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Transport Study in Support of the Bradford City Centre AAP

May 2015

City of Bradford MDC

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Background

The Bradford City Centre and Shipley and Canal Road Corridor Area Action Plans (AAPs) are being produced as part of the Local Plan for the Bradford District. The AAPs will establish planning policies and land use allocations to guide development proposals in the city centre and the Shipley and Canal Road corridor.

This report focusses on the Bradford City Centre Area AAP and presents an analysis of the impact of forecast demands on existing networks and identifies a package of potential interventions, both physical and non-physical, that could be delivered to support growth and accommodate additional demand. The report should be read in conjunction with Baseline Evidence Report.

The baseline report concluded that there are high levels of traffic currently travelling into and out of the City in the morning and evening peak hours, but offers no prediction of whether future growth of the City, partly driven by development proposals identified for each of the AAP areas, can be delivered without adverse effect on the transport network.

The implications for growth and the introduction of existing AAP proposals have been evaluated in a SATURN traffic model of Bradford district, which has been updated to reflect forecast increases in demand both at specific sites and across the district.

Growth in demand

For both the City Centre AAP and the Shipley and Canal Road Corridor AAP, City of Bradford MDC published an Issues and Options Report in March 2013 which identified numerous sites for development in each of the areas. Although this report is specifically concerned with Issues and Options for the City Centre AAP, the level of development proposed in the adjacent Shipley and Canal Road Corridor cannot be ignored as it will generate new trips which interact with city centre traffic. There follows a list of those development proposals to which specific quantum of changes in land-use, and associated increase in demand, can be allocated.

- City Centre
  - Various residential development sites
  - Broadway Shopping Centre development
- Shipley and Canal Road Corridor
  - New Bolton Woods development
  - Bolton Woods Quarry (1000 homes)
  - Shipley East residential proposals (100 homes)
  - Dockfield Road Area proposals (400 homes)
  - Mixed use development in Shipley town centre (300 homes)

It has been agreed that the future year for assessment should be 2030, and by 2030 it is predicted that there will be 4,814 new residential units in the city centre.

Overall, the numbers of trips expected to be generated by specific developments in each of the two AAP areas is summarised in the following table.

Total trips – AAP developments	IN	OUT
AM peak	1131	2229
PM peak	2199	1938

Although these forecasts seemingly represent a significant amount of additional traffic, the forecasts need to be considered alongside general predictions of traffic growth over the period between now and 2030. Where significant growth is concentrated in a relatively small number of sites, there is greater potential for impacts to be mitigated through the planning process and requirements for adequate access arrangements, contributions to public transport provision and the promotion of non-car modes of travel.

Growth in traffic between 2014 and 2030 is predicted to reach 35% in the Bradford district.

Implications for growth

The Bradford SATURN model has been used to assess the impact of growth in demand on the highway network in 2030. Assessment has been undertaken for both the AM and PM peak hour and it has been acknowledged that flows in the base year model are high when applying growth.

An initial analysis of the impacts of growth has identified a small number of 'hot spots' where improved highway infrastructure is considered critical to support growth in demand across the City Centre.

- Canal Road – dualling between the Stanley Road and Hillam Road junctions
- Queen's Road/Manningham Road junction and Shipley-Airedale Road/Bolton Road junction – both would benefit from an optimisation of future year signal arrangements as development traffic begins to be seen on the network.

Increased demand for the Shipley-Airedale Road/ Barkerend Road and Godwin Street/ Thornton Road junctions is also identified, but no obvious improvements can be identified without the need for significant land-take and demolition. It is recommended that further monitoring and analysis of the performance of each of these junctions is carried out as development starts to be delivered over the coming years.

Given these improvements, the modelling supports a conclusion that the future highway networks should be capable of accommodating AAP proposals, assuming that local mitigation and appropriate levels of support for non-car modes through the travel planning process are delivered. The main caveat being that more detailed work and/or monitoring of the Barkerend Road and Thornton Road junctions will be needed.

This, of course, relies on the mode shares in Bradford remaining at current levels, as a minimum. Analysis contained in the Baseline Evidence Report describes how the percentage of peak hour movements by bus has remained within 15-20% since 2000, although there was evidence that the bus share in the morning peak has 'caught up' with other time periods in the latest 2014 data. If mode share bus remains constant to 2030, and up to 20% of new development trips by bus can be achieved, this would result in the need for some 30 additional buses in each peak hour.

Support from developers should be sought to help provide improvements to the public transport, cycling and walking networks. The cost of improvements should be gathered through Section 106 and/or Section 278 contributions.

The modelling provides future support that future networks can support general growth in the district and specific growth in the two AAP areas. Growth in demand to 2030 is only expected to increase the length of an average trip across the network from 18 to 20 minutes and there will be a corresponding slight reduction in average speed.

Additional proposals

Given the conclusion that future growth, with mitigation, can be accommodated, a number of additional proposals have been identified which aim to address issues around safety and accessibility, rather than provide additional capacity. These proposals represent a combination of schemes already being pursued by the Council, as well as additional proposals identified during the course of the study. They are:

- City Ring Road Extension
- John Street Bus Gate
- West Bradford Cycle Route
- Improved cycle route, Stanley Road to City Centre
- Hall Ings/Bridge Street reconfiguration
- Improved pedestrian movement, Kirkgate

Schemes promoting improved walking and cycling facilities cannot be tested in the SATURN model but can be delivered. Those schemes with an impact on current highway capacity have been modelled and in each case it has been demonstrated that there are no capacity reasons why either of the schemes could not be pursued.

The most significant proposal is for extension of the City Ring Road. The scheme offers benefits in terms of legibility of the road network in the western part of the city and would also eliminate most of the pedestrian/vehicle conflicts currently experienced on Westgate and address existing safety issues for pedestrians. These benefits must, however, be considered alongside the main negative aspect of the scheme in which additional traffic would be routed along Thornton Road, one of the City's few Air Quality Management Areas.

Delivery and funding

Throughout the assessment of anticipated transport conditions in 2030, and the specific implications for development sites in the City Centre AAP, a number of assumptions have been made which will need policy support to deliver.

All new development must require a detailed transport assessment and Travel Plan to be submitted in support of the proposals. Similarly there is a need to support the use of low vehicular trip rates in the current assessments, and to encourage use of the various cycling initiatives being implemented or proposed. The Council's parking standards must be upheld.

Developers should demonstrate, through their Travel Plans, real commitment to promoting non-car modes. They should also ensure that all major developments are 'PT ready' and that there are strong connections to local walking and cycling networks.

Section 106 and Section 278 contributions should be used to fund the requirements of individual development sites. For wider mitigation, which is only identified when a number of development proposals are considered together, a more holistic approach to funding is required.

A number of local authorities are developing a Community Infrastructure Levy, and it is considered an appropriate approach for Bradford to secure the projects required to deliver the proposed growth in the AAP areas to 2030, and beyond.

