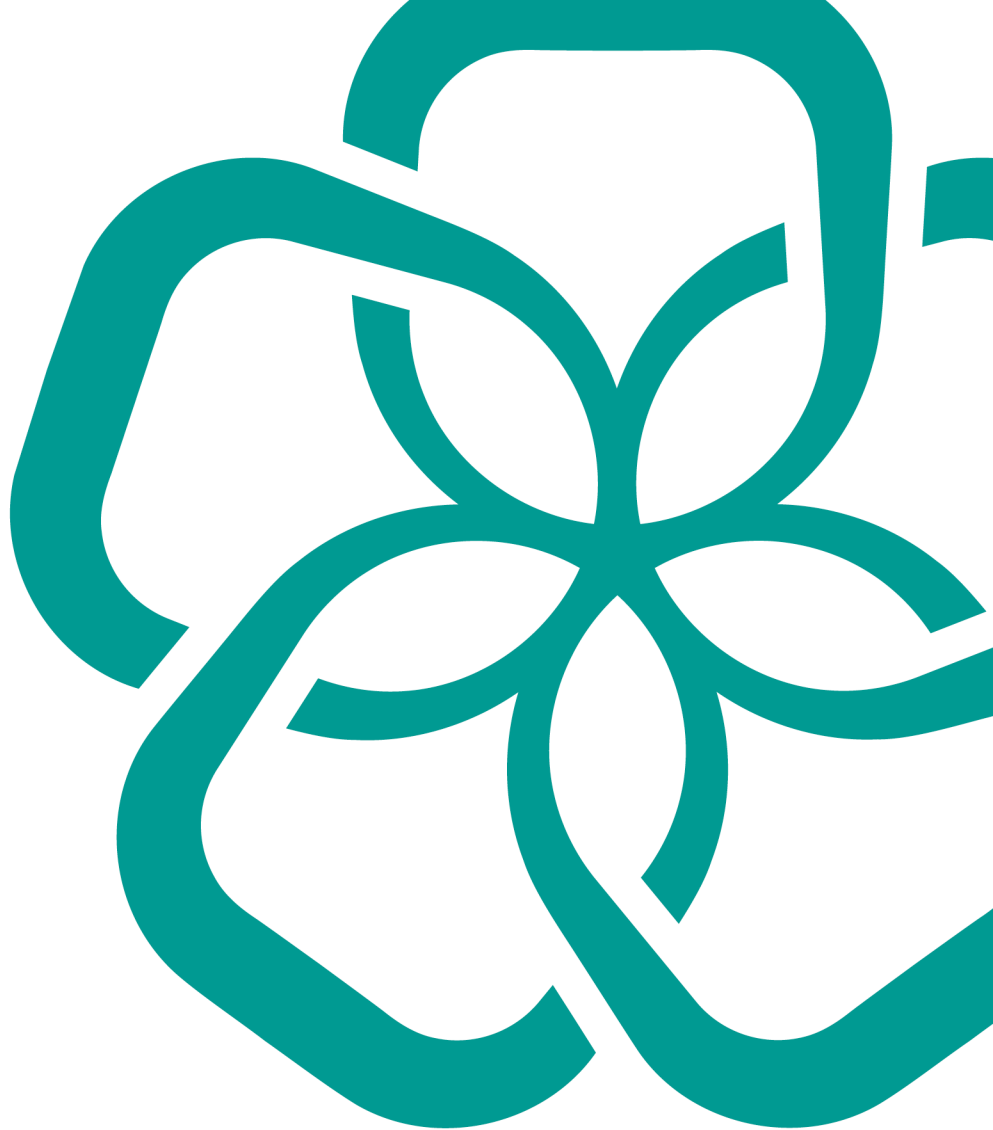
- NOTE As an example of how to use Figures 3.24a and 3.24b, if the diverge flow is 2000 vph and the downstream mainline flow is 4000 vph, this would give a Type D layout with 3 lanes downstream and 4 lanes upstream.
- 3.26.1 Where the flows are in the region indicated by the * symbol in Figures 3.25b and Layout D option 2 is to be used, an extended auxiliary lane should be provided instead of a taper diverge.
- 3.26.2 A diverge layout that offers a higher level of capacity than the worst case peak flow may be provided, for example Layout C instead of Layout A.

Appendix E – Carbon Impact Assessment Report



West
Yorkshire
Combined
Authority

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Brabin
Mayor of
West Yorkshire



Bradford Local Plan Carbon Impact Assessment Tech Note

Strategic Transport Modelling Team

August 2026

Purpose of note

For the Bradford Local Plan 2026, an assessment of the transport generated carbon impacts of the plan is required.

This note summarises the following:

- Technical approach to estimating carbon impacts
- High level summary of local plan assumptions – additional households, additional trips generated (SATURN model)
- Annualization factors
- Summary of carbon impact assessment

Technical approach

The approach for estimating and quantifying the Carbon Impacts of the Bradford Local Plan will use the Department for Transport (DfT) Vehicle Emissions Carbon Tool (VECAT).

This approach has been chosen for a number of reasons:

- The spreadsheet-based tool has been developed by DfT and is widely used across project appraisal
- It is simple to use and easily links to the SATURN model

Here is a link to the VECAT model and documentation [Vehicle emissions carbon tool \(VECAT\) - GOV.UK](#)

VCAT requires the following inputs:

- Car, LCV, OGV traffic volumes by model link for 'with and without scheme' scenarios
- Link (road) distance, speed

VECAT undertakes emissions calculations drawing on a range of assumptions (defined in the DfT TAG data book) relating to:

- Change in vehicle fleet composition through time
- Emissions factors by vehicle type (petrol, diesel) and engine size
- Ratio of OGV 1 / OGV 2

The key outputs are as follows (for each year in the 60 yr appraisal period):

- Annual VKT (without scheme, with scheme, differences) by vehicle type, fuel type, time period
- Annual Emissions (without scheme, with scheme, differences) by vehicle type, fuel type, time period

Local Plan Summary

Two scenarios have been run through the Bradford SATURN Model (BSTM) to provide the required inputs to VECAT:

- 'Without Local Plan' – 2034 and 2043
- 'With Local Plan' – 2034 and 2043

Infrastructure schemes that are more than likely to happen (or, in some cases, have already happened since 2023) have been added to the model to reflect our current best-guess of future network conditions to develop the 2034 and 2043 with and without local plan networks (note these have common networks). The schemes assumed were as follows:

- Bradford City TCF Improvements (completed),
- Great Horton Road/Horton Grange Road (completed),
- Thornton Road/Cemetery Road CIP,
- Thornton Road Cycle Superhighway Extension Phase 2,
- Toller Lane CIP,
- Wakefield Road/Tong Street,
- Bus Hotspots – Westgate & Thornbury Gyratory,
- loss of multi-storey car parks at City Village,
- Completed 20mph schemes (Manningham, Shipley and Ilkley)
- King's Road,
- Leeds Road/Carr Lane,
- New Works Road/Abb Scott Lane junction improvements, and
- Manchester Road Targeted Bus Improvements.

The travel demand for both scenarios was created as a result of the following process:

- BSTM 2023 base year model was developed
- West Yorkshire Transport model (WYTM) scenarios for 2034 and 2043 were developed as follows:
 - 2034 and 2043 Without Local Plan → standard NTEM growth applied for Bradford with overall growth controlled to NTEM West Yorkshire totals
 - 2034 and 2043 With Local Plan → same as 'Without Local Plan' outside of Bradford, local plan growth applied in Bradford instead of controlling to NTEM
 - The only difference between with and without local plan scenarios relates to the growth – without local plan controls to NTEM within Bradford, with local plan does not constrain to NTEM and results in higher population / jobs
- Changes in WYTM demand between 2023 and 2034 / 2043 with and without local plan scenarios were estimated
- BSTM 2034 and 2043 with and without local plan demand was created by applying the WYTM change (2023 → 2034 / 2043) to the BSTM 2023 demand matrices

Annualisation Factors

In order to estimate annual emissions and emissions across a 60 year appraisal period, SATURN time period demand needs to be annualised.

The BSTM has two peak hour models:

- AM peak – 08.00 to 09.00
- PM peak – 16.30 to 17.30

As a starting point, the AM and PM peak demand matrices were summarised to understand the split between cars, LGV and HGV.

Table 1 BSTM AM and PM peak Base Year matrix totals

User Class	User Class Definition	AM Peak			PM Peak		
		Prior	Post-ME	%diff	Prior	Post-ME	%diff
UC1	Car business	39305	38473	-2.10%	47402	46769	-1.30%
UC2	Car commute	259490	257440	-0.80%	226204	225886	-0.10%
UC3	Car Other	215879	216953	0.50%	297886	299185	0.40%
	All cars	514674	512867	-0.30%	571491	571841	0.10%
UC4	LGV	63985	63175	-1.30%	54468	53752	-1.30%
UC5	HGV	68491	67949	-0.80%	40551	40283	-0.70%
	Total	647150	643991	-0.50%	666511	665876	-0.10%

Data from 50 count locations was obtained to estimate the ratio average AM / PM hourly car trips to average Inter-peak hourly car trips, as summarised below. The average figures in red were used for the annualization process.

Table 2 Ratio of average AM / PM hour counts to Inter-peak counts

Ratio of AM / PM hour to inter-peak counts	Car	LGV	HGV	All vehicles
50 count sites - Average	0.42	0.58	0.49	0.43
50 counts sites - Min	0.23	0.29	0.13	0.23
50 count sites - Max	0.55	0.9	0.83	0.56
17 cordon count - Average	0.43	0.61	0.47	0.44
17 CC - Min	0.31	0.38	0.16	0.33
17 CC - Max	0.51	0.9	0.76	0.53

The count data was used along with the following factors:

- factor for 6.30-18.30 --> Daily – 1.28
- factor for weekday --> average weekend day – 0.83
- weekday → annual – 252
- weekend → annual – 113

The calculations came up with the following annualization factors:

- AM peak hour → annual AM peak / half off-peak: 2423
- PM peak hour → annual PM peak / half off-peak: 2311
- The final annualization of trips is calculated by $(AM * 2423) + (PM * 2311)$

Summary of Carbon Impact Assessment

The tables below summarise the results for the following scenarios

- 2034 With Local Plan
- 2034 Without Local Plan
- 2043 With Local Plan
- 2043 Without Local Plan

Outputs are provided for vehicle kilometres travelled (within Bradford), tonnes Co2 emitted (within Bradford) for all vehicles, cars, light vehicles and heavy vehicles separately. Buses account for less than 1% of total vehicles so are not presented separately.

Figures are provided for 2034 and 2043, and the full 60 year appraisal period (2034 to 2093)

Table 3 All vehicles - Emissions and VKT

	Vehicle Kilometres (000's)			Annual emissions (tCO2e)		
	2034	2043	60yr	2034	2043	60yr
Without	2,857,392	3,064,185	182,865,084	381,023	270,625	15,370,924
With	2,872,610	3,131,745	186,657,074	382,042	272,982	15,475,544
Diff (With)	15,219	67,560	3,791,990	1,019	2,357	104,620
% Diff (With)	0.5%	2.2%	2.1%	0.3%	0.9%	0.7%

Table 4 Cars - Emissions and VKT

	Vehicle Kilometres (000's)			Annual emissions (tCO2e)		
	2034	2043	60yr	2034	2043	60yr
Without	2,426,767	2,595,250	154,913,598	205,133	105,543	5,668,979
With	2,444,168	2,666,502	158,919,549	206,796	108,768	5,823,386
Diff (With)	17,402	71,251	4,005,951	1,663	3,225	154,408
% Diff (With)	0.7%	2.7%	2.6%	0.8%	3.1%	2.7%

Table 5 LCV - Emissions and VKT

	Vehicle Kilometres (000's)			Annual emissions (tCO2e)		
	2034	2043	60yr	2034	2043	60yr
Without	219,151	250,389	14,870,766	29,179	22,438	1,262,977
With	218,031	248,702	14,772,357	29,047	22,328	1,256,813
Diff (With)	- 1,120	- 1,687	- 98,409	- 131	- 110	- 6,164
% Diff (With)	-0.5%	-0.7%	-0.7%	-0.4%	-0.5%	-0.5%

Table 6 HCV - Emissions and VKT

	Vehicle Kilometres			Annual emissions (tCO2e)		
	2034	2043	60yr	2034	2043	60yr
Without	186,574	193,798	11,594,481	128,677	124,604	7,369,897
With	185,527	191,810	11,479,893	128,149	123,779	7,322,526
Diff (With)	-1,047	-1,988	-114,588	-529	-825	-47,371
% Diff (With)	-0.6%	-1.0%	-1.0%	-0.4%	-0.7%	-0.6%

Table 7 Cars as % of total Emissions and VKT

	Vehicle Kilometres			Annual emissions (tCO ₂ e)		
	2034	2043	60yr	2034	2043	60yr
Without	84.9%	84.7%	84.7%	53.8%	39.0%	36.9%
With	85.1%	85.1%	85.1%	54.1%	39.8%	37.6%

In summary:

- Over a 60-year period, the local plan is forecast to increase vehicle kilometres by around 2% and transport generated CO₂ emissions by around 0.7% - this difference is due to the fact that whilst the majority of the VKT change is due to additional car trips, car trips produce much lower emissions per kilometres (compared to LCVs and HCVs in particular) resulting in a lesser increase in emissions.
- At a user class level, there is forecast to be smaller (less than 1%) decreases in LCV and HCV vehicle kilometres travelled and transport generated CO₂ emissions over a 60 year period, balanced by a 2.5% increase in car VKT and emissions over the 60 year period
- Through time, the car contribution to VKT remains broadly similar (85%) however the car contribution to emissions declines from 54% (2034) to around 37% for the whole appraisal period (and 30% in 2094 – end of 60 yr appraisal period) due to the car fleet having a faster rate of transition from ICEs to hybrid and electric vehicles compared to LCVs and HCVs.

Appendix F – Air Quality Assessment Report

Report

Bradford Local Plan

Air Quality Assessment

For City of Bradford Metropolitan District Council

24 September 2026

Document Control

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Principal Contact:	Stephen Hay
Document Title:	Air Quality Assessment
Document Number:	17776A-10-R01-01-F
Prepared By:	Lola McAuley
Reviewed By:	Dr Ben Marner

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3rd Floor St Augustine's Court, 1 St. Augustine's Place, Bristol, BS1 4UD Tel: +44(0)117 974 1086

First Floor, 3 – 7 Herbal Hill, London, EC1R 5EJ Tel: +44(0)20 3873 4780

First Floor, Patten House, Moulders Lane, Warrington, WA1 2BA Tel: +44(0)1925 937 195

Nile House, Nile St, Brighton and Hove, Brighton, BN1 1HW Tel: +44(0)20 3873 4780

1 Aire St, Leeds, LS1 4PR Tel: +44(0)20 3873 4780

Avenue du Port, 86c Box 204, 1000 Bruxelles Tel: +44(0)20 3873 4780

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1 Introduction

- 1.1 This report has been prepared by Air Quality Consultants Ltd I Part of Logika Group (AQC). The experience of the authors is summarised in Appendix A1. The report describes the potential air quality impacts on public health associated with the emerging Bradford Local Plan.
- 1.2 The principal reason why development allocated in the emerging Local Plan might affect air quality is because of emissions from road traffic. New development will also generate emissions from other sources, such as construction dust and from boiler plant, however any air quality effects from these sources are only likely to occur close to each development. It is not, therefore, necessary to consider these sources explicitly in relation to the emerging Local Plan. This report therefore considers emissions from road traffic.
- 1.3 Developments contained within the local plan will each require individual planning approval. Where there is potential for significant air quality effects, it is expected that those effects will be considered at that stage, including the identifying any required mitigation. However, such assessments only consider the air quality effects of each development individually and therefore it is helpful to consider the combined effects of all expected growth in a strategic way. This assessment follows a strategic approach which is significantly less detailed than project-specific air quality assessments, but which highlights where there is the potential for future air quality impacts.

2 Pollutants of Concern

- 2.1 The main air pollutants of concern in relation to road traffic are nitrogen dioxide (NO₂) (which is formed in the atmosphere from emissions of nitrogen oxides (NO_x)), and fine particulate matter (PM₁₀ and PM_{2.5}). Road traffic also emits ammonia and Volatile Organic Compounds (VOCs), which react in the atmosphere to produce health-relevant air pollutants, but these reactions typically take place over distances of several kilometres and do not, therefore, require considering here.
- 2.1 UK-wide objectives for NO₂ and PM₁₀ were to have been achieved by 2005 and 2004 respectively and continue to apply in all future years thereafter. The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2022). The annual mean objectives for NO₂ and PM₁₀ apply at the façades of residential properties, schools, hospitals etc. The 24-hour mean objective for PM₁₀ applies at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for NO₂ applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets. For PM_{2.5}, the objective set by Defra for local authorities is to work toward reducing concentrations without setting any specific numerical value. In the absence of a numerical objective, it is convention to assess local air quality impacts against the limit value¹, originally set at 25 µg/m³ and currently set at 20 µg/m³. The relevant air quality criteria for this assessment are provided in Table 2-1.

Table 2-1: Air Quality Criteria for Nitrogen Dioxide, PM₁₀ and PM_{2.5}

Pollutant	Time Period	Value
Nitrogen Dioxide	1-hour Mean	200 µg/m ³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m ³
PM ₁₀	24-hour Mean	50 µg/m ³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m ³ ^a
PM _{2.5}	Annual Mean	20 µg/m ³ ^b

^a A proxy value of 32 µg/m³ as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM₁₀ objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM₁₀ objective are possible (Moorcroft and Barrowcliffe et al, 2017).

^b There is no numerical PM_{2.5} objective for local authorities (see Paragraph 2.1). Convention is to assess against the UK limit value which is currently 20 µg/m³.

- 2.2 Defra has also set two new targets for PM_{2.5} concentrations in England. One target focuses on absolute concentrations, with the long-term target to achieve an annual mean PM_{2.5} concentration of 10 µg/m³ by the end of 2040 (referred to as the annual mean concentration target or AMCT). The second target relates to reducing overall population exposure to PM_{2.5}. By the end of 2040, overall population exposure to PM_{2.5} should be reduced by 35% compared with 2018 levels (referred to as the population exposure reduction target or PERT). The most recent interim targets published in the

¹ See Paragraph 2.3.

2025 Environmental Improvement Plan (Defra, 2025) aim to meet the AMCT 10 years early, by December 2030², with the interim PERT being a reduction of 30% by December 2030 (Table 2-2).

Table 2-2: Environment Act PM_{2.5} Targets

Metric	Target	Target year
AMCT	Interim target: 10 µg/m ³	2030
	Legally binding target: 10 µg/m ³	2040
PERT	Interim target: 30% reduction in exposure compared to 2018	2030
	Legally binding target: 35% reduction in exposure compared to 2018	2040

^a Annual Mean Concentration Target.

^b Population Exposure Reduction Target.

- 2.3 EU Directive 2008/50/EC sets limit values for NO₂, PM₁₀ and PM_{2.5}, and is implemented in UK law through the Air Quality Standards Regulations (2010) (as amended through The Air Quality Standards (Amendment) Regulations 2016 and The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020). The limit values for NO₂ and PM₁₀ are the same numerical concentrations as the UK objectives, but achievement of the limit values is a national obligation rather than a local one and concentrations are reported to the nearest whole number. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. However, Defra identified Bradford as an area with exceedances of the annual mean nitrogen dioxide limit value, resulting in the creation of a Clean Air Zone (CAZ) in the city (see Section 4.2).

² The 2040 target will be assessed using measurements from 2040. National targets are assessed against concentrations expressed to the nearest whole number, for example a concentration of 10.4 µg/m³ would not exceed the 10 µg/m³ target.

3 Methodology

Baseline Conditions

- 3.1 A review of existing air quality conditions in the District has been undertaken through a review of the City of Bradford Metropolitan District Council (CBMDC)'s 2025 Annual Status Report (City of Bradford Metropolitan District Council, 2026).

Air Quality Screening

National Highways

- 3.2 National Highways' guidance on the assessment of air quality impacts from road schemes is set out in the Design Manual for Roads and Bridges (DMRB). The current version of this guidance is LA 105 (National Highways, 2024), which states that the air quality impacts of each individual project should be scoped out from any further assessment where the changes caused by the project do not meet any of the following criteria:

- annual average daily traffic (AADT) $\geq 1,000$; or
- heavy duty vehicle (HDV) AADT ≥ 200 ; or
- a change in speed band; or
- a change in carriageway alignment by $\geq 5\text{m}$.

- 3.3 Although this guidance was intended for highway schemes, these thresholds are often used in the context of Local Plan Assessments; they are broadly taken to describe changes below which the combined effects of multiple individual developments can be discounted as not significant irrespective of the baseline air quality conditions.

IAQM Guidance

- 3.4 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)³ recommend a screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by individual developments have the potential for significant air quality impacts. This compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. The screening thresholds inside are:

- inside an Air Quality Management Area (AQMA):
 - 100 Light Duty Vehicles (LDVs) per day; or
 - 25 HDVs per day;
- outside of an AQMA:
 - 500 LDVs per day; or
 - 100 HDVs per day.

- 3.5 Developments which generate fewer additional vehicles than this are typically discounted as not significant with respect to air quality. This guidance is intended for air quality assessments for individual

³ The IAQM is the professional body for air quality practitioners in the UK.

developments, and the thresholds take account of the potential for multiple developments to have a cumulative effect. The thresholds are not, therefore, directly applicable to assessing the Local Plan, which already represents the combined effect of multiple developments. They nevertheless provide helpful context to consider the potential for changes to traffic volumes to give rise to significant changes to air quality.

Fall-Off Distance

- 3.6 Concentrations of traffic-related primary air pollutants tend to reduce quickly as the distance from the road increases (AQC, 2008), (Defra, 2022). Figure 3-1 illustrates how annual mean concentrations typically decline by around 85% over the first 50 m from the road. Consequently, the greater the distance from the pollution source, the lower the associated environmental and human health impacts are likely to be. This is important when considering the potential air quality effects caused by changes to traffic. A large increase in traffic on a road some distance from any locations with relevant exposure to the air quality objectives, may have a much smaller air quality effect than a small increase in traffic on roads close to homes.

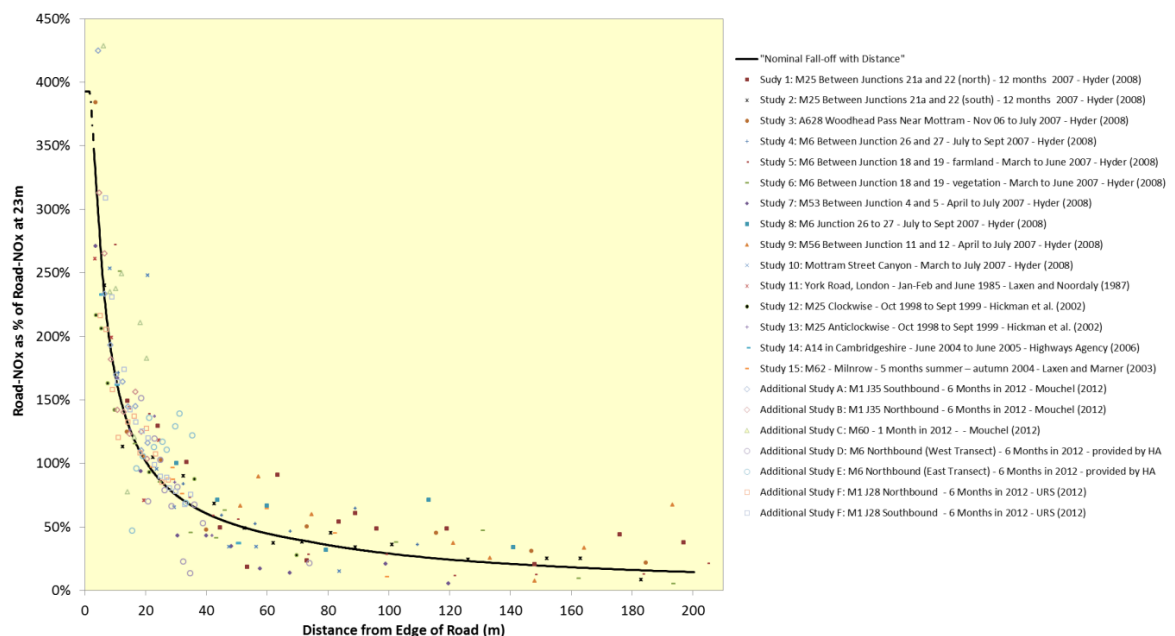


Figure 3-1: Rate of Change in Road Contribution to Annual Mean NOx Concentrations vs Distance from Road across 22 Monitoring Transects (AQC, 2021)

Traffic Data Scenarios

- 3.7 The traffic data used in the air quality screening exercise was provided by CBMDC and was derived from strategic transport modelling and testing of potential additional housing development locations beyond those identified within the currently adopted Local Plan. The modelling sought to assess the potential traffic implications of different development and transport policy futures in the plan period.
- 3.8 To support this assessment, CBMDC developed four transport scenarios:
- 2034 without the Local Plan;
 - 2034 with the Local Plan;
 - 2043 without the Local Plan; and

- 2043 with the Local Plan.

- 3.9 This assessment has taken consideration of the impact of the Local Plan by calculating the difference of the 'Without Local Plan' and 'With Local Plan' scenarios in 2034 and 2043.
- 3.10 A separate air quality assessment has been prepared to inform the Habitats Regulations Assessment (HRA) of the Local Plan. This follows specific requirements for HRA and therefore uses traffic scenarios which differ from those considered here. The differences relate to the treatment of development which is not provided by the Emerging Local Plan, and which is therefore not relevant to this current assessment.

4 Baseline Conditions

- 4.1 The Bradford district is diverse in character, with a population of over half a million, making it one of the largest metropolitan areas in England. It includes the city of Bradford and the important market towns of Keighley, Shipley, Bingley and Ilkley. While the district is primarily urban, two-thirds of its area is rural in character, comprising of villages, landscapes and open spaces.

Clean Air Zone

- 4.2 CBMDC implemented a CAZ in 2022 to improve air quality across the worst impacted areas of Bradford. The CAZ covers the area inside and including the Bradford outer ring road and extends along the Aire valley corridor to include Shipley and Saltaire, as shown in Figure 4-1. The UK Government mandated the introduction of the CAZ in Bradford in 2022, due to years of exceeding the legal NO₂ limits.

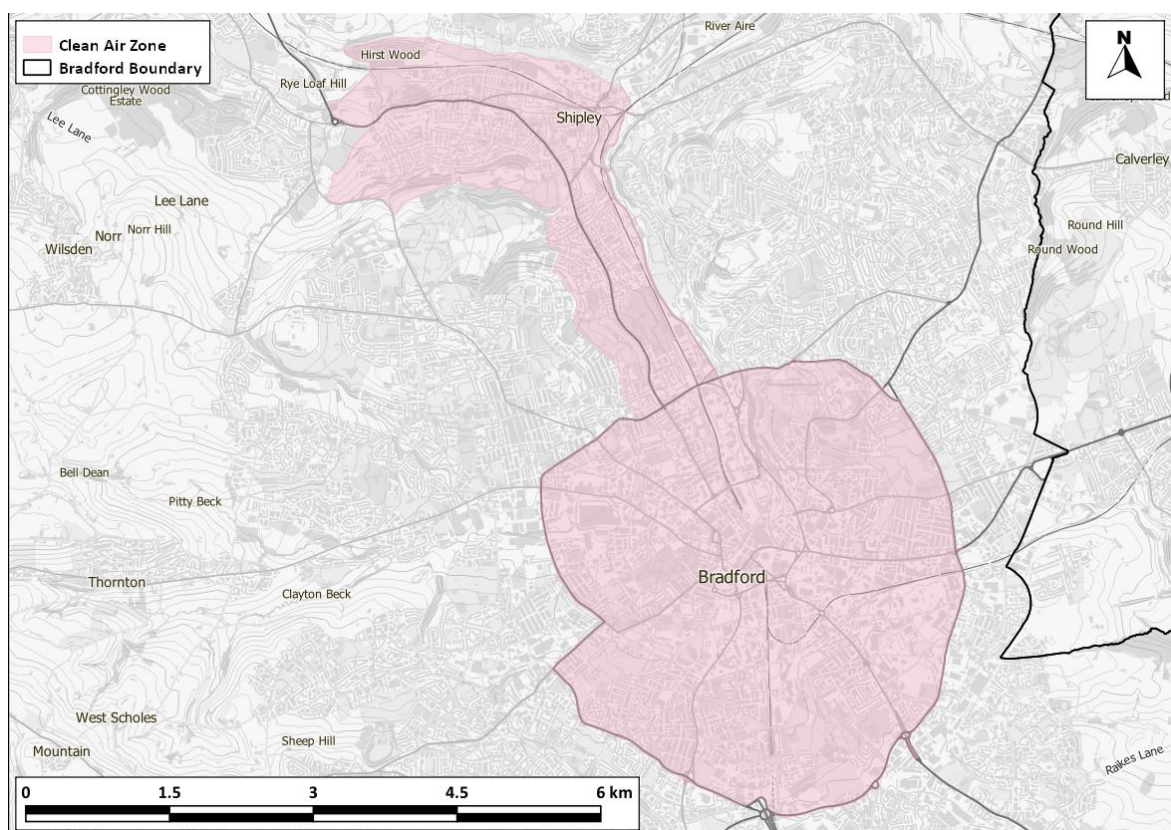


Figure 4-1: Bradford Clean Air Zone

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 4.3 It is a Class C+ CAZ, which imposes a daily fee on vehicles entering CAZ that don't meet the required emission standards. The zone applies to buses, Heavy Good Vehicles (HGVs), Light Good Vehicles (LGVs), coaches, hackney carriages, and private hire vehicles, but private cars are not affected. The money from the charges and fines goes directly into schemes designed to improve Bradford's air quality.

Air Quality Management Areas

- 4.4 The main source of air pollution in the district is road traffic, but there are also contributions from industry, heat and power generation and agriculture. AQMAs are declared when there is an exceedance or likely exceedance of a UK air quality objective.
- 4.5 In 2006, CBMDC declared four AQMAs for exceedances of the annual mean objective for NO₂. These AQMAs are shown in Figure 4-2 and are:
- AQMA order 1 – Mayo Avenue;
 - AQMA order 2 – Manning Lane / Queens Road;
 - AQMA order 3 – Thornton Road; and
 - AQMA order 4 – Shipley Airedale Road.

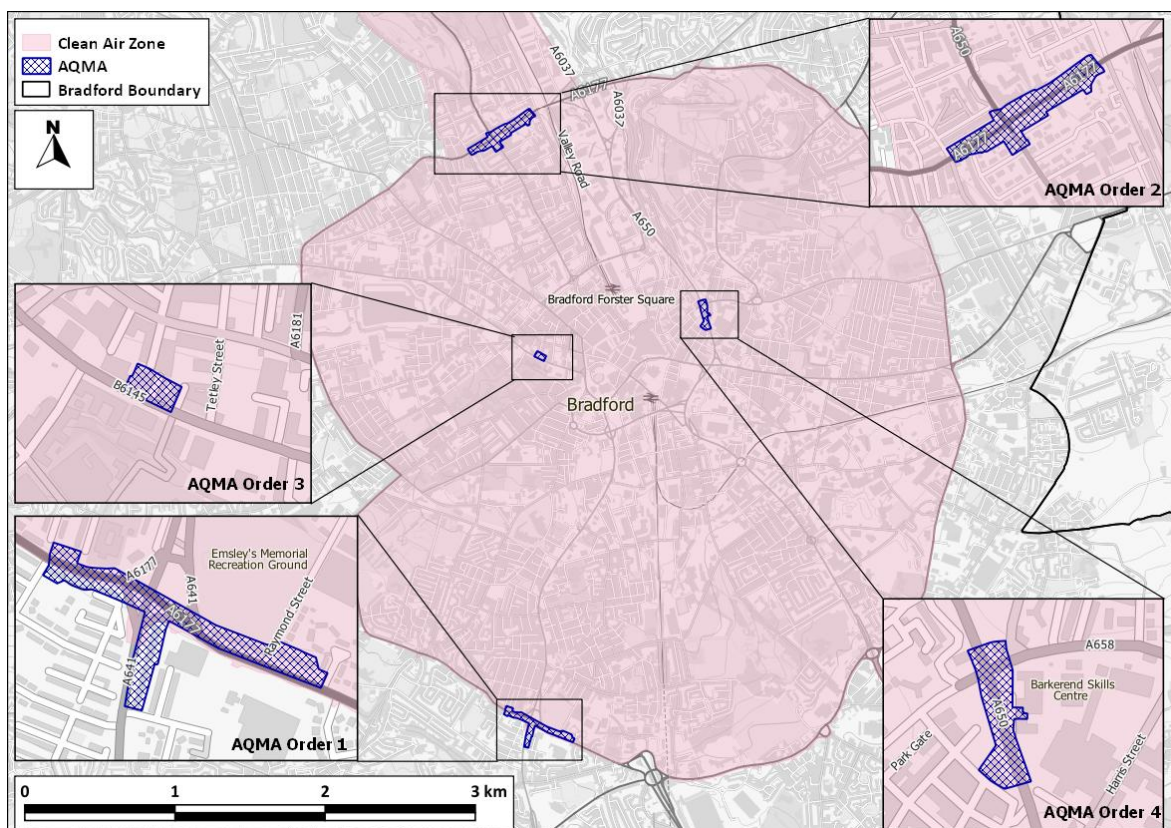


Figure 4-2: Bradford AQMAs

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

Monitoring Results

NO₂ Monitoring

- 4.6 CBMDC undertakes a programme of air quality monitoring using a combination of automatic (continuous) analysers and non-automatic (passive) NO₂ diffusion tubes to assess pollutant concentrations across the district. Automatic monitoring provides high-resolution, continuous data at key locations, while diffusion tubes are used to provide wider spatial coverage at roadside and

background locations. Defra also undertakes a combination of automatic and non-automatic monitoring in Bradford as part of the Automatic Urban and Rural (AURN) and UK Urban NO₂ Network (UUNN) (Defra, 2026). Figure 4-3 presents a map showing the locations of all monitoring sites operating during 2025.