1 Introduction

Background

1.1 The Bradford City Centre and Shipley and Canal Road Corridor Area Action Plans (AAPs) are being produced as part of the Local Plan for the Bradford District. The AAPs will establish planning policies and land use allocations to guide development proposals in the city centre and the Shipley and Canal Road corridor.

1.2 Steer Davies Gleave has been commissioned to carry out a robust study of the area and, in line with the National Planning Policy Framework (NPPF), to determine 'an adequate and up to date evidence base' (NPPF 158) and to 'assess the ability of infrastructure to meet forecast demands' (NPPF 162).

1.3 This report focusses on the Bradford City Centre Area AAP and presents an analysis of the impact of forecast demands on existing networks and identifies a package of potential interventions, both physical and non-physical, that could be delivered to support growth and accommodate additional demand. The report should be read in conjunction with the Baseline Evidence Report[1].

1.4 The baseline report concluded that:

- There are high levels of traffic into and out of the city in the peak hours, and in particular along the Canal Road corridor.
- The percentage of people crossing the city centre cordon by bus has remained fairly consistent at around 15-20% since 2000, although the figures for the Canal Road corridor are slightly lower. This reflects the relatively poor bus provision along Canal Road, probably linked to the corridor being well served by rail.
- Over the past 5 years there has been a steady growth in rail use across stations in the City Centre AAP area.
- Walking and cycling numbers are relatively low and further encouragement to use non-motorised modes should be considered.
- Within the City Centre, there are clusters of accidents at a number of key locations with high pedestrian activity. Within the corridor, accidents are more widely spread and the proportion involving pedestrians is significantly lower.

[1] Transport Study in Support of the Bradford City Centre and Shipley and Canal Road AAP, Baseline Evidence Report (Steer Davies Gleave, September 2014)

2 Current Situation

Overview

2.1 Bradford city centre has been identified as a Strategic Growth Centre in the Leeds City Region SEP Growth Plan which recognises business support, skills development and infrastructure growth among its priorities. The city centre is the economic focal point for the district and is home to more than 2,000 businesses, supporting 22% of jobs and generating 31% of the district's GVA.

2.2 The planning policies required to guide future development proposals and associated infrastructure in the city centre, along with details of how the proposals will be delivered, are set out in the City Centre AAP.

2.3 The City Centre AAP is steered by the concepts of the 2003 Alsop Masterplan and the subsequent 2005 Neighbourhood Development Frameworks. In 2007, the city centre was identified as an area of significant change in the Local Development Framework and the decision was made to produce an Area Action Plan to provide a detailed planning framework to manage this change and growth. In 2014, a new City Plan has been delivered which forms a 10 year delivery plan and has informed the next iteration of the AAP (Preferred Approach). The City Centre AAP sets out the expected phasing for all development types and supporting infrastructure over the next 15 years.

2.4 The City Centre AAP and the City Plan will together be used to inform planning application decision making in the city centre over the next 15 years.

2.5 As defined in the AAP, the city centre is divided into six different neighbourhoods, each derived from the unique character and development patterns in that part of the city. The Neighbourhoods are derived as follows:

- Southern Gateway – an area identified for a move from industrial uses towards residential development and supporting uses, such as the new primary school;
- The Bowl – location of the business core and main tourist attractions;
- The Channel - a focus for new retail (Broadway Shopping Centre);
- The Learning Quarter – the main campus for Bradford College and University of Bradford;
- The Market – the home of traditional city centre retail; and
- The Valley – a focus for city living.

2.6 The area covered by the City Centre AAP, including the key road links and railway stations, is shown in Figure 2.1.

2.7 Information about trips into and out of the city centre are collected by the Council on an annual basis at a series of 25 locations. The data collected covers walkers, cyclists, motorbike users, car drivers and passengers and estimates of bus and rail passengers.

2.8 Typical numbers entering the city in the morning are around 55,000 over a 2 and half hour period. The numbers exiting the city in the evening are generally higher at around 56,000, particularly given these figures are collected over just a two hour period. This likely illustrates a greater mix of trip purposes in the evening peak with a higher number of shopping and leisure trips mixed in with daily commuters.

2.9 Average car occupancy is recorded at 1.37 per vehicle in the evening peak but lower at 1.28 in the morning peak. This lower morning peak figure is reflected by higher proportions of single occupancy vehicles observed during the same period. However, there has been very little change in the proportion of single occupancy cars, in either time period, over the entire period for which data are available.

1.1 Based on the current weekday bus timetable, there are a total of 238 buses in the city centre each hour of the day. . Of these, 184 buses enter/exit Bradford Interchange. Other areas with significant bus flows are:

- 52 buses per hour on Sunbridge Road (north of Aldermanbury)
- 95 buses per hour on Market Street
- 26 buses per hour on Hall Ings

2.10 The predominant bus operator is First, running approximately 76.5% of buses in Bradford. Other operators include Arriva, Keighley and District and Yorkshire Tiger.

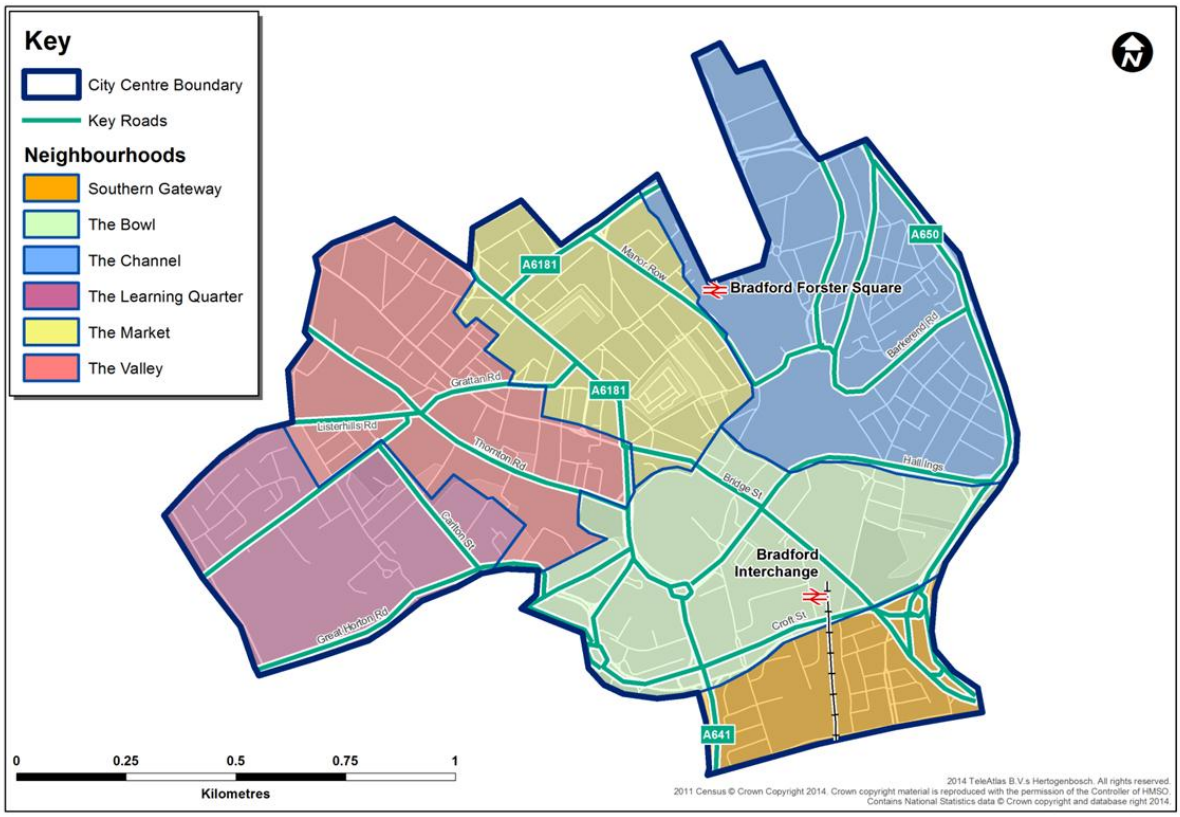
2.11 The data collected at 25 cordon locations around the city centre indicated the number of people entering the city by bus in the morning, and leaving in the city in the evening and off-peak periods. Give or take a few percentage points, the proportion of people travelling by bus has remained fairly constant since 2000 at between 15 and 20% of all people passing through the cordon.