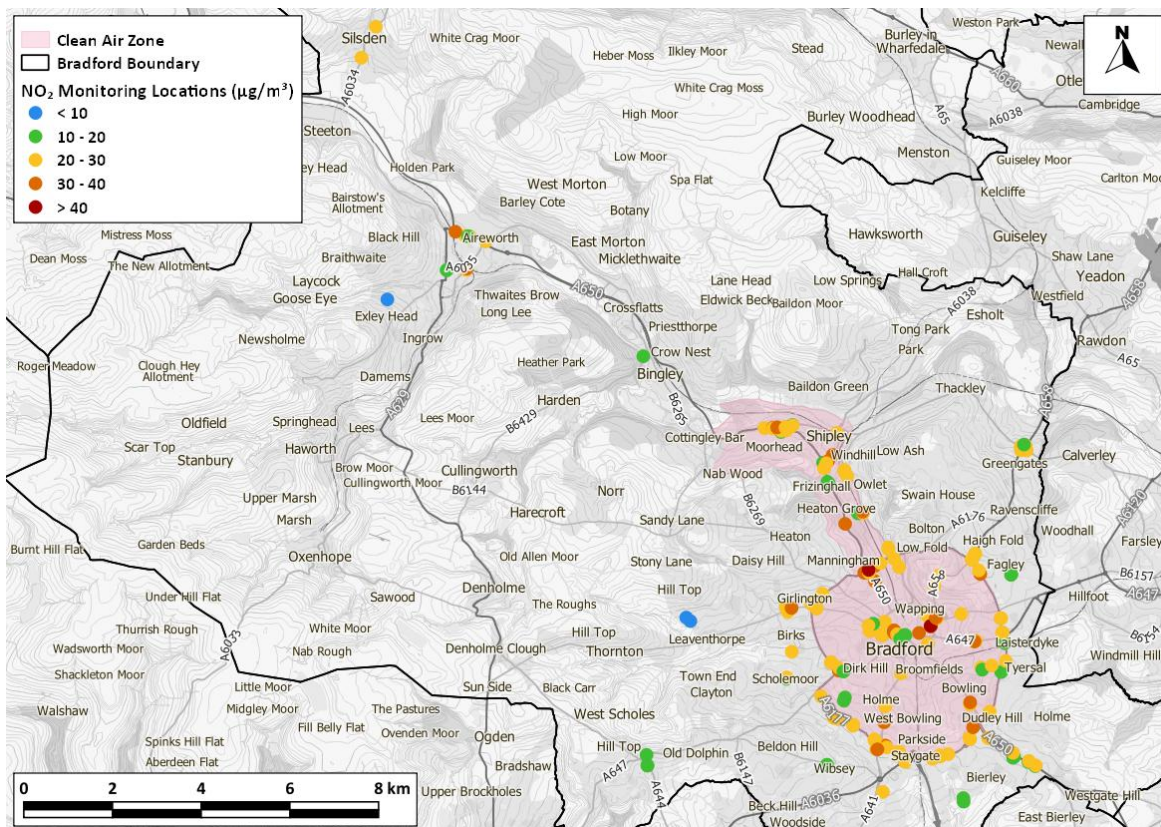


Figure 4-3: 2025 Bradford NO₂ Monitoring Locations and Measured Annual Mean Concentrations in 2025

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 4.7 The 2026 annual status report (City of Bradford Metropolitan District Council, 2026) shows that air pollution in Bradford is improving, with 2025 recording some of the lowest NO₂ concentrations since Bradford's records began. Within Bradford City Centre there was a major improvement in air quality in 2025 due to recent pedestrianisation of a large proportion of city centre and changes to traffic routing. This reflects broader national improvements in air quality resulting from cleaner vehicle fleets and emissions standards, although evidence from Bradford (City of Bradford Metropolitan District Council, 2024) indicates that the Clean Air Zone has made a significant contribution to the observed reductions in NO₂ and the associated reductions in respiratory and cardiovascular health impacts.
- 4.8 The 2025 automatic monitoring results (City of Bradford Metropolitan District Council, 2026) show that both the long term and short term objectives for NO₂ were met at the seven automatic monitoring stations (comprising of six roadside locations and one urban centre).
- 4.9 In 2025, the diffusion tube locations measured two exceedances of the 40 µg/m³ annual mean NO₂ objective. The exceedances are outlined in Table 4-1 below. Defra recorded no limit value exceedances in 2025 at the UUNN sites.

Table 4-1: Non-Automatic Monitoring Sites with Exceedances of the Annual NO₂ Objective

Diffusion Tube ID	Site Name	In AQMA?	NO ₂ concentration in 2025 (µg/m ³)
Site DT12 ^a	Shipley Airedale Road	Shipley Airedale Road AQMA (order 4)	44.4
Site DT72	Queen's Road	Manningham Lane / Queen's Road AQMA (order 2)	42.9

^a Average of triplicate diffusion tubes.

- 4.10 Since the annual mean NO₂ concentration did not exceed 60 µg/m³ at any monitoring location, exceedances of the NO₂ 1-hour mean objective are unlikely.

PM₁₀ and PM_{2.5} Monitoring

- 4.11 The annual mean PM₁₀ and PM_{2.5} concentrations remained below the objectives 40 µg/m³ and 20 µg/m³ respectively. The 24-hour mean PM₁₀ objective was also met. Figure 4-4 presents a map showing the locations of all monitoring sites operating during 2025.

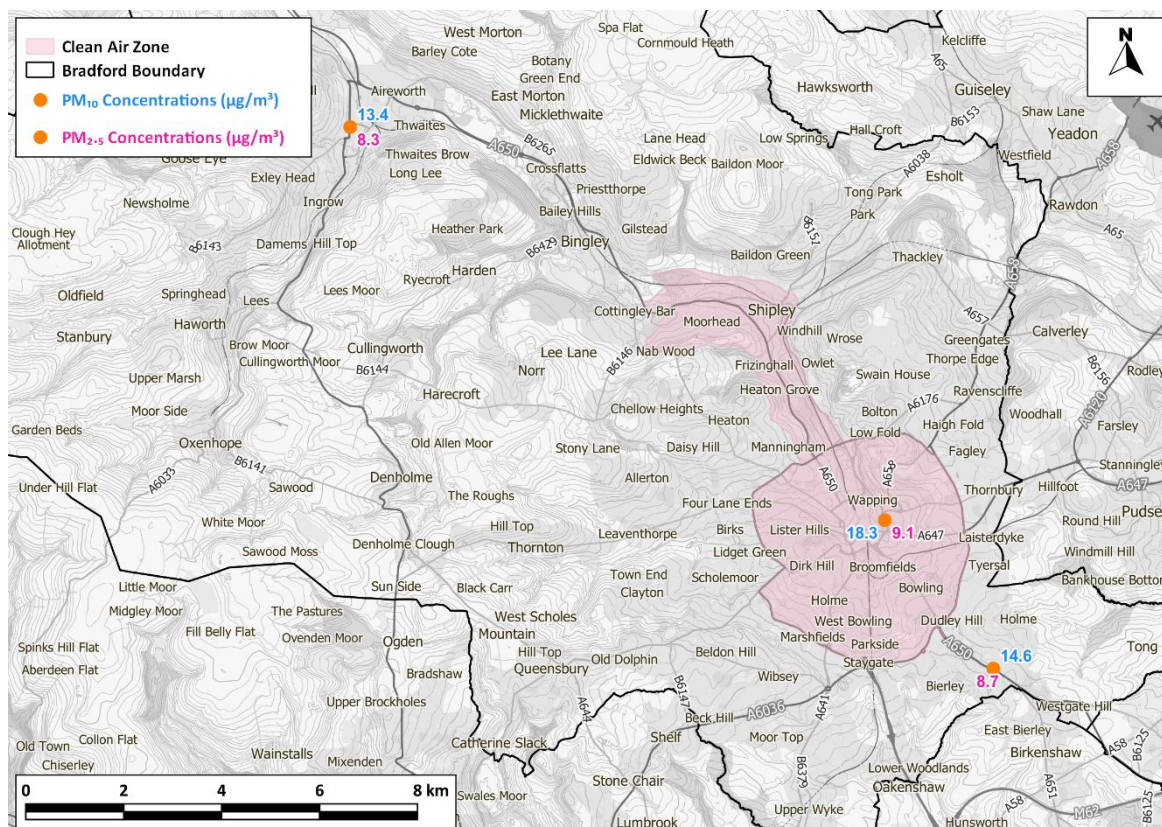


Figure 4-4: 2025 Bradford PM₁₀ and PM_{2.5} Monitoring Locations and Measured Annual Mean Concentrations in 2025

Future Trends in Traffic Emissions

- 4.12 Air pollution emissions from road traffic are falling over time. This is because of progressive tightening of vehicle emissions standards and a move to electric vehicles. The expected reductions in emissions of NO_x, PM₁₀ and PM_{2.5} are shown in Figure 4-5. These trends do not take explicit account of the Clean Air Zone and the reductions in the centre of Bradford may therefore be even greater in

practice. The forecast reductions in emissions of NO_x are dramatic, while those for PM₁₀ and PM_{2.5} are smaller; this reflects the fact that NO_x emissions are entirely from vehicle engine exhausts while those of PM₁₀ and PM_{2.5} also come from abrasion of brakes, tyres, and the road surface. In addition to these reductions, relevant emissions from other sources are also generally falling.

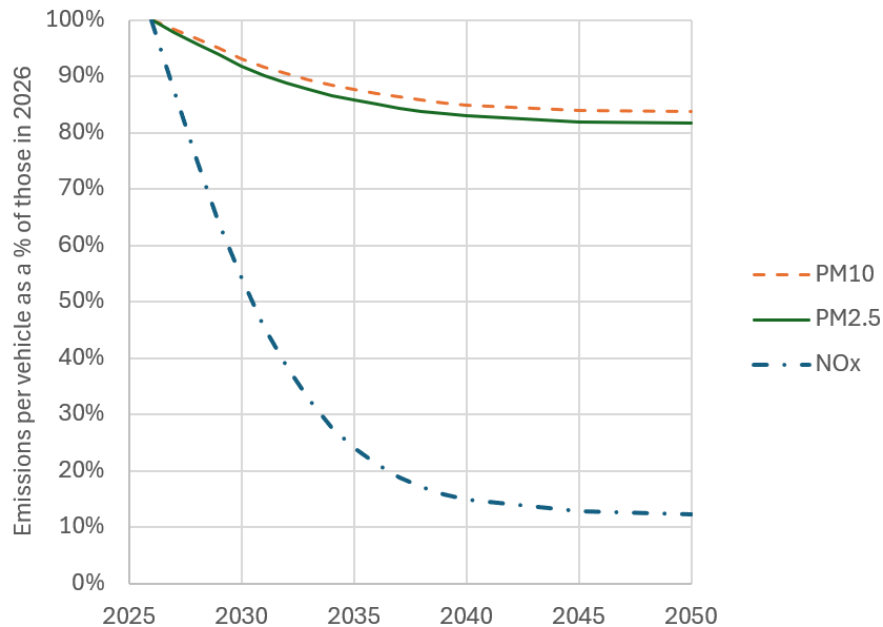


Figure 4-5: Predicted Average Emissions Per Vehicle PM₁₀, PM_{2.5} and NO_x as Percentages of those in 2026 (based on Defra's Emissions Factors Toolkit V14.2, for an urban road in England with an average speed of 50 kph and with 5% Heavy Duty Vehicles)

- 4.13 New road traffic associated with the emerging Local Plan may therefore increase air pollution in comparison to the concentrations which would otherwise exist, but overall, it is still likely that air quality will be better than it is at present.

5 Assessment

- 5.1 This section discusses traffic flows in terms of total traffic volume. For the impact of the scenarios on HDV flows specifically see Appendix A2. In general, the predicted changes in HDV numbers are less likely to give rise to significant air quality effects than the changes in total traffic volumes. Appendix A2 therefore shows fewer road links predicted to exceed the HDV traffic screening criteria than are highlighted in the section below. Where there are areas in which potentially significant increases in HDV volumes are predicted which are not also highlighted for total traffic, they are identified in the text below.

Bradford CAZ

2034

- 5.2 As discussed in Sections 4.2 and 4.3, a CAZ operates within Bradford to improve air quality and reduce the associated health impacts in the areas most affected by pollution. The CAZ covers Bradford city centre, encompassing the area within the Bradford Outer Ring Road and extending along the Aire Valley corridor, including Shipley and Saltaire.
- 5.3 Within the Bradford CAZ, the draft Local Plan is not expected to result in a breach the 1,000 AADT threshold. Projected changes in traffic volumes range from a decrease of approximately 500 AADT to an increase of up to 500 AADT, as illustrated in Figure 5-1. The CAZ has historically contained the highest NO₂ concentrations in the district, as discussed in Sections 4.2 to 4.3. Furthermore, Bradford city centre contains the highest volume of sensitive receptors, such as residential properties, within the district. The predicted changes to traffic within the CAZ are mostly increases, which will consequently have an overall adverse effect on exposure to poor air quality.
- 5.4 While the overall picture is one of traffic increases, there will be a number of roads experiencing decreases in traffic volumes, as shown in Figure 5-1. The largest reduction occurs on Ransdale Road in the southwest of the CAZ.

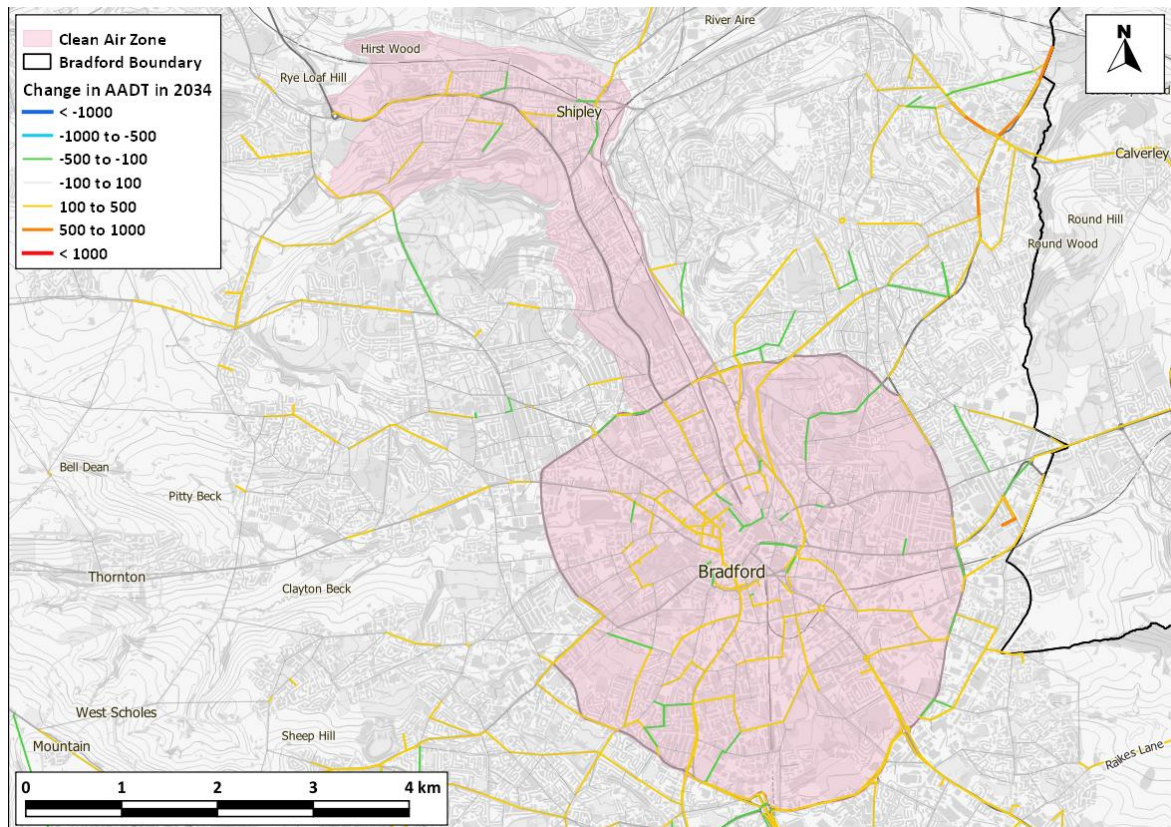


Figure 5-1: Bradford CAZ with the impact of the draft Local Plan in 2034

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.5 The most notable change in traffic flows within the CAZ is an increase of 466 AADT within the Mayo Avenue AQMA, which is discussed further in Section 5.8.
- 5.6 The corridor comprising the A641 Manchester Road / Prince's Way / Godwin Street is expected to experience increases in traffic flows of approximately 400 AADT. This section of road is primarily bordered by council and museum buildings, which are not sensitive receptors to annual mean concentrations as defined in Section 2. Consequently, this increase is not expected to result in a significant air quality impact.

AQMAs

- 5.7 The four AQMAs are areas of historically high NO₂ concentrations (as discussed in Section 4.4 to 4.5) and are a particular focus when considering air quality impacts in Bradford.
- 5.8 Mayo Avenue AQMA (order 1) is not expected to experience any traffic increases above 1,000 AADT in 2034. The greatest changes within the AQMA are increases of up to 466 AADT along the A641 Manchester road. All roads within the AQMA will experience an increase in traffic flows, apart from the westbound carriageway on the A6177 which will have a decrease of approximately 85 AADT. Although the traffic flows within the AQMA increase, these increases remain below the 1,000 AADT criterion.

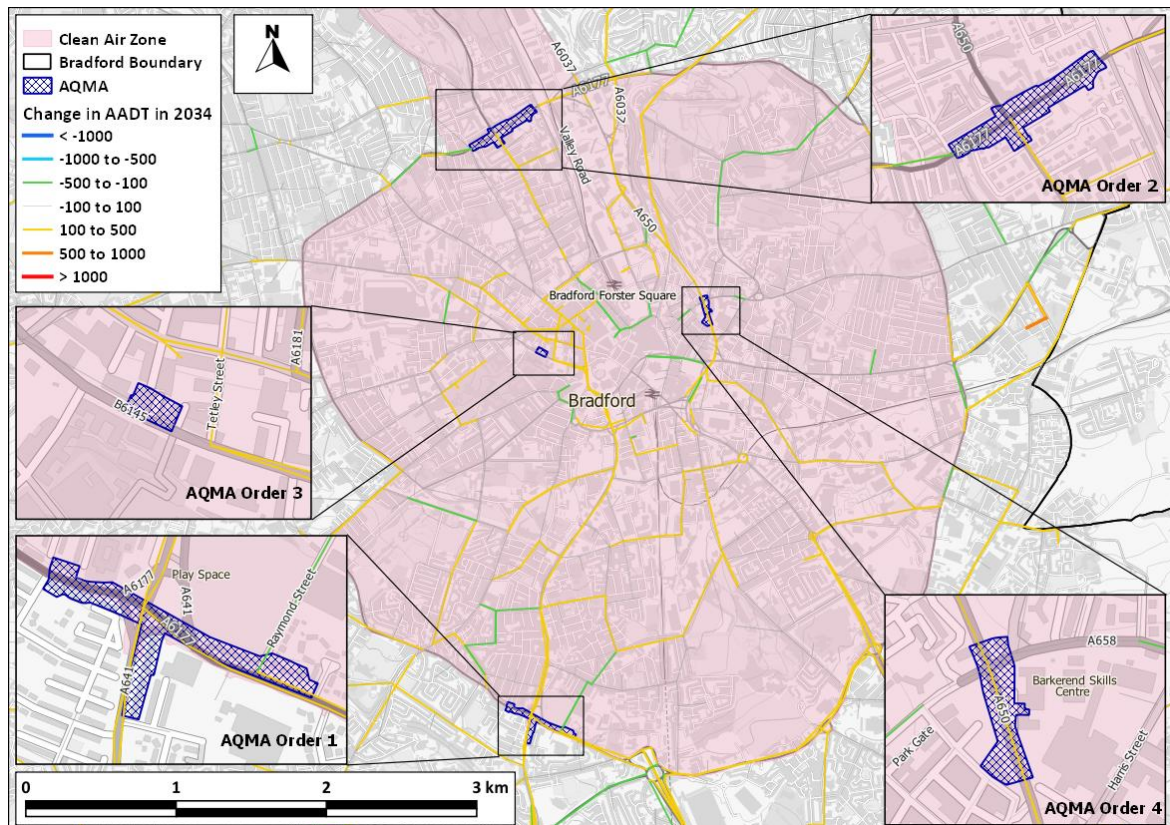


Figure 5-2: Bradford AQMAs with the impact of the draft Local Plan in 2034

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.9 Morning Lane / Queens Road AQMA (order 2) is not expected to experience major changes in traffic flows in 2034, with only one road experiencing a change in traffic flows of more than 100 AADT (southbound Manningham Lane, south of the junction will experience an increase of 121 AADT). These changes in flow are well below the 1,000 AADT threshold.
- 5.10 Thornton Road AQMA (order 3) is not expected to experience major changes in traffic flows in 2034, with the road not experiencing a change in traffic flows of more than 100 AADT in either direction, remaining well below the 1,000 AADT threshold.
- 5.11 Shipley Airedale Road AQMA (order 4) is not expected to experience any traffic increases above 1,000 AADT in 2034. An increase of up to 297 AADT on the southbound A650 Shipley Airedale Road represents the greatest change within the AQMA, remaining well below the 1,000 AADT threshold.

2043

- 5.12 In 2043, the draft Local Plan will have much greater impacts on the traffic flows within the Bradford CAZ compared to 2034. However, as explained in Paragraph 4.12, by 2043, average emissions per vehicle will be lower. As Figure 5-3 shows, the majority of roads are expected to experience an increase in traffic flows of more than 100 AADT in 2043, as well as numerous road links which are expected to exceed the 1,000 AADT threshold. A number of these roads are bounded by residential properties, which are classed as high sensitivity receptors by IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), meaning they are more susceptible to air quality issues.

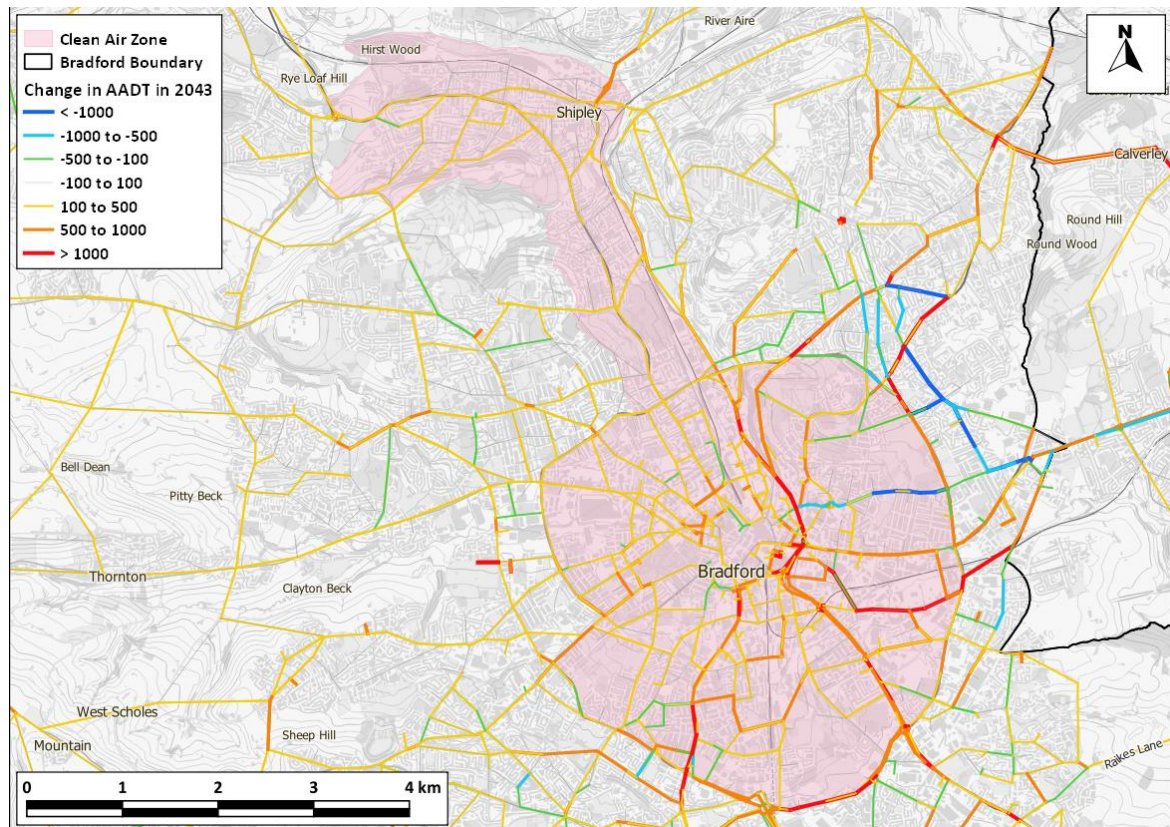


Figure 5-3: Bradford CAZ with the impact of the draft Local Plan in 2043

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.13 The A6037 Canal Road and A650 Shipley Airedale Road are predicted to have increases of over 1,000 (of up to 2,165 AADT) from the junction between King's Road to Dryden Street. Hammerton Street, starting at Buck Street, and along Bowling Back Lane to the end of the CAZ will also experience increased traffic flows over the 1,000 AADT threshold, with increases of up to 1,163 AADT. As Figure 5-3 shows, there are numerous other roads that also experience increases above the 1,000 AADT threshold, including the A6177, A650 Wakefield Road and A641 Manchester Road. As discussed in Sections 4.2 to 4.3, the CAZ covers the worst-affected areas of Bradford. Consequently, these projected traffic increases may exacerbate existing poor air quality across the city.
- 5.14 As Figure 5-3 shows, there are also a few road links which are expected to experience decreases in 2043. In particular, the B6381 Barkerend Road is expected to have decreases of up to 1,408 AADT. This will have beneficial impacts on the air quality of the local area, which is bounded by residential properties, health centres and Bradford Moor Community Primary School, all highly sensitive receptors.

AQMAs

- 5.15 Mayo Avenue AQMA (order 1) is expected to have more substantial increases in 2043 compared to 2034, as shown in Figure 5-4. The A641 Manchester Road northbound is expected to experience an increase of the 1,541 AADT as a result of the draft Local Plan. The A6177 Smiddles Lane and Mayo Avenue are also expected to experience increases between 135 AADT and 759 AADT. These increases will have a further detrimental effect to an area of existing poor air quality (as discussed in section 4.4 to 4.5).

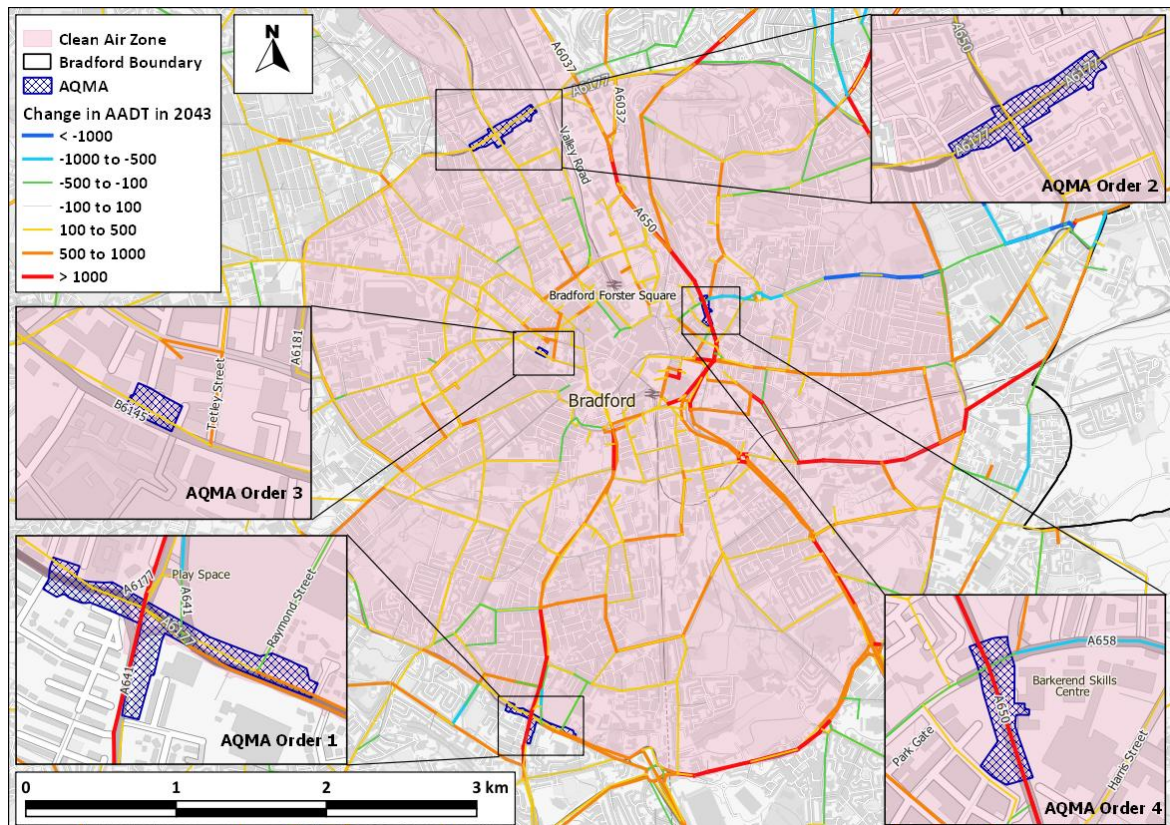


Figure 5-4: Bradford AQMAs with the impact of the draft Local Plan in 2043

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.16 Morning Lane / Queens Road AQMA (order 2) will have traffic flow increases between 32 AADT to 359 AADT, which are below the 1,000 AADT threshold.
- 5.17 Thornton Road AQMA (order 3) is not expected to experience major changes in traffic flows in 2043, with Thornton Road not experiencing a change in traffic flows of more than 225 AADT in either direction, remaining well below the 1,000 AADT threshold.
- 5.18 The draft Local Plan is expected to have a more substantial effect on Shipley Airedale Road AQMA (order 4) in 2043 compared to 2034. The A650 Shipley Airedale Road is expected to have increases of up to 2,165 AADT. This is well above the 1,000 AADT threshold and will have a further detrimental effect to an area of existing poor air quality (as discussed in Section 4.4 to 4.5).

North Bradford

2034

- 5.19 The north of Bradford District is characterised primarily by large rural areas of the Yorkshire Dales, as well as key urban areas such as the towns of Keighley, Ilkley and Bingley which contain many residential properties.
- 5.20 The draft Local Plan is not expected to have significant impacts on traffic flows in the North of Bradford district in 2034. The majority of roads are only expected to experience reductions and increases of less than 100 AADT as shown in Figure 5-5. These changes in traffic flows are well below the 1,000

AADT threshold as well as the 100 AADT screening criterion outlined in Section 3.4, and therefore the air quality impacts are not expected to be significant.

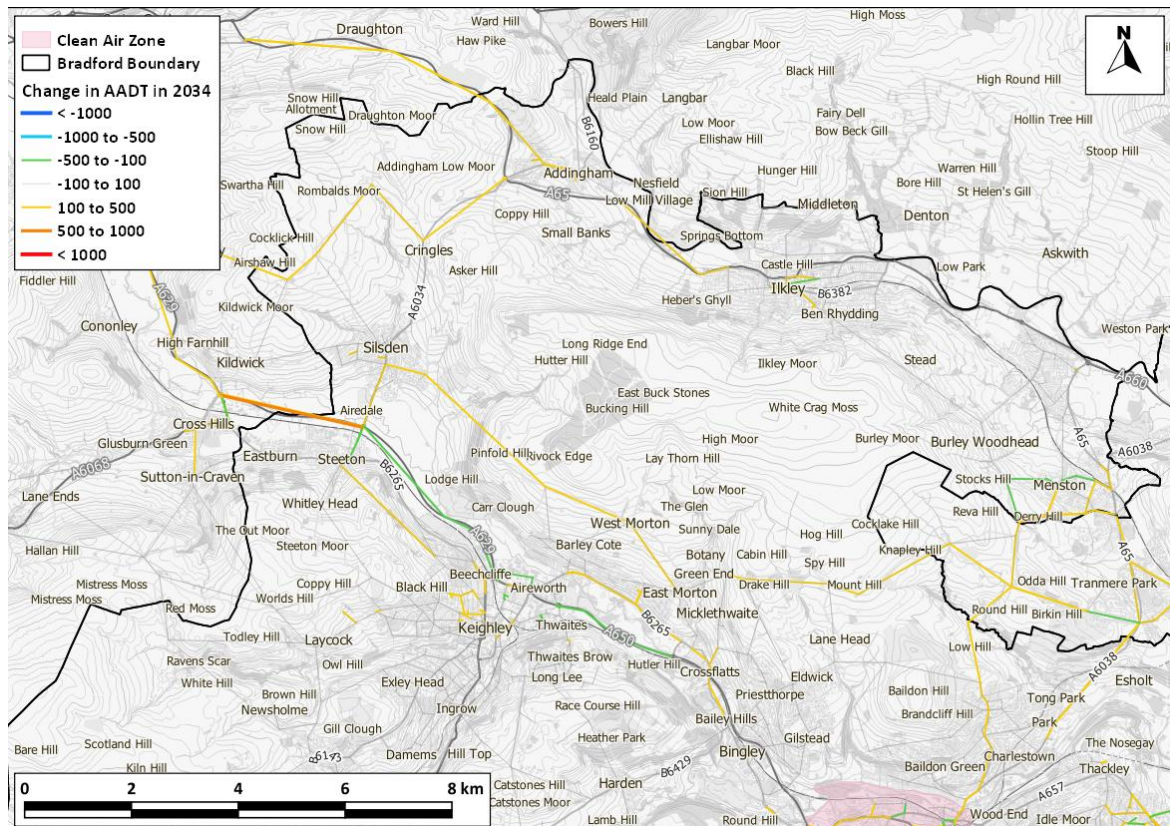


Figure 5-5: North Bradford with the impact of the draft Local Plan in 2034

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.21 The greatest change in traffic flows in the North of Bradford is expected to be an increase of approximately 550 AADT on the A629 to the west of Steeton and Silsden train station, which is still well below the 1,000 AADT threshold.
- 5.22 As shown in Figure 5-5, there are a small number of road links which will experience a decrease in traffic flows. Predominantly, decreases of up to 243 AADT are seen on the A650 and A629 across the northern outskirts of Keighley. Decreases of approximately 130 AADT will be seen on the B6142 through Haworth, as well as decreases of up to 170 AADT through Oxenhope, both of which are adjacent to many high sensitivity residential receptors. These decreases in traffic flows will have beneficial impacts on air quality in the local area.

2043

- 5.23 In 2043, traffic generation associated with the draft Local Plan is generally not expected to breach the 1,000 AADT threshold. Projected changes in traffic volumes primarily range from a decrease of approximately 500 AADT to an increase of up to 500 AADT, as illustrated in Figure 5-6. As these changes are below the IAQM screening thresholds for outside of an AQMA, these changes in traffic flows are not expected to have significant effects on the local air quality.