2.12 Bradford is served by two major rail stations; Bradford Interchange and Bradford Forster Square. The Interchange is located at the southern side of the city centre and shares space with the city's main bus and coach station. It is the predominant station for rail connections to Leeds as well as along the Calder Valley Line to Halifax, Hebden Bridge, Huddersfield and Manchester Victoria. Forster Square is located to the north of the city centre, close to major retail parks and the markets area, from which trains serve Leeds, Shipley and Skipton on the Airedale Line, and Ilkley on the Wharfedale Line.

2.13 Since 2008-09, passenger numbers at Bradford Interchange have grown steadily to a total of just over 3 million passengers per year during 2012-13. At Forster Square, passenger numbers rose to 2011-12, but then dropped back to around 2.04 million in 2012-23, the average figure over the 5 years. It is shown that there has been a slow but steady growth in rail passenger numbers in Bradford, with a particular jump seen in 2010-11. The cordon surveys do indicate a recent increase in the percentage of people crossing the cordon travelling by train, particularly in the evening peak.

2.14 Walking and cycling numbers are relatively low. However, within the City Centre, there are clusters of accidents at a number of key locations with high pedestrian activity.

Figure 2.1: Bradford City Centre AAP



2.15 As part of a wider review of existing and future cycle connections between Shipley and Bradford[2], a review of opportunities for improved routes into the city centre has been undertaken with a view to consistency with the City Connect route between Leeds and Bradford.

2.16 The Leeds-Bradford City Connect route enters the city from the east, and there is also a proposal for a western route, along Thornton Road, which connects with the city park, more detail of which is provided later in this report. It has been acknowledged that it would be an opportunity lost if the Canal Road route did not connect to each of these.

Demographics

2.17 The most recent demographic data available is from the 2011 Census, which provides information on place of work and the method of travel to work.

2.18 The following table provides a summary of journey to work (JTW) trips into and out of Bradford District, and therefore excludes movements by those employees that both live and work in the district. In addition, for each mode, the greatest movement of employees is between Bradford and Leeds and a breakdown of the subsection of journeys to work between Bradford and Leeds is also provided.

2.19 Across all modes, there is a net outflow of commuters away from Bradford, although this pattern is not reflected by car drivers or bicycle users. The greatest difference between inflow

[2] Canal Road – Stanley Road to City Centre Cycle Route Study (Steer Davies Gleave, July 2014)

and outflow is seen by rail users, with close to 4,500 more commuters travelling out of the district by train than coming in the opposite direction. Almost all this difference is accounted for in rail use between Bradford and Leeds.

Table 2.1: Journey to work trips by mode – to/from Bradford district

Method of travel to work	All JTW trips – Bradford district			JTW between Bradford & Leeds only		
	Inflow	Outflow	Net change	Inflow	Outflow	Net change
All methods of travel	50439	55755	-5316	16957	25708	-10551
Driver – car or van	39969	37883	2086	13195	17533	-4338
Passenger – car or van	2453	3735	-1282	773	1392	-619
Taxi	167	342	-175	58	193	-135
Bus, minibus or coach	2996	3812	-816	1087	1678	-591
Train	2725	7213	-4488	1343	5769	-4426
Motorcycle, moped or scooter	322	363	-41	98	166	-68
Bicycle	411	374	37	149	201	-52
On foot	1216	1525	-309	220	452	-232
Other	180	508	-328	34	124	-90

Source: **www.nomisweb.co.uk/census/2011/wu03uk**

City Centre AAP proposals

2.20 As set out in the Evidence Base report, the main development site in central Bradford is the new Broadway shopping centre. The restart of works on the site provided a real confidence boost for the City and the development is planned to be completed, and opened to shoppers, by September 2015. Broadway will have a 1300 space car park for shoppers, and employ some 2500 retail sector staff.

2.21 The Broadway Shopping Centre scheme will result in changes to highway operations around Lower Kirkgate and Cheapside, with the result of pushing additional traffic out to the ring road.

2.22 Funding has been allocated in the Council's capital plan to support the delivery of an extension to the City Ring Road and support for land assembly for this scheme was sought from the Single Local Growth Fund but was unsuccessful. This scheme would extend from Westgate/Drewton Road across to Thornton Road, allowing for measures to restrict cars from using Westgate as a through route.

2.23 The City Connect project which is a cycle super highway linking Bradford with Leeds will provide some enhancement to cycle provision to the east of the city centre. In addition, a proposal for a Bradford West Cycle Route, using Thornton Road, was included in the Leeds City Region SEP submission for Single Local Growth Funding but was unsuccessful. Alternative funding for this scheme will continue to be sought.

3 Future Demand for Travel

Growth in Demand

3.1 For the City Centre AAP and the Shipley and Canal Road Corridor AAP, City of Bradford MDC published an Issues and Options Report in March 2013 which identified numerous sites for development in each of the areas.

3.2 Although this report is specifically concerned with transport issues for the City Centre AAP, the level of development proposed in the adjacent Shipley and Canal Road Corridor cannot be ignored as it will generate new trips which interact with city centre traffic. As such, this chapter provides details of development in each AAP area and a more detailed description of the future demand for travel is provided at Appendix A.

3.3 There follows a list of those development proposals to which specific quantum of changes in land-use, and associated increase in demand, can be allocated.