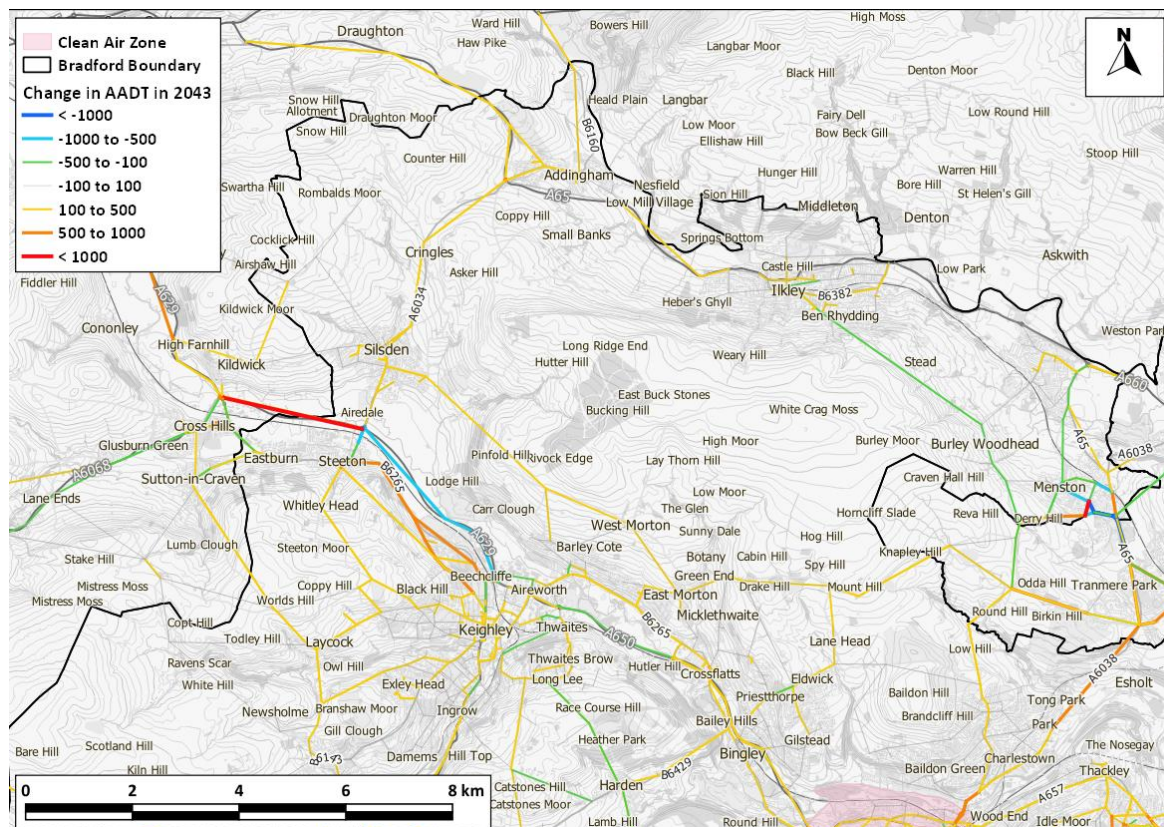


Figure 5-6: North Bradford with the impact of the draft Local Plan in 2043

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.24 The only increase of traffic flows that exceed the 1,000 AADT threshold is along the A629, that runs westbound from Steeton and Silsden station (which is expected to see increases of up to 1,289 AADT). These areas do not contain sensitive receptors as defined in Section 2. Consequently, this increase is not expected to result in a problematic air quality impact at present.
- 5.25 The greatest reductions seen in northern Bradford are along the A629 running eastbound between Steeton and Keighley, with reductions of up to 1,080 AADT in 2043. This section of road is primarily bordered by agricultural land and an industrial estate along Riparian Way and so there will not be notable benefits to pollution exposure.
- 5.26 The A650 Hard Ings Road, adjacent to the Keighly Retail Park, is expected to decrease by up to 241 AADT HDVs. Although this road is not adjacent to any highly sensitive receptors, this decrease is above the threshold outlined in Section 3.2.

East Bradford

2034

- 5.27 The east of Bradford District is characterised by residential suburbs to the east of the City of Bradford. These residential areas contain high sensitivity receptors for air quality as defined in Section 2.
- 5.28 In 2034 in the east of Bradford, there are not expected to be changes that will breach the 1,000 AADT threshold. The majority of roads will experience changes between increases and decreases of 100

AADT, which are below the IAQM screening threshold of 500 AADT (as outlined in Section 3.4). Therefore, the draft Local Plan is not expected to have significant impacts on air quality in the area.

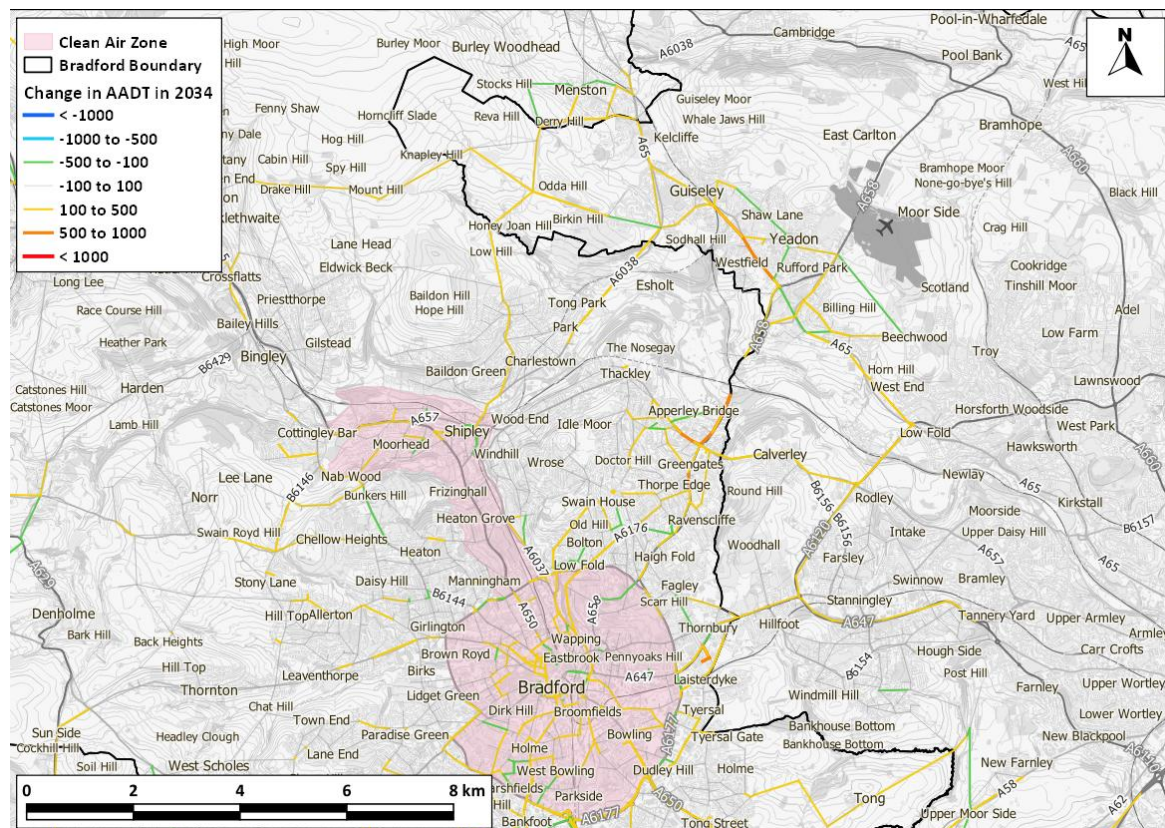


Figure 5-7: East Bradford with the impact of the draft Local Plan in 2034

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.29 The only roads exceeding the IAQM screening threshold are increases between 500 to 775 AADT. These are along the A658, A657, Petrie Road and Lower Rushton Road. There are numerous high sensitivity receptors (as defined by IAQM guidance (Moorcroft and Barrowcliffe et al, 2017)) including residential receptors and Thornbury Primary School, therefore there are possibilities of air quality impacts along these roads.
- 5.30 There are a few roads with decreases in traffic flows of more than 100 AADT throughout the east of Bradford, as shown in Figure 5-7, which will likely have a positive impact on air quality in the local area.

2043

- 5.31 In 2043, the draft Local Plan has more pronounced impacts on the traffic flows in the east of Bradford. The majority of roads are expected to have increases of 100 to 1,000 AADT, as shown in Figure 5-8.

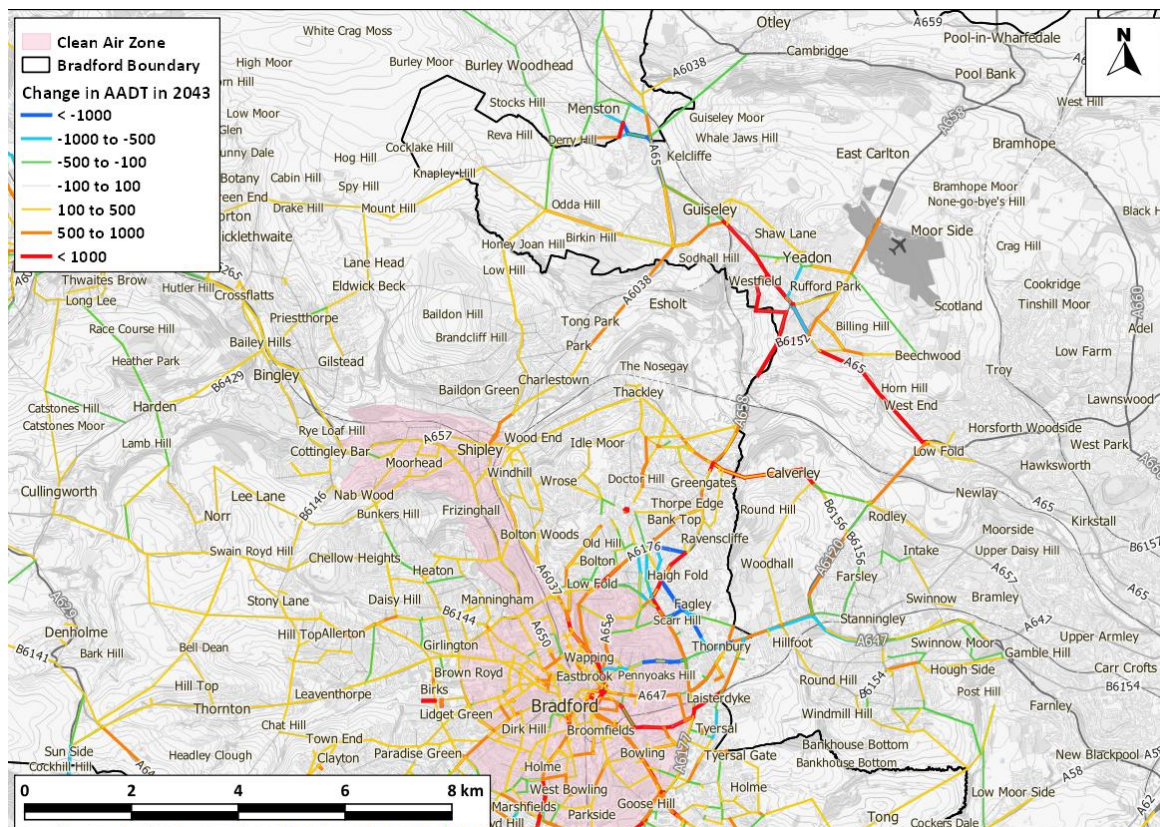


Figure 5-8: East Bradford with the impact of the draft Local Plan in 2043

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.32 There are some roads which are expected to have an increase of over 1,000 AADT threshold. The greatest increases of up to 2,076 AADT are seen along the A658 Harrogate Road and A6177 Killinghall Road, as shown in Figure 5-8. Whilst these roads are bordered by highly sensitive residential receptors, these properties are largely set back from the road, which will reduce the potential magnitude of air quality impacts associated with the increased traffic flows.
- 5.33 Whilst the A659 Harrogate Road is expected to experience increases in traffic flows of over 2,000 AADT, the number of HDVs is expected to decrease by 183 AADT.
- 5.34 As Figure 5-8 shows, in 2043 there will be exceedances of the 1,000 AADT threshold outside of Bradford boundaries. In Rawdon (within the Leeds District Boundary), the A65 Leeds Road, Warm Road, Greenlea Road and the A658 Apperley Lane are expected to have increases in traffic flows of up to 2,137 AADT. Many of these roads are adjacent to residential properties, which are sensitive receptors with respect to air quality. The increase in traffic flows has the potential to have adverse effects on air quality.
- 5.35 The draft Local Plan is also expected to introduce major reductions in traffic flows in 2043. The greatest reductions will be seen on the A6176 Pullan Avenue, B6381 Leeds Old Road, Fagley Road, and Leeds Road, with reductions of up to 2,025 AADT. This will cause improvements in the air quality in the local area.

South Bradford

2034

- 5.36 South Bradford is composed predominantly of suburban areas, containing a large concentration of high sensitivity receptors as defined in Section 2. In 2034, across the south of Bradford, overall, the draft Local Plan is expected to increase traffic flows, with a few roads expected to breach the 1,000 AADT threshold. Projected changes in traffic volumes range from a decrease of more than 500 AADT to an increase of over 1,000 AADT, as illustrated in Figure 5-9. The predicted changes to traffic across South Bradford are predominantly increases, which will consequently have adverse effects on air quality.

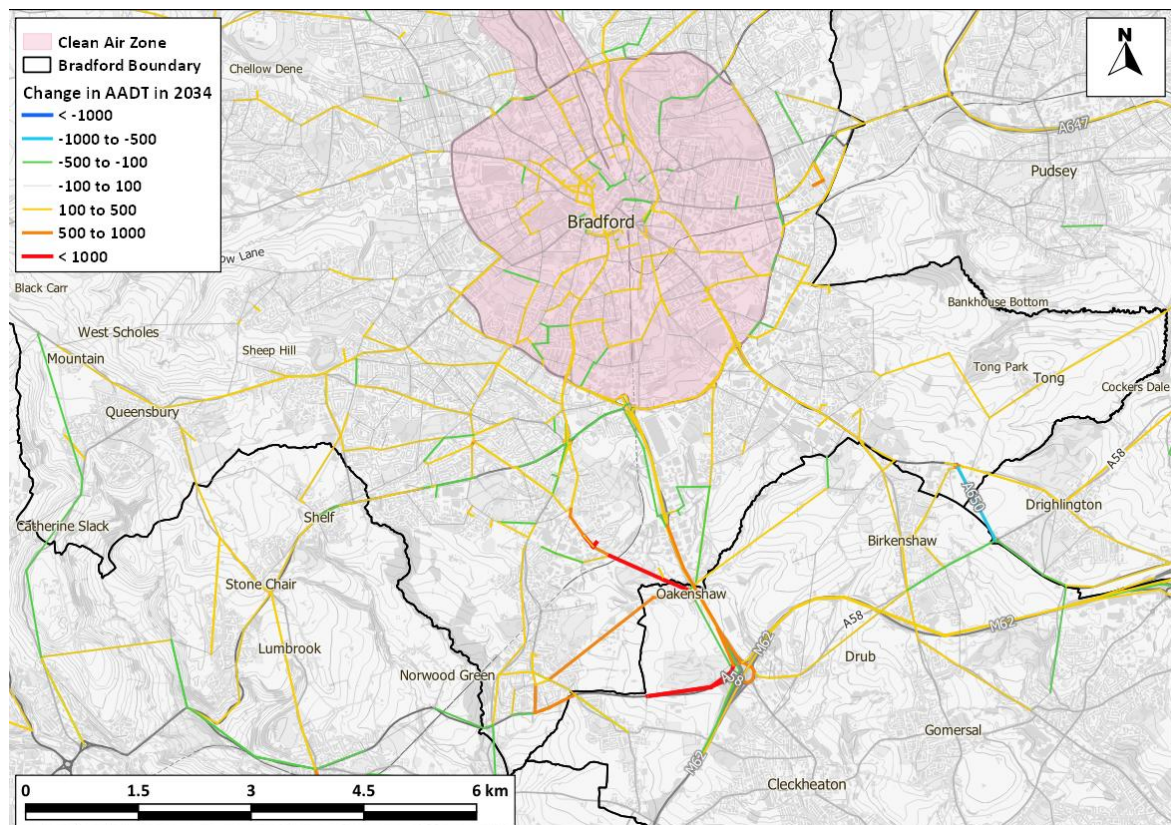


Figure 5-9: South Bradford with the impact of the draft Local Plan in 2034

Additional data sourced from third parties, including public sector information licensed under the Open Government Licence v3.0.

- 5.37 On the border of Bradford District and Kirklees, in the Oakenshaw area, the majority of road links are expected to see major increases of over 500 AADT, with a couple exceeding the 1,000 AADT threshold, as shown in Figure 5-9. The A58 Whitehall is expected to have an increase of over 1,322 AADT in 2034, however there are no high sensitivity receptors (as defined by IAQM guidance (Moorcroft and Barrowcliffe et al, 2017)) bordering this road and consequently this increase is not expected to result in a significant air quality impact. However, along Cleckheaton road, there are expected to be increases in the traffic flows of approximately 1,030 AADT. This road is primarily bordered by residential properties, which are high sensitivity receptors in regard to air quality.
- 5.38 The draft Local Plan will also lead to traffic reductions in 2034 across South Bradford, with many roads seeing reductions of up to 500 AADT. The most substantial reduction is on the A650 to the east of Birkenshaw, which is expected to see a decrease in more than 525 AADT in 2034. These decreases in traffic flows will be beneficial to the air quality of the local area.

2043

- 5.39 In 2043, the draft Local Plan is expected to cause larger changes in South Bradford in traffic flows compared to 2034. Whilst the majority of road links are still expected to experience changes ranging from a decrease of 100 AADT to an increase of 100 AADT, there is an increase in the number of roads forecast to see traffic growth of between 100 and 1,000 AADT, as shown in Figure 5-10.
- 5.40 Compared to 2034, there are also expected to be a higher number of road links which will see a decrease in traffic flows, especially between 100 to 1,000 AADT. The A650 heading southbound from Tong will see the greatest decrease in traffic in the south of Bradford with a decrease of 1,143 AADT which will lead to an improvement in the air quality of the local area. However, there are also links along the A650 Tong Street, which are also expected to see increases of up to 1,144 AADT. These are adjacent to residential properties which are highly sensitive receptors as defined in Section 2, meaning they are more susceptible to air quality issues.

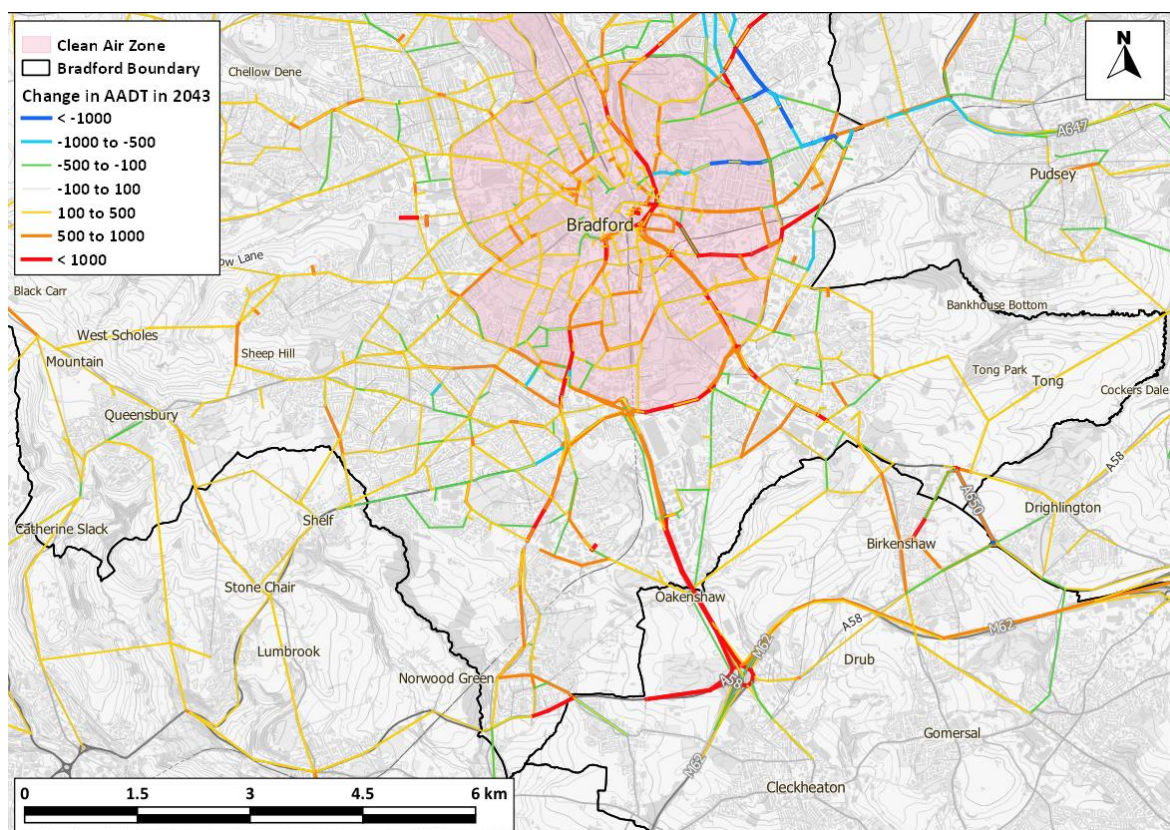


Figure 5-10: South Bradford with the impact of the draft Local Plan in 2043

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- 5.41 As Figure 5-10 shows, there are a small number of roads which exceed the screening threshold and are expected to see increases of 1,000 AADT. The M606 heading out of Bradford towards the M62 is expected to see increases of up to 2,135 AADT. This road is also expected to see increase in HDV traffic of up to 379 AADT, which exceeds the threshold outlined in Section 3.2. These increases will have detrimental effects on local air quality; however, the road is not bound by any highly sensitive receptor as defined in Section 2 meaning this increase is not expected to result in a significant air quality impact.

- 5.42 The A6036 Rooley Avenue westbound is also expected to exceed the threshold of 200 HDVs per day, with increases expected of up to 308 AADT. Although this road is bound by highly sensitive residential receptors, these properties are set back from the road which will reduce the potential air quality impacts of this HDV increase.
- 5.43 In the Low Moor area, the A641 Huddersfield Road and Sal Royd Road are also expected to see increases of up to 1,318 AADT. These increases exceed the 1,000 AADT threshold and the roads are bound by highly sensitive residential receptors, which are more susceptible to air quality issues.
- 5.44 The number of HDVs on Cleckheaton Road and Bradford Road is expected to decrease by up to 416 AADT. This is above the threshold outlined in Section 3.2, and will be expected to improve the air quality in the surrounding area.

West Bradford

2034

- 5.45 The west of Bradford District is characterised by residential suburbs to the west of Bradford city centre, whilst the remainder of the area consists largely of rural land and outlying villages including Oxenhope, Cullingworth, and Haworth. These residential areas contain high sensitivity receptors for air quality as defined in Section 2.
- 5.46 The draft Local Plan is not expected to result in substantial changes to traffic flows in western Bradford in 2034, as seen in Figure 5-11. The greatest increase is of 375 AADT on Acacia Drive off the B6146 in northern Allerton, which remains below the IAQM screening threshold of 500 AADT (as outlined in Section 3.4). There are only a small number of road links with increases of over 100 AADT, with the vast majority of road links within western Bradford having changes in traffic flows of less than 100 AADT.
- 5.47 There are some road links in western Bradford which will experience decreases in traffic flows, with decreases of up to 195 AADT expected in 2034 on the B6141, Trough Lane and B6429 between Oxenhope and Cullingworth.

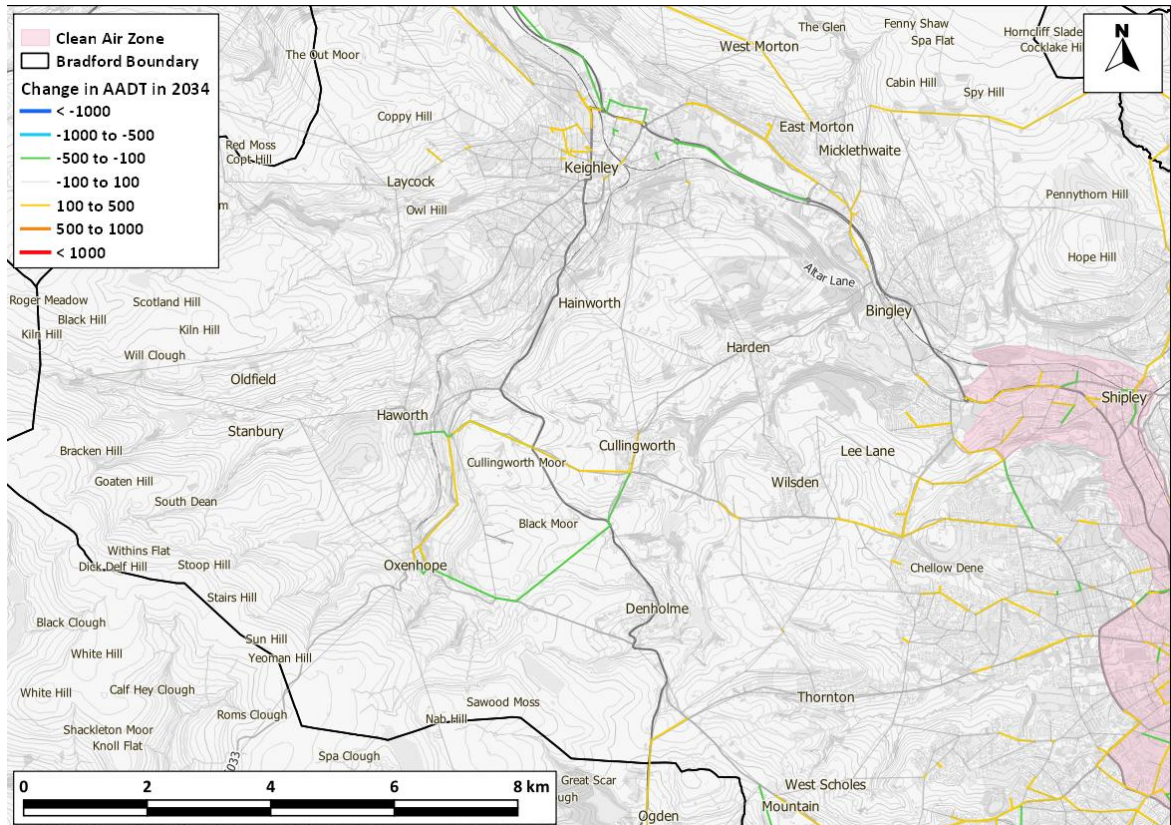


Figure 5-11: West Bradford with the impact of the draft Local Plan in 2034

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2043

5.48

In the west of the Bradford District, the Local Plan has greater effects on the traffic flows in 2043 compared to 2034. A large proportion of the roads that in 2034 had a change in traffic between decreases to increases of 100 AADT, in 2043 are expected to have an increase of up to 500 AADT. As these increases are below the IAQM screening threshold (Moorcroft and Barrowcliffe et al, 2017), they are not expected to have a significant influence on the air quality.

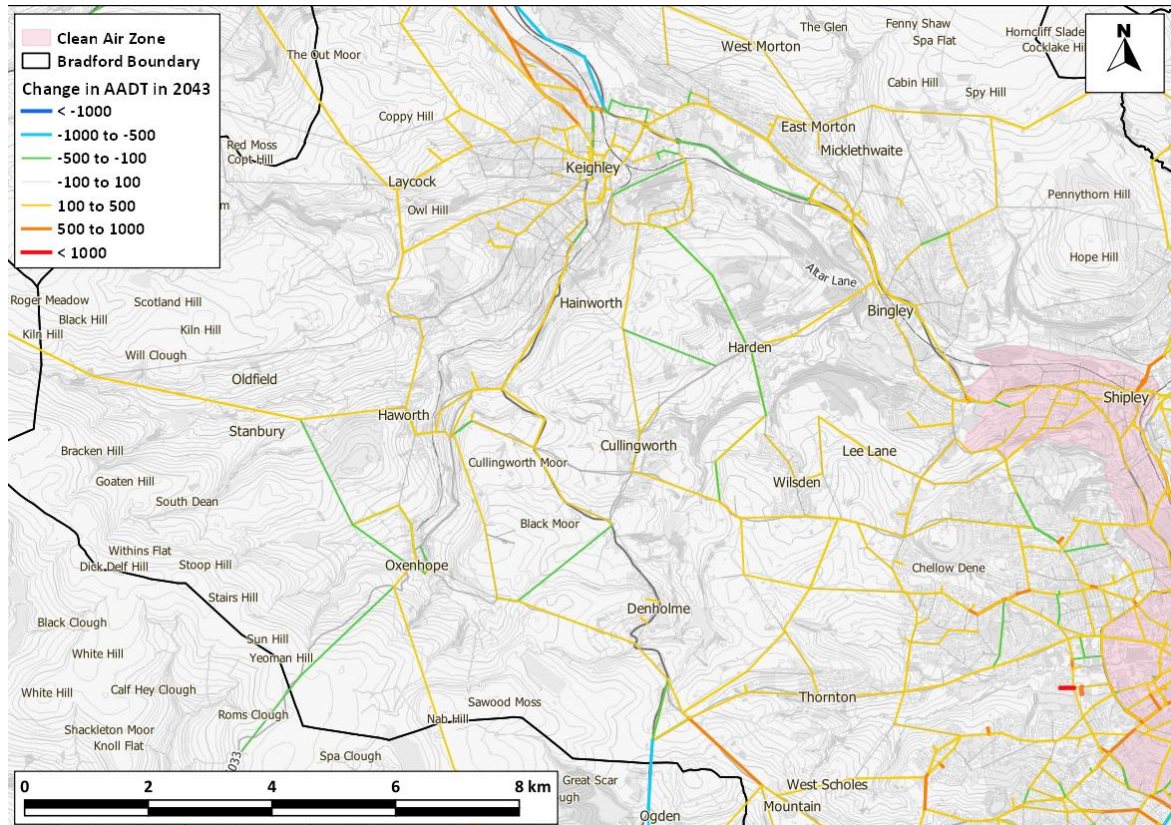


Figure 5-12: West Bradford with the impact of the draft Local Plan in 2043

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- 5.49 As seen in Figure 5-12, there are very few roads in the west of Bradford that will experience increases greater than 500 AADT. The only road that is expected to breach the 1,000 AADT threshold, is Birks Fold which is expected to increase by up to 1,334 AADT. Birks Fold is adjacent to Lidget Green Primary School, which is a highly sensitive receptor as defined in Section 2, meaning it is more susceptible to air quality issues.
- 5.50 Whilst there are some roads with decreases expected in the west of Bradford, there are not expected to be any decreases greater than 500 AADT as shown in Figure 5-12.

6 Conclusions

- 6.1 This Air Quality Assessment has examined the potential impacts of the draft Bradford District Local Plan to local air quality in 2034 and 2043. The assessment focused on emissions from road traffic and utilized a screening approach based on DMRB LA 105 and IAQM screening criteria.

Overview of Findings

- 6.2 The assessment demonstrates that the implementation of the Local Plan is likely to result in limited impacts on air quality within the district in 2034, however by 2043 there will be more substantial impacts. These findings should be considered in the context of continuing reductions in vehicle emissions and the likelihood that overall air quality will improve compared with current conditions.
- 6.3 In 2034, the draft Local Plan is not predicted to cause large air quality impacts. Traffic volume changes across the vast majority of the district road network remain well below the 1,000 AADT screening threshold, and changes within the CAZ and AQMAs are minor. Where traffic changes exceed the IAQM screening threshold, these locations may warrant further assessment as individual developments come forward or when any future strategic transport solutions are being developed, particularly where sensitive receptors are present.
- 6.4 In 2043, cumulative Local Plan-related growth across the district results in more extensive traffic increases, with several key corridors exceeding the screening thresholds. However, the draft Local Plan also introduces substantial traffic reductions on key links, which will deliver meaningful air quality benefits to sensitive receptors. The results identify locations where air quality considerations may need to be incorporated into future transport planning and project-level assessments, allowing any necessary mitigation measures to be identified and implemented.

Impact on Bradford CAZ and AQMAs

- 6.5 The Bradford CAZ and four AQMAs represent areas with historically elevated baseline NO₂ concentrations and the highest density of sensitive receptors.
- 6.6 In 2034, no road links within the CAZ or AQMAs are predicted to exceed the 1,000 AADT threshold. The greatest increase occurs on the A641 Manchester Road within AQMA 1, of less than 500 AADT. Modest reductions are also predicted on some links, most notably Ransdale Road.
- 6.7 In 2043, traffic growth is substantially higher within the CAZ, with multiple routes exceeding the 1,000 AADT threshold. Substantial increases, which exceed the 1,000 AADT threshold, are forecast within AQMA 1 and 4. These increases are highest on the A650 Shipley Airedale Road corridor and the A641 Manchester Road northbound.
- 6.8 The B6381 Barkerend Road within the CAZ will experience a significant traffic reduction of up to 1,408 AADT in 2043, providing local air quality benefits to adjacent high-sensitivity receptors, including residential dwellings, health centres, and Bradford Moor Community Primary School.

Impact across Greater Bradford

- 6.9 In 2034, traffic changes are minimal across North Bradford, with the greatest increase 550 AADT on the A629. In 2043, the A629 exceeds the 1,000 AADT threshold. However, this road is not adjacent to sensitive receptors, so these increases are unlikely to result in materially greater air pollution exposure.
- 6.10 In East Bradford, the traffic increases are expected to remain below 1,000 AADT in 2034. However, by 2043 there are increases above the 1,000 AADT threshold along the A658 Harrogate Road and A6177 Killinghall Road. Although these road links are adjacent to residential properties, these are set back

from the road so the air quality impacts will be minimised. However, there will also be major reductions of up to 2,025 AADT along the A6176 Pullan Avenue and B6381 Leeds Old Road / Fagley Road corridor, providing local air quality improvements.

- 6.11 In 2034, there are exceedances of the 1,000 AADT threshold on the A58 Whitehall and Cleckheaton Road in South Bradford. By 2043, the traffic flows increase further, and exceedances occur on the M606, Sal Royd Road / A641 Huddersfield Road and sections of A650 Tong Street. These increases will be detrimental to the air quality in the area. However, in 2043 significant traffic reductions are also forecast on the southbound A650 from Tong and the A650 east of Birkenshaw.
- 6.12 In West Bradford, traffic changes are minimal in 2034 and remain well below 500 AADT. In 2043, only one link exceeds the 1,000 AADT threshold (Birks Fold), which is adjacent to Lidget Green Primary School and which is highly sensitive to air quality issues.

Heavy Duty Vehicles (HDVs)

- 6.13 Screening of HDVs (in Appendix A2) shows that HDV flow changes are less extensive in relation to relevant screening criteria than the total traffic changes. In 2034, there are no major impacts due to HDV increases. In 2043, there are specific links with HDV increases exceeding the 200 AADT HDV criterion, including the M606 and A6036 Rooley Avenue westbound, which will have an impact on air quality. There are also reductions in HDVs forecast in 2043 along the A658 Harrogate Road and the Cleckheaton Road / Bradford Road corridor, mitigating air quality impacts along these residential links.

Summary

- 6.14 In summary, the draft Bradford Local Plan is expected to cause relatively modest impacts in 2034. By 2043, while widespread traffic reductions will improve conditions in several sensitive communities, significant traffic increases are predicted along key strategic routes within the CAZ, AQMA 1, AQMA 4, and specific residential corridors across East, South, and West Bradford.
- 6.15 Concurrent improvements in vehicle technology mean that air quality is still most likely to improve between 2026 and 2043 despite the increases in traffic. However, in these areas, growth provided by the Local Plan will cause air quality to be worse than it otherwise would be. The findings of this strategic assessment may therefore inform where future more detailed studies may be needed, as individual developments come forward or when any future strategic transport solutions are developed.

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8 Glossary

AADT	Annual Average Daily Traffic
AMCT	Annual Mean Concentration Target (for PM _{2.5})
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
CAZ	Clean Air Zone
CBMDC	City of Bradford Metropolitan District Council
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HGV	Heavy Goods Vehicles
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (< 3.5 tonnes)
LGV	Light Good Vehicles
µg/m ³	Microgrammes per cubic metre
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides (taken to be NO ₂ + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PERT	Population Exposure Reduction Target (for PM _{2.5})
PM ₁₀	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
PM _{2.5}	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants based on assessment of the effects of each pollutant on human health, including the effects on sensitive sub-groups.

VOC Volatile Organic Compounds

9 Appendices

A1 Professional Experience

Dr Ben Marner, BSc (Hons) PhD CSci MEnvSc MIAQM

Dr Marner is the Director of Air Quality Modelling and Assessment at AQC and has more than 20 years' relevant experience. He has been responsible for air quality and greenhouse gas assessments of road schemes, rail schemes, airports, power stations, waste incinerators, commercial developments and residential developments in the UK and abroad. He has acted as expert witness at public inquiries, where he has presented evidence on health-related air quality impacts, the impacts of air quality on sensitive ecosystems, and greenhouse gas impacts. He has developed a range of widely-used air quality models and contributed to the development of best practice. Dr Marner has provided support and advice to foreign governments, Highways England, Transport Scotland, Transport for London, Greater London Authority, the Joint Nature Conservation Committee, the Environment Agency, and numerous local authorities. He is a Member of the Institute of Air Quality Management and a Chartered Scientist. He currently advises the UK Government on air quality as part of its Air Quality Expert Group (AQEG), where his specific area of expertise relates to air quality assessment in the development control process, and has separately provided advice on air quality issues to Defra's Chief Scientific Adviser, the UK Chief Medical Officer, and the UK Chief Planner.