- City Centre
  - Various residential development sites
  - Broadway Shopping Centre development
- Shipley and Canal Road Corridor
  - New Bolton Woods development
  - Bolton Woods Quarry (1000 homes)
  - Shipley East residential proposals (100 homes)
  - Dockfield Road Area proposals (400 homes)
  - Mixed use development in Shipley town centre (150 homes)

Specific development trips

3.4 To estimate the number of trips associated with this level of new development, TRICS has been used to select residential development sites for a mix of tenures in the Yorkshire region. It is not known what type of residential development is proposed for each zone, so a weighted average trip rate has been derived across houses, flats and mixed use sites, both private and for rent.

3.5 Trips to and from the Broadway Shopping Centre development have been taken directly from the 2011 transport Assessment prepared by WSP, and trip forecasts for the New Bolton Woods development have been taken from the work undertaken to develop a microsimulation model of Canal Road. Which form part of the transport assessment for the outline planning application or this site.

3.6 Overall, the numbers of vehicular trips associated with specific developments in each of the two AAP areas is summarised in Table 3.1.

Table 3.1: Total trips – all specific development combined

Total trips – AAP developments	IN	OUT
AM peak	1131	2229
PM peak	2199	1938

3.7 Although these forecasts seemingly represent a significant amount of additional traffic, the forecasts need to be considered alongside general predictions of traffic growth over the period between now and 2030. Where significant growth is concentrated in a relatively small number of sites, there is greater potential for impacts to be mitigated through the planning process and requirements for adequate access arrangements, contributions to public transport provision and the promotion of non-car modes of travel.

Background growth

3.8 It has been agreed that the future year for assessment should be 2030 in line with the Core Strategy, which sets out the aims and objectives for sustainable development within the Bradford District for the next 15 years.

3.9 Growth in traffic across the district up to 2030 is taken from standard guidance, and adjusted to account for traffic specifically associated with the major developments outlined above.

3.10 Revised factors are calculated to be 1.26 in the morning and 1.21 in the evening peak.

Non-car modes

3.11 Background growth and growth associated with specific development sites will impact on public transport demand as well as the number of future car trips on the network.

3.12 General traffic growth across the district up to 2030 is predicted to be +35% in the AM peak and PM peak. Applying these to current bus and rail demand across the city centre gives the following predictions of overall increases in peak hour trips.

Table 3.2: Predicted increase City Centre bus and train use, 2030

	Peak Period		Peak hour	
	Bus	Train	Bus	Train
AM Peak increase				
City Cordon	3004	1334	1201	534
PM Peak increase				
City Cordon	3161	1648	1581	824

3.13 For these forecasts of additional public transport demand to be realised, investment in new public transport capacity will be required. Mitigation of future demand growth will also play a part in achieving the West Yorkshire Local Transport Plan (LTP3) target of keeping the number of car journeys made each year by West Yorkshire people at current (2011) levels.

Impact of growth

Impact on the roads

3.14 The Bradford SATURN model has been used to assess the impact of growth in demand on the highway network in 2030. Assessment has been undertaken for both the AM and PM peak

hour and it has been observed that flows in the base year model are high compared to current traffic levels. This has been acknowledged when applying growth.

3.15 Assigning updated 2030 demand to the existing network, updated to reflect specific infrastructure improvements associated with Broadway, New Bolton Woods and Shipley East, results in increased demand on most routes within the City Centre AAP and Shipley and Canal Road Corridor AAP areas.

3.16 This initial assignment of future year demands identified a number of locations where significant queues/delays would arise if growth was permitted without mitigation. In the most extreme case definite proposals can be identified, as described below, and has been included in all future modelling.

- Canal Road –dual Canal Road between the Stanley Road and Hillam Road junctions.

3.17 A more detailed description of the use of the SATURN model is provided in Appendix B.

3.18 For each time period, the model predicts that additional demand will be generally spread across the City Centre network. There are some parts of the model, such as around Sunbridge Road to the west of the city and around Little Germany and the Shipley Airedale Road / Barkerend Road junction, where the model starts to become unstable and predicts changes in routes between model scenarios, in some cases suggesting reductions in flow.

3.19 In the City Centre, there are generally increases in delay across much of the network but the most significant impacts are around the Barkerend Road and Harris Street area, immediately adjacent to Shipley Airedale Road. It has already been recommended that further monitoring and analysis of the performance of the Barkerend Road junction is carried out as development starts to be delivered over the coming years. Delays are also shown at junctions along the border of the Market and Learning Quarter neighbourhoods, where a number of city centre residential sites are located, and it must be ensured that appropriate mitigation is conditioned as part of the planning approval process.

3.20 In summary, the modelling indicates that the City Centre network is likely to be able to accommodate the level of development proposed in both AAPs, although there will be impacts on certain junctions which will require future interventions or mitigation.

Impact on public transport and walking/cycling networks

3.21 Earlier in this chapter we provide broad estimates of future public transport demand and conclude that investment in public transport capacity will be required for these forecasts to be realised. There is every reason to also assume that AAP development sites will generate additional walking and cycle trips too.

3.22 The provision of extra peak hour buses and improved cycle connections to and from the City Centre should be funded by developer contributions. Opportunity may have been lost for those sites with existing planning consents, but it is recommended that Section 106 contributions are secured from new sites, or those currently in the planning process, to support the delivery of initiatives required to promote the continued growth in non-car modes of transport.

Summary of key issues relating to increased demand for travel

- Movements into and out of the City from the north will become restricted without additional capacity provided on Canal Road, particularly between Stanley Road and Hillam Road.
- A number of key junction should be further investigated to identify potential re-configuration, to accommodate increased traffic.
  - Shipley Airedale Road / Bolton Road
  - Shipley Airedale Road / Barkerend Road
  - Queen's Road / Manningham Lane
  - Thornton Road / Godwin Street
- There is a need for additional peak hour bus capacity to maintain a level of 20% of all trips into and out of the City Centre to be made by bus.
- There is a need for improved cycle connections to and from the City Centre, to encourage cycle use and to maintain growth in numbers of cyclists in the City Centre.

4 Issues Arising

Evidence Base

4.1 The "Movement" section of the City Centre AAP report[3] sets out the following objective and identifies a number of issues which will need to be considered.

> Easy access to and around the city centre for all sections of the community, and a reduction in problems caused by through traffic

4.2 The key issues include

- Quality and availability of pedestrian routes,
- Provision of public transport services and infrastructure,
- Air quality management,
- Parking provision, and
- Impact of new development upon the transport network.

4.3 More specifically, the report supports the introduction of traffic management systems to remove or restrict traffic from some through routes and to create more pedestrian only zones.

4.4 Although there is no specific reference to cyclists, our Baseline Evidence report identifies a rise in the number of cyclists entering the city centre in recent years and the quality and availability of cycling routes should also be considered.