Lola McAuley, MChem (Hons)

Miss McAuley is an Assistant Consultant with AQC and joined in 2025. Throughout her Chemistry integrated master's degree (MChem) at the University of Leeds, she developed an interest in climate change and atmospheric chemistry, with her master's research project using an atmospheric simulation chamber to measure oxidation reactions of key pollutants. The application of this is to improve the effectiveness of satellite measurements for air quality and pollution monitoring. She is currently gaining experience undertaking a variety of assessments, ranging in scope from standalone assessments to contributions to EIA developments, across both air quality and climate change disciplines. She is an Associate Member of the Institute of Environmental Sciences and an Affiliate Member of the Institute of Air Quality Management.

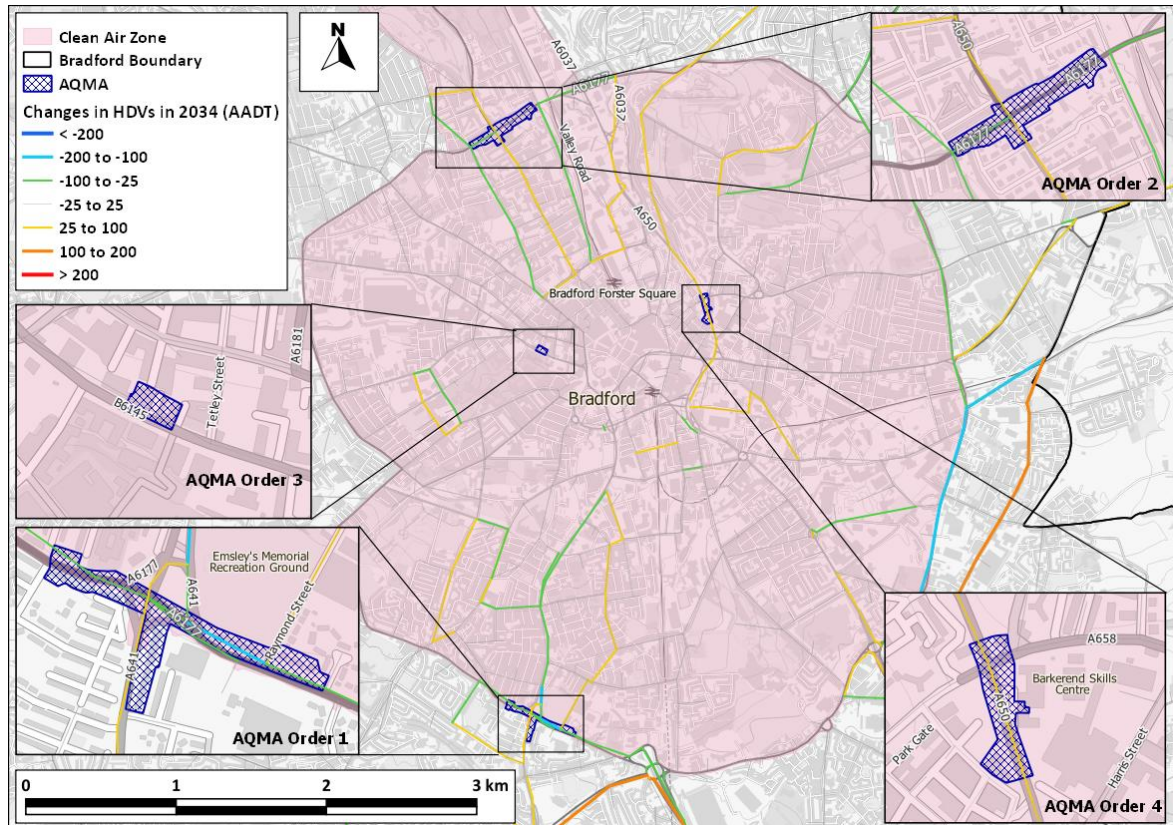


Figure A2-2: Bradford AQMAs with the impact on HDV flows in 2034

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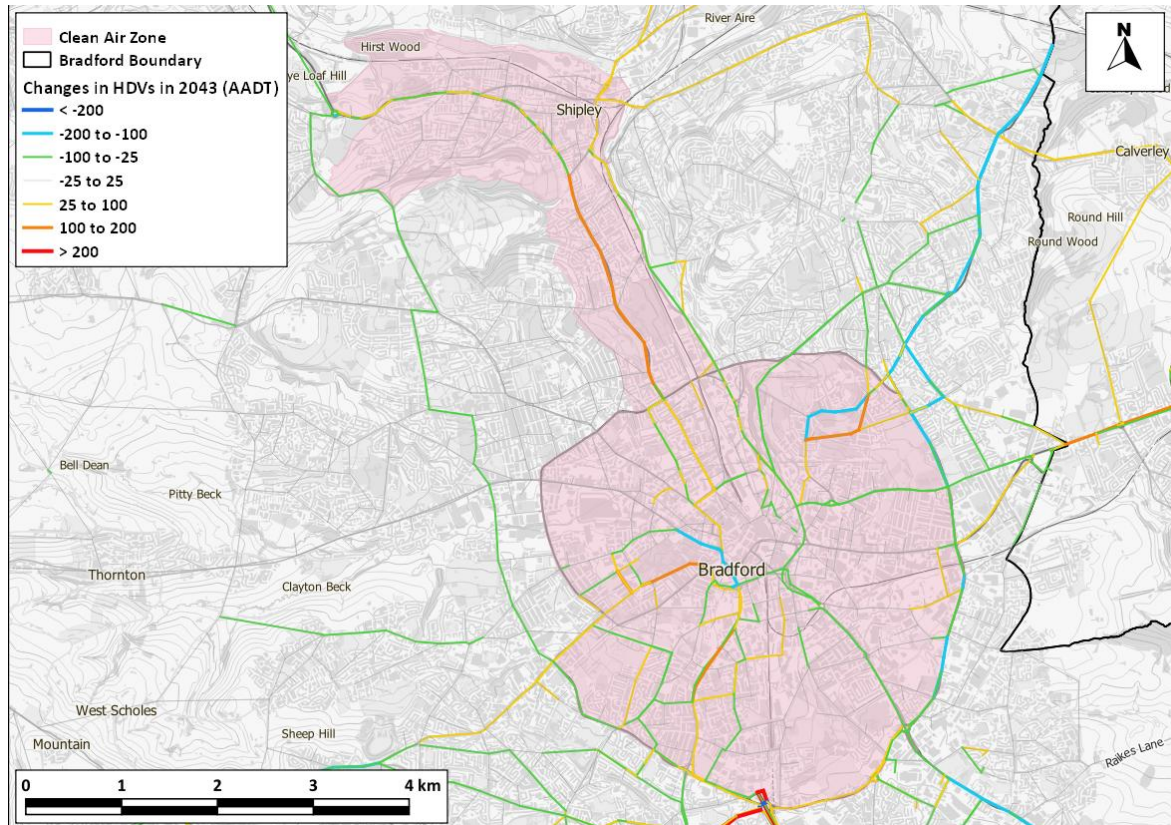


Figure A2-3: Bradford CAZ with the impact on HDV flows in 2043

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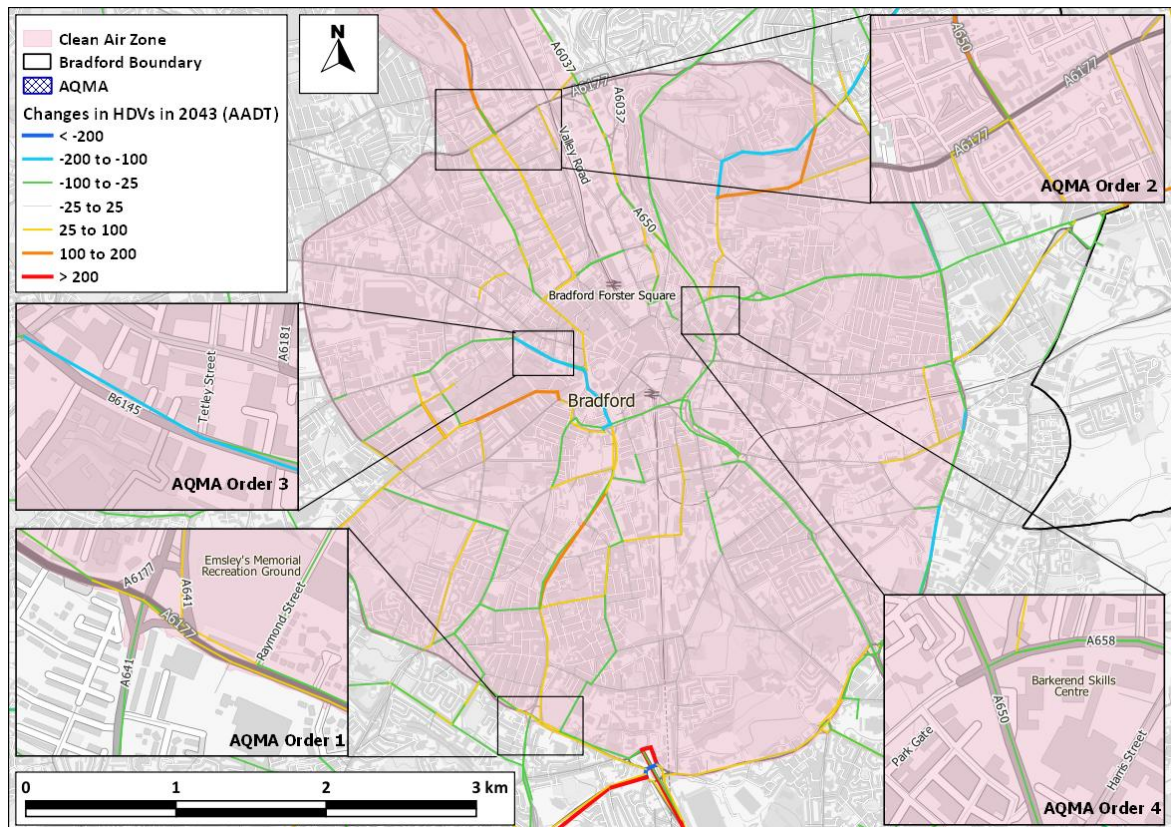


Figure A2-4: Bradford AQMAs with the impact on HDV flows in 2043

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North Bradford

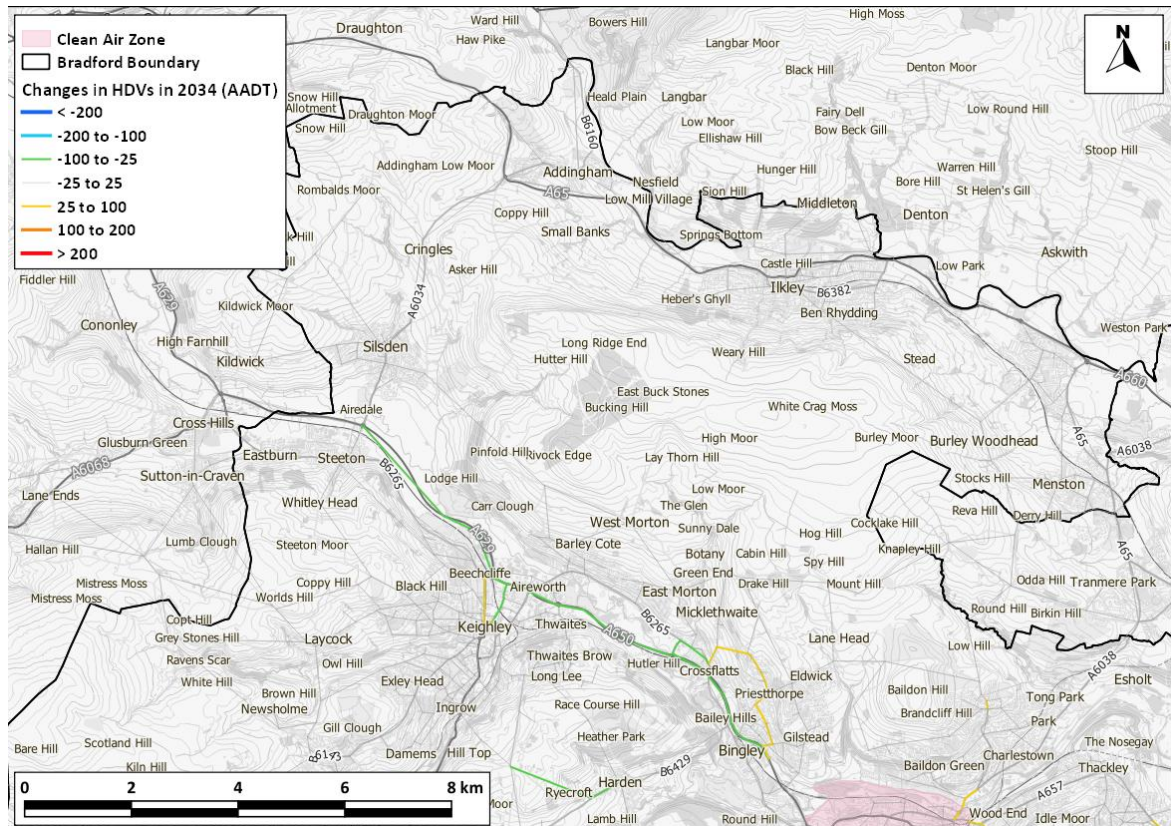


Figure A2-5: North Bradford with the impact on HDV flows in 2034

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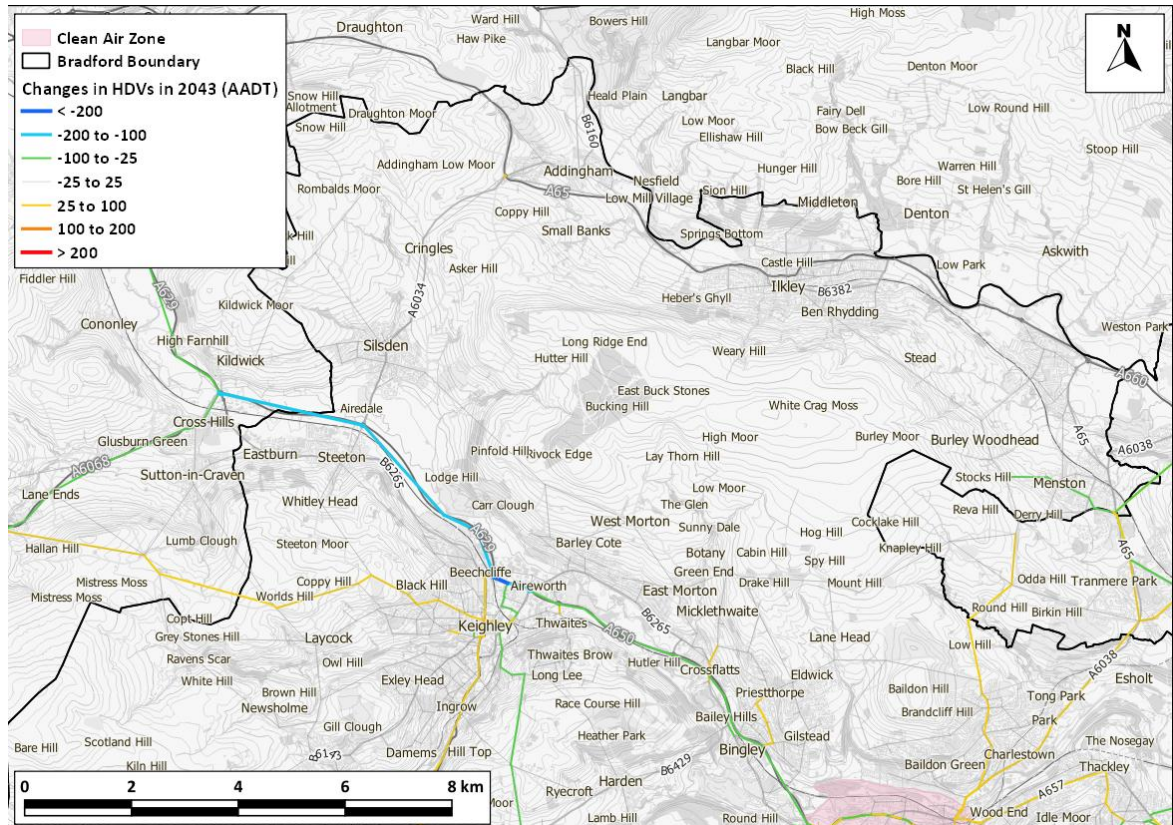