4.5 In the City Centre, the Baseline Evidence Report identifies a small number of the locations where the most serious accidents occur, and highlights that the majority are in areas of high pedestrian activity; around Kirkgate Shopping Centre, along Westgate, at the pedestrian crossing of Godwin Street between City Park and The Alhambra, and at the junction of Hall Ings and Bridge Street.

4.6 In addition, it is noted that two out of the four Air Quality Management Areas in the district are located within the City Centre AAP area. The Shipley Airedale Road site is the site with the highest concentrations of NO_2 in the entire district.

- Shipley Airedale Road – immediately south of, and including, its junction with Otley Road
- Thornton Road- a short section of road either side of its junction with Holmfield Street, some 300m to the west of Princes Way.

[3] City Centre Area Action Plan, Further Issues and Options Report, City of Bradford MDC, March 2013

Implications of Growth in Demand for Travel

4.7 There are a number of changes to the highway network proposed, either linked to access to major development sites or to be delivered as conditions to existing planning permissions. These are described in more detail in the following Chapter and in Appendix B.

4.8 When compared to the Base Model, future growth in demand, up to 2030, is expected to reduce average speeds across the full District network from 44kph to 40kph in each of the morning and evening peaks. Combined with adding new trips of varying lengths, this would result in the average trip length increasing slightly from a 18 minute journey to a 20 minute journey. These represent only modest changes in speeds and journey length over a 16 year period.

4.9 In the city centre, however, traffic speeds are lower and the impact of growth in demand is often greater than seen across the District as a whole. The following table shows changes in delay (seconds) and speed (kph) between Base Year and anticipated conditions in 2030 for six key routes passing through the City Centre AAP area. The six routes can be defined as follows:

1. Between Manchester Road (j/w Mill Lane) and Canal Road (j/w Valley Road), via Westgate and Hamm Strasse
2. Between Manchester Road (j/w Mill Lane) and Leeds Road (j/w Edderthorpe Street), via Jacob's Well and Hall Ings
3. Between Manchester Road (j/w Mill Lane) and Leeds Road (j/w Edderthorpe Street), via Croft Street
4. Between Wakefield Road (j/w Bowling Back Lane) and Canal Road (j/w Valley Road), via Shipley Airedale Road
5. Between Manchester Road (j/w Mill Lane) and Thornton Road (j/w Sunbridge Road), via Jacob's Well and Thornton Road
6. Between Leeds Road (j/w Edderthorpe Street) and Canal Road (j/w Valley Road), via Shipley Airedale Road

Table 4.1: Impact on traffic speeds – City Centre

Route	Direction	AM Peak Base		AM Peak 2030		PM Peak Base		PM Peak 2030	
		Delay (s)	Speed (kph)	Delay (s)	Speed (kph)	Delay (s)	Speed (kph)	Delay (s)	Speed (kph)
1	N/B	67	20.3	163	16.9	76	19.1	305	13.1
	S/B	73	22.5	176	18.0	98	20.5	219	16.1
2	W/B	86	17.6	131	14.3	22	21.4	153	14.9
	E/B	17	25.0	21	24.5	25	23.0	30	22.8
3	W/B	70	21.7	120	18.1	79	19.6	246	12.4
	E/B	25	26.5	27	26.1	66	24.3	57	23.1
4	N/B	81	28.7	173	21.8	120	25.3	332	15.3
	S/B	99	27.4	355	14.5	91	26.8	234	18.1
5	W/B	101	20.8	169	18.1	115	19.3	278	13.5
	E/B	66	24.1	126	20.4	71	23.2	199	16.5
6	N/B	41	27.8	116	20.8	55	26.4	235	14.8
	S/B	79	24.0	271	13.4	48	25.8	180	16.4

4.10 The main impacts on speeds and increased delay are predicted to be seen on those routes passing along Shipley Airedale Road (routes 4 & 6) where conditions in 2030 more than double the delay to traffic. The majority of these increases in delay are predicted to occur on the approach to the Barkerend Road junction.

4.11 We also see reductions in traffic speeds, in each direction, along Route 1 passing through the western side of the city centre between Jacob's Well and Hamm Strasse.

4.12 In both cases, intervention will be required in future years to mitigate increases in delay in each part of the network.

Summary of additional issues relating to increased demand for travel

- Additional demand for all modes will increase the likelihood of conflict between vehicles and pedestrians in those locations where the most serious accidents occur.
- Additional traffic levels are predicted in areas of the City Centre designated as Air Quality Management Areas; Shipley Airedale Road and Thornton Road.
- Traffic speeds in the City centre are predicted to reduce, particularly along routes passing along Shipley Airedale Road or through the western side of the City Centre.

5 Interventions

5.1 To accommodate growth in traffic to 2030, interventions will be required.

5.2 Capacity improvements have been identified (3.37) to accommodate general growth in traffic levels.

- Canal Road – dualling between the Stanley Road and Hillam Road junctions
- Adjustment to the signal arrangements at Queen's Road/Manningham Lane and Shipley-Airedale Road/Bolton Road junctions

5.3 Although the above improvements are specifically related to the Shipley and Canal Road Corridor , it is important for them to be added to the model to derive a baseline scenario against which the implications of further proposed schemes can be assessed.

5.4 Assuming that these proposals are delivered, and that access to major new sites are designed to accommodate traffic associated with those sites, the modelling demonstrates that the network will be able to accommodate demand levels associated with AAP sites and growth up to 2030.

Proposed schemes

5.5 Further interventions to further improve conditions in the City Centre have then been identified which fall into three categories,

- Interventions linked to the delivery of Broadway Shopping Centre;
- Schemes already being pursued by the Council; John Street Bus Gate, West Bradford Cycle Route and the City Ring Road extension; and
- Additional proposals identified during the course of the study aimed at addressing specific issues.

Development related

5.6 For the Broadway Shopping Centre, access to/from the shoppers' car park will be via a new signalised junction on Hall Ings, opposite Drake Street. In addition, links between the centre and Forster Square railway station would be improved through the restriction of general traffic from Lower Kirkgate.

5.7 As above, access to the Broadway Shopping Centre has been added to the model baseline scenario against which the implications of further proposed schemes can be assessed.

Council schemes

5.8 A small number of schemes have been considered by the Council but not, as yet, pursued. These have been tested within the SATURN model where feasible and are described below.

John Street Bus Gate

5.9 A scheme to give priority for bus movements eastbound along John Street, accompanied by an extension of the pedestrianised zone through closure of Duke Street to traffic between James Street and Barley Street. There is a need to permit 2-way traffic on James Street to accommodate these changes. Support for expansion of the pedestrianised scheme comes from the link between high pedestrian activity and accident numbers, identified in the Evidence base report.