Figure A2-6: North Bradford with the impact on HDV flows in 2043

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East Bradford

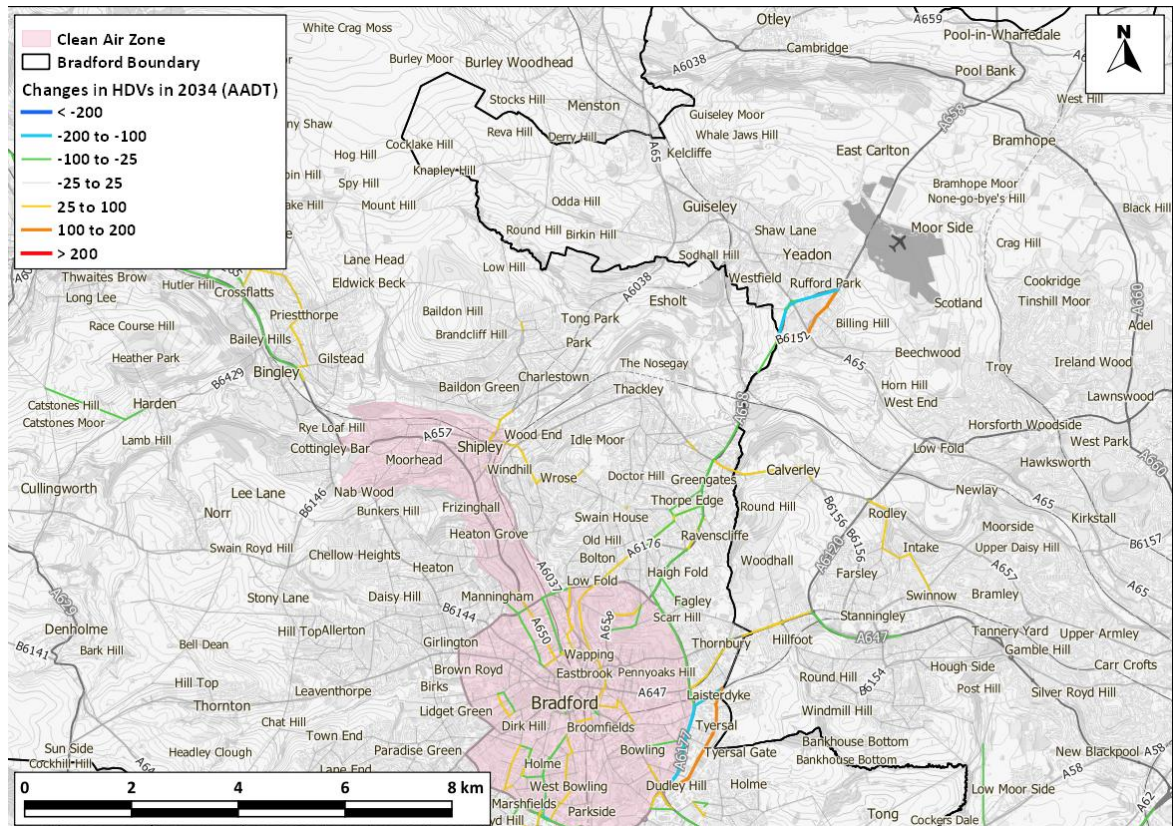


Figure A2-7: East Bradford with the impact on HDV flows in 2034

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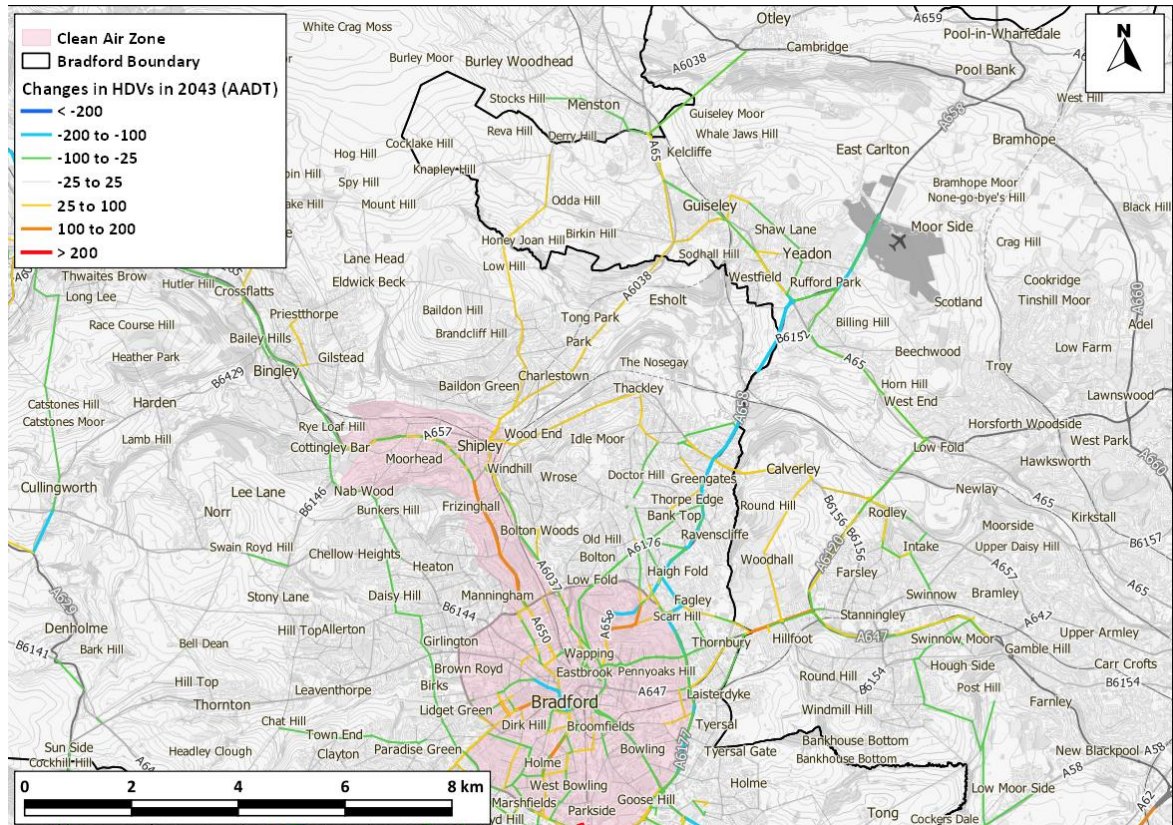


Figure A2-8: East Bradford with the impact on HDV flows in 2043

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South Bradford

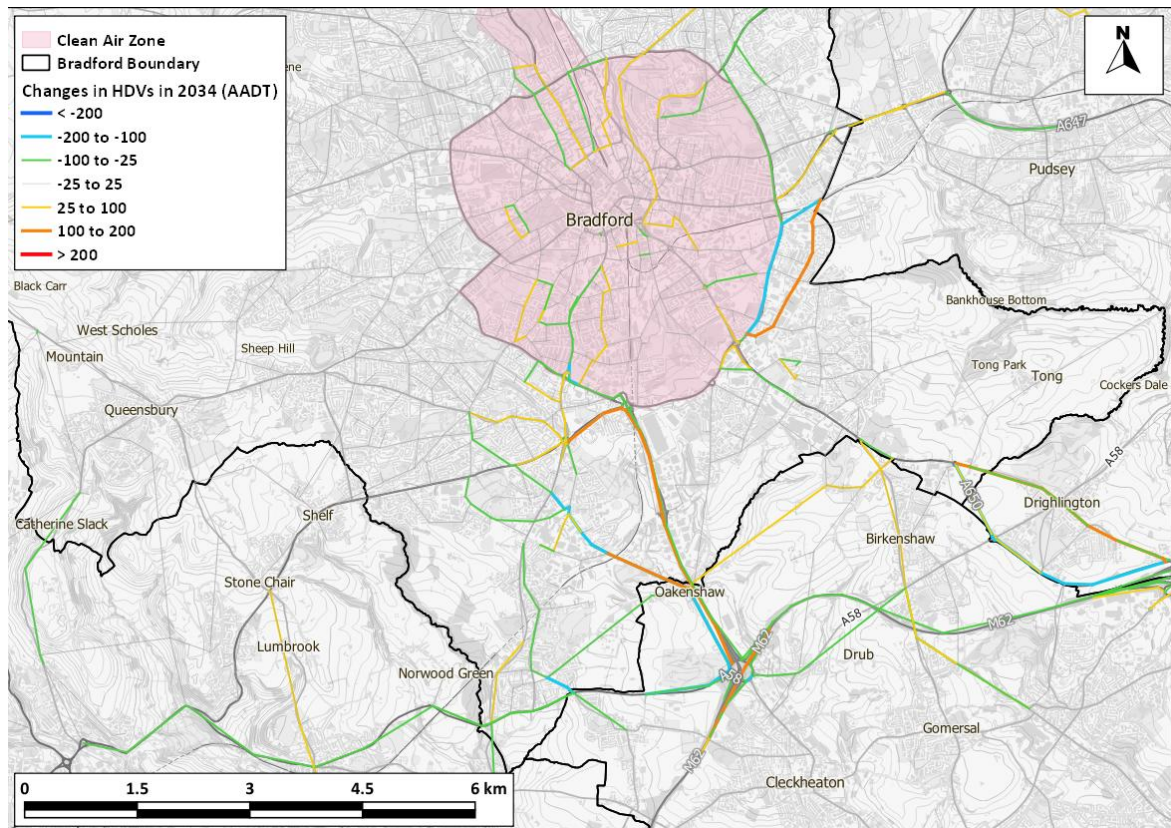


Figure A2-9: South Bradford with the impact on HDV flows in 2034

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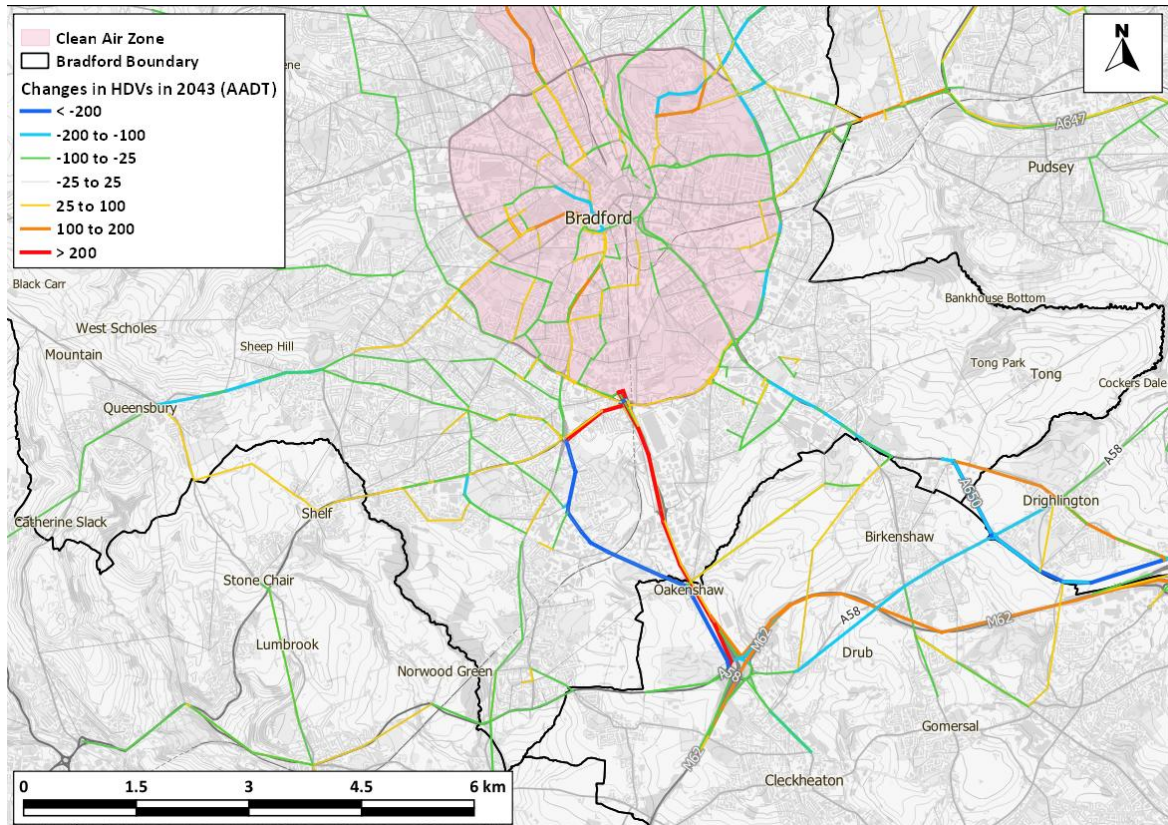


Figure A2-10: South Bradford with the impact on HDV flows in 2043

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West Bradford

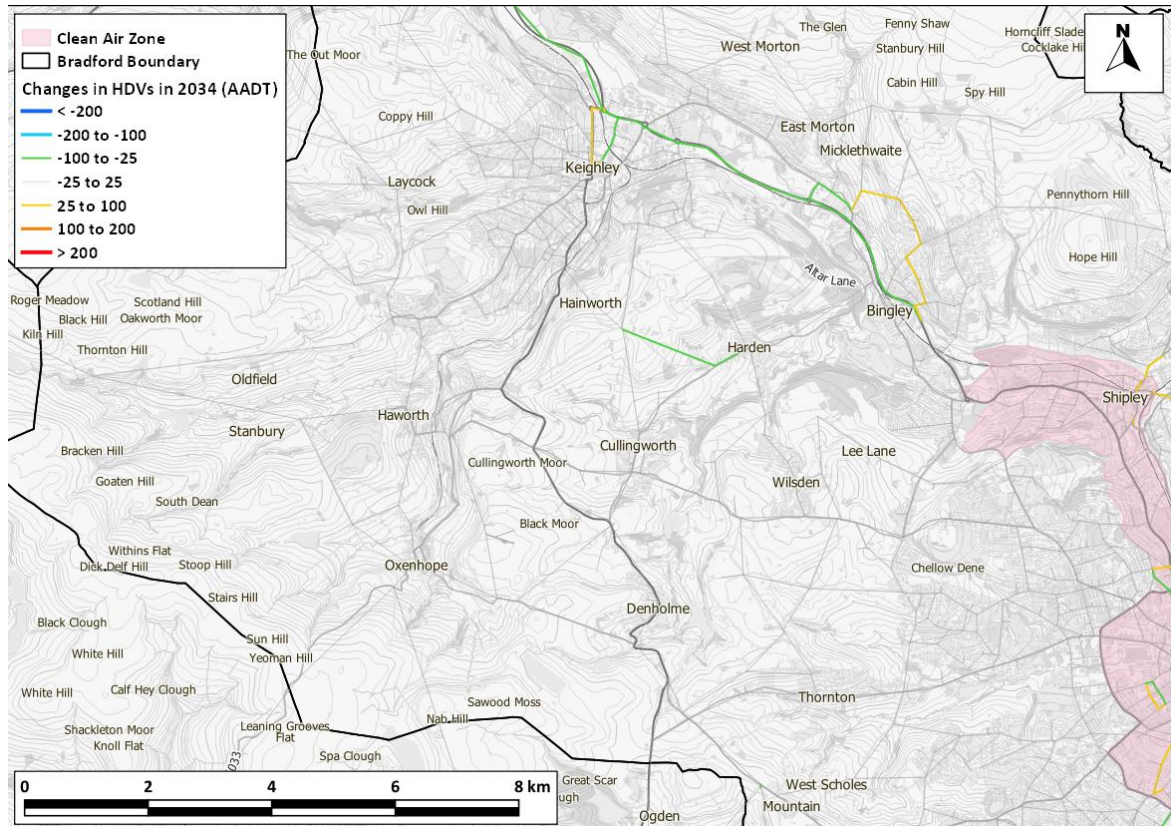


Figure A2-11: West Bradford with the impact on HDV flows in 2034

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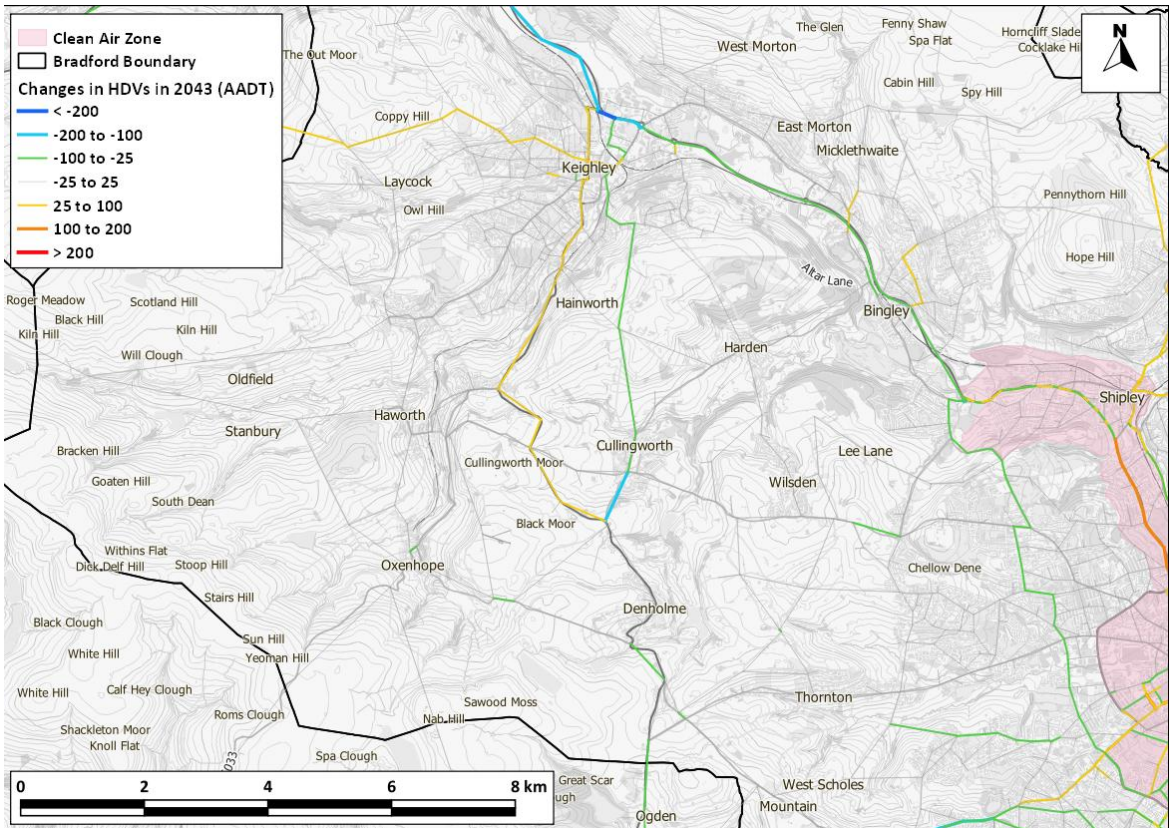


Figure A2-12: West Bradford with the impact on HDV flows in 2043

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