West Bradford Cycle Route

5.10 A proposal to complement both the Sustrans route south of the City and the City Connect proposals to link Bradford with Leeds. The route would follow Thornton Road out of the City before turning south-west towards Clayton and connecting with the Queensbury Tunnel proposals. Additional cycle routes into the city will support observed and forecast growth in cyclist numbers.

Canal Road Cycle Route

5.11 The Cycle Route Study[4] has considered opportunities for connections from the southern section of Canal Road into the city centre in two parts; between City Park and the termination of the Leeds-Bradford City Connect route on Lower Kirkgate, and onward connections to Forster Square. A combination of segregated and on-road routes, depending upon the ability of the cyclist, are promoted between Lower Kirkgate and the city centre. Improved connections to City Park will again support observed and forecast growth in cyclist numbers, as well as maximising benefits of the City Connect proposals.

City Ring Road Extension

5.12 The Ring Road extension would provide a direct connection between Drewton Road and Thornton Road, between their junctions with Westgate and Listerhills Road respectively. A key component of the scheme could be the introduction of a gyratory type system whereby Thornton Road will predominantly cater for westbound traffic, with eastbound trips focussed on Sunbridge Road. The proposals are further complimented by the introduction of restrictions to general traffic along Westgate.

5.13 The Council's proposal for the Ring Road extension are supported by analysis of future year traffic speeds in the city centre, resulting from growth in demand, predicting that this part of the network will suffer from increased delays without intervention.

New schemes

5.14 Additional proposals have also been put forward during the course of this study to help address specific issues of pedestrian safety or improved pedestrian and cycle routes.

- Lower Kirkgate – A proposal to restrict use of Lower Kirkgate to bus and cycle use only. This will reduce traffic along this section of road, thereby allowing safer connections for pedestrians between Broadway and both Forster Square rail station and the adjacent retail park. In addition, the proposals complement improvements to cycle linkages between the eastern side of the city and City Park.

[4] Canal Road-Stanley road to City Centre Cycle Route Study (Steer Davies Gleave, July 2014)

- Hall Ings / Bridge Street Junction – A proposal to reduce east-west capacity along Hall Ings, to widen the central reserve on the west side of the junction and to reconfigure the pedestrian crossing facilities to improve conditions for pedestrians passing between the City Centre and Bradford Interchange. These proposals have been developed in response to a pedestrian accident cluster at this junction.
- Kirkgate – A proposal to make the short section of Kirkgate between Cheapside and Piccadilly to one-way westbound operation, to facilitate widening of the footway on the southern side to improve connections for pedestrians between the Broadway Shopping Centre and the City's current retail offer. To make the one-way proposals work, there is a requirement for one-way operation on the southern part of Dale Street, along with 'opening up' and resurfacing of Commercial Street, between Dale Street and Cheapside.

5.15 A schematic representation of the location of each of the various schemes within the City Centre AAP area is provided in Figure 5.1.

5.16 In addition, it is recommended that further work is undertaken to explore and evaluate opportunities for relieving congestion on Shipley Airedale Road.

5.17 Analysis of key traffic routes through the city centre, and how conditions are expected to change as future growth begins to impact on the network, has highlighted that Shipley Airedale Road will become more congested, particularly on approaches to the Barkerend Road junction. This is a busy junction today, and built up an all sides. A more detailed study of current operation, through new surveys and more detailed modelling, is recommended to establish any scope for increasing capacity through reconfiguration of signal timings or to establish the amount of land required to accommodate future growth in traffic in this part of the network.

Additional schemes

5.18 In addition to the proposals discussed above, a parallel study has been conducted to develop Masterplans for the redevelopment of Bradford Interchange and Bradford Forster Square railway stations.

5.19 The key objectives of the Masterplan study were to:

- create a high quality station gateways for a major city centre,
- improve the visibility and connectivity of the stations within the wider city centre, and
- provide better connectivity at the stations between different transport modes.

5.20 These interventions will encourage more people to use public transport and will improve conceptions of the city for new and regular visitors. In addition, the proposals will identify new commercial opportunities within each station and make the stations more efficient to run.

5.21 Although not specifically addressing issues identified in the course of this study, the Masterplan proposals are fully supported.

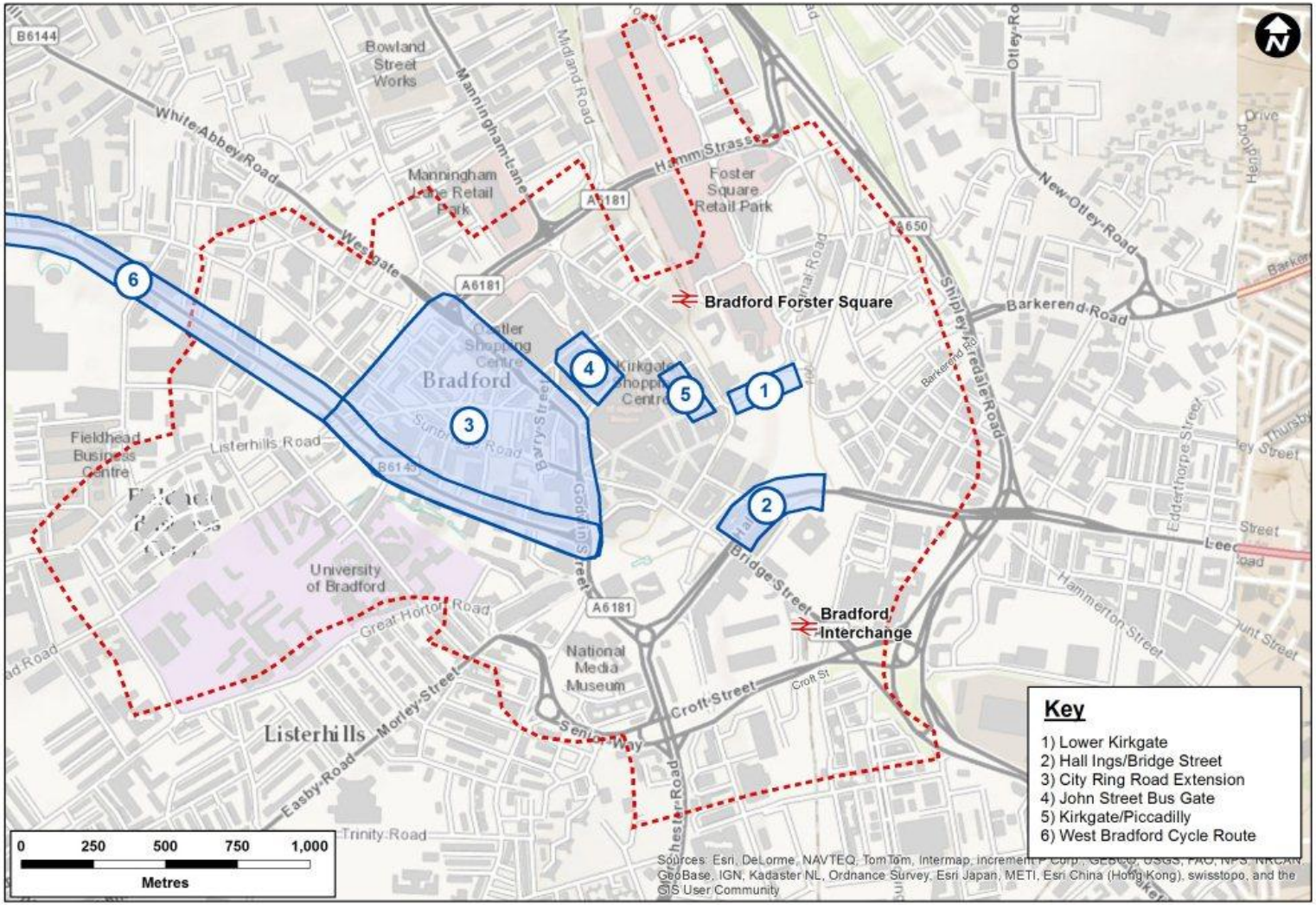
5.22 In addition to the Masterplan proposals, other schemes funded by the West Yorkshire plus Transport Fund (WY+TF) which will encourage increased rail use include:

- Calder Valley Line enhancements, plus potential electrification,
- Additional rail services to London from Bradford Forster Square, and
- New services to Chester and to Manchester Airport.

5.23 Furthermore, there are other schemes in the wider District, while not assessed as part of this study, which are being delivered through the WY+TF and which have the potential to impact on traffic flows in the City Centre. These include:

- A658 Harrogate Road/A657 New Line junction improvements
- A650 Hard Ings Road dualling, Keighley
- Tong Street Corridor Improvements
- South East Bradford Access Route
- Highways Efficiency Bus Package

Figure 5.1: Indicative location of proposed interventions



Testing of highway interventions

5.24 Where applicable, these interventions have been coded in to the SATURN model and the impact of their introduction assessed through the assignment of the 2030 Forecast Year demand.

5.25 A total of 4 tests have been undertaken for the City Centre AAP area, summarised below. The Kirkgate one-way proposals cannot be included in the model because of lack of detail in that part of the network.

- Test 1: Lower Kirkgate – bus/cycle use only
- Test 2: Hall Ings / Bridge Street - reduced capacity for through traffic
- Test 3: City Ring Road extension
- Test 4: John Street Bus Gate

5.26 For each test, a full description of differences in traffic flows between the tested scheme and the 2030 Forecast Year reference case are provided in Appendix C. The findings are summarised here.

Test 1: Lower Kirkgate

5.27 Restrictions to general traffic on Lower Kirkgate under Test 1 naturally reduces flow on this link, but also results in reduction on Cheapside and the southern part of Canal Road. The diversion of traffic is relatively self-contained with the main impact being increased flow on Hamm Strasse. The findings in the AM and PM peaks are similar, with the PM peak impacts slightly less widespread.

Benefits

5.28 Reducing traffic levels on Lower Westgate will improve connections for pedestrians between the Broadway Shopping Centre and both Forster Square railway station and existing retail parks. In addition, the proposals provide some reduction in flow on John Street, which would be complementary to the proposals considered in Test 4.

Issues and feasibility

5.29 There are no physical changes to the highway network proposed, and the scheme could be introduced relatively cheaply.

Test 2: Hall Ings / Bridge Street

5.30 In each peak, the impacts are constrained to the City Centre network. There is a reduction in flow along the route, particularly eastbound, with traffic diverted to, arguably, the more suitable Croft Street route.

Benefits

5.31 Reduced traffic levels through the Bridge Street junction facilitates improvements for pedestrians passing between the Interchange and the City Centre. Improved, safer crossing facilities for pedestrians on the eastern side of the junction can be introduced to address a specific accident issue.

Issues and feasibility

5.32 Any concerns over access to Broadway Shopping Centre, through reducing capacity through the city, appear unfounded. Some physical works would be required to deliver the improved

pedestrian facilities at the junction, but the scheme could be implemented at relatively modest cost, and should ideally by timed to complement proposed improvements at the Interchange.

Test 3: City Ring Road Extension

5.33 The implications for extension of the City Ring Road are more widespread. Through the nature of the proposals, we see reductions in flow on Westgate and on Godwin Street to the north of Thornton Road, with increases in flow in Sunbridge Road eastbound and Thornton Road westbound. There is increased demand for Hamm Strasse, which is expected given the proposals are for the extension of the ring road.

5.34 Outside the City, the redistribution of traffic results in greater demand along the A6177 outer ring road, with more traffic leaving the City along Canal Road and similar reductions along the A650. By Shipley, the impacts are negligible in the AM peak. In the PM peak there is a small redirection of traffic through Shipley, but these are not shown to have an adverse effect on queues and delays in the town.

Benefits

5.35 As well as improving the legibility of the road network for traffic passing through the western part of the city centre, the removal of general traffic on Westgate will eliminate most of the pedestrian/vehicle conflicts and address existing safety issues for pedestrians. Similarly, safety improvements will be achieved through the proposed reconfiguration of the Godwin Street/Sunbridge Road junction.

Issues and feasibility

5.36 Any increase in traffic along Thornton Road will have a detrimental impact on one of the City's few Air Quality Management Areas. As well as extending the Ring Road being a high cost proposal, with funding sources needing to be identified, there are also concerns over the deliverability of the scheme due to the topography of the area and the gradients involved.

Test 4: John Street Bus Gate

5.37 Changes to the use of John Street and Godwin Street under Test 4 results in a direct switch of westbound traffic from Godwin Street to John Street. In each peak, the model suggests slightly wider implications of a switch in northbound traffic from Manningham Lane to Lumb Lane.

Benefits

5.38 The scheme will extend the pedestrianised zone in a part of the city identified as having a problem with pedestrian accidents.

Issues and feasibility

5.39 The scheme could be implemented for little cost, but similar reductions in traffic through this area could be achieved through the Test 1 proposals.

5.40 Table 5.1 provides forecast changes in two-way flows on key links in the City Centre AAP area, and supplements the plots in Appendix C showing differences in traffic flows associated with each test.

5.41 The basic assessment of the impacts of each of the proposed schemes has not identified any issues that might not have been expected given the nature and scale of each scheme. As such, there would seem no reason why either of the proposed interventions could not be introduced in isolation.

5.42 However, a further test has been undertaken to assess the likely implications of introducing all the proposals in combination.

5.43 As shown in Appendix C, the results of the combined test are dominated by the City Ring Road extension, but we still clearly identify separate City Centre impacts of closing Lower Kirkgate and reducing capacity along Hall Ings/Leeds Road.

Assessment of non-highway interventions

5.44 The model is not suitable for testing the impact of introducing non-highway measures. However, a qualitative assessment of the benefits and delivery issues of each intervention can be made.

Canal Road Cycle Route

5.45 The need to connect cycle routes along the Canal Road corridor into the city centre has been identified. Within the context of the City Centre AAP, connections into the city centre are seen in two parts; between City Park and the termination of the Leeds-Bradford City Connect route on Lower Kirkgate, and onward connections to Forster Square and beyond to ultimately connect to the Greenway route north of the Canal Road/Stanley Road junction.

Benefits

5.46 Connecting directly to the city centre at City Park will maximise the benefits of the Leeds-Bradford CityConnect route, which is planned to terminate at Lower Kirkgate. Providing a safe route between the Greenway and the city centre will also support observed and forecast growth in cyclist numbers in the district.

5.47 The route will provide a strategic cycle link from both the existing deprived areas of North Bradford and the new residential areas on Canal Road to the jobs and training opportunities in Bradford City Centre. It also enables connection from Bradford city centre to the National Cycle Network.

Issues and feasibility

5.48 Cycling improvements between Stanley Road and the city centre are to be funded by the Cycle City Ambition Grant Programme “CityConnect 2”.

West Bradford Cycle Route

5.49 A cycle route to West Bradford would complement both the Canal Road link into City Park, outlined above, and the Sustrans route south of the City. The route would follow Thornton Road out of the City before turning south-west towards Clayton and connecting with the Queensbury Tunnel proposals.

Benefits

5.50 As with the link to Canal Road, a new cycle route to the west of the city centre would support observed and forecast growth in cyclist numbers in the district. In addition, there is further growth identified in the Core Strategy for the west of Bradford, and current bus provision to the west is poorer than elsewhere in the city.

Issues and feasibility

5.51 The route will be predominantly on street, parts of which have existing cycle lanes. There is no funding currently allocated to the proposals, and opportunities for future funding streams should continue to be sought.

Kirkgate – improved pedestrian links

5.52 A proposal to convert the short section of Kirkgate between Cheapside and Piccadilly to one-way westbound operation, will allow widening of the footway on the southern side to improve connections for pedestrians between the Broadway Shopping Centre and the City's current retail offer.

Benefits

5.53 The current two-way operation encourages unofficial pick-up/drop-off activity, resulting in vehicles u-turning within the carriageway with little regard for other road users. Converting Kirkgate to one-way operation should discourage this activity, and introduction of a widened footway will provide a safer, more attractive connection for pedestrians seeking to visit both existing city centre shops and new shops in Broadway.

Issues and feasibility

5.54 Enforcing one-way operation along Kirkgate requires reversing the direction of Dale Street, between Commerce Street and Kirkgate. Commerce Street itself should have resurfacing of the existing cobbles, along with parking restrictions to maintain two-way flow.

5.55 This would be a relatively low cost scheme and could be introduced in the short term.

Matching interventions to issues

5.56 In the previous chapters, a number of issues have been identified which will need to be addressed if increased demand in future years is to be successfully managed.

5.57 Where possible, the interventions identified in this chapter are designed to address some of those issues.

Intervention	Issue
John Street Bus Gate	Conflict between cars and pedestrians in areas of high numbers of pedestrian accidents
West Bradford Cycle Route Canal Road Cycle Route	The need for improved cycle connections to and from the City Centre, to encourage cycle use and maintain growth in the number of cyclists
City Ring Road Extension	Increased pressure on Thornton Road/ Godwin Street junction; reduced traffic speeds through the western side of the City Centre
Lower Kirkgate Kirkgate	Improved connectivity between city centre sites for cyclists and pedestrians
Hall Ings / Bridge Street	Improved pedestrian crossing facilities, not only to improve connectivity between city centre locations but also to address a particular accident issue

Table 5.1: Change in key link flows across each modelled scenario – 2030, AM and PM peak

Key Routes	AM Peak flow (2-way)					PM peak flow (2-way)				
	2030 DM	Test 1	Test 2	Test 3	Test 4	2030 DM	Test 1	Test 2	Test 3	Test 5
City Centre										
Hall Ings, west of Bridge Street	1880	1940	1340	1830	1910	1920	1930	1440	1740	1920
Leeds Road, west of Shipley Airedale Road	1740	1780	1580	1820	1840	2510	2490	2340	2580	2510
Godwin Street, south of Thornton Road	4460	4460	4460	3640	4460	3880	3880	3880	4030	3880
Croft Street	3930	4010	4180	3900	3990	2990	3190	3380	3280	3200
Shipley Airedale Road, north of Barkerend Road	5010	5020	5020	5030	5010	5260	5260	5260	5260	5260
Hamm Strasse	2320	2500	2350	2260	2480	2460	2440	2520	2330	2470
Westgate	2530	2570	2500	100	2730	2630	2620	2610	100	2650
Thornton Road	1810	1810	1780	2330	1820	1570	1630	1550	2340	1610
Sunbridge Road	320	330	310	1100	370	600	610	600	770	590

Policy considerations

5.58 Throughout the assessment of anticipated transport conditions in 2030, and the specific implications for development sites in the City Centre and Shipley & Canal Road Corridor AAPs, a number of assumptions have been made which will need policy support to deliver.

Planning policy

5.59 Adequate local mitigation for each new development application should be ensured. The Council should continue to enforce its policy that all new planning applications, and reserved matters applications if appropriate, will require a detailed transport assessment and Travel Plan to be submitted in support of the proposals.

5.60 Developers should be required to demonstrate how the impacts of development can be mitigated through the design of the development, the provision of user friendly access to bus networks and rail stations and to ensure that connections into key pedestrian and cycle routes are made available.

City Centre parking

5.61 There is a need to support the use of low vehicular trip rates in the current assessments, and to encourage use of the various cycling initiatives being implemented or proposed.

5.62 Parking standards for different types of development are presented in the Core Strategy. For residential development, the standards already establish a distinction between city centre developments and those elsewhere. Furthermore, there is an discretionary allowance for more restrictive levels of car parking provision in the case of multi-occupancy residences.

5.63 It is worth noting that on 25th March 2015 the Secretary of State for Communities and Local Government issued a written statement[5] that "Local planning authorities should only impose local parking standards for residential and non-residential development where there is clear and compelling justification that it is necessary to manage the local road network". As such, Bradford Council may review its parking standards in the near future and current parking standards may change.

5.64 Whichever standards are current at the time of a planning application must be upheld. Going forward, city centre developments should seek to minimise the amount of car parking that is provided as part of the scheme. The Council should seek to uphold minimal operational requirements for car parking for any new major developments in the city centre to avoid any potential significant detrimental impacts upon the highway network in the city centre and beyond. The Evidence Baseline identified that there is no shortage of public car parking within the city centre and, as such, restrictions on new development-related parking should not impact on the viability of those schemes.

5.65 City centre developments should also offer cycle parking, as included in the standards, but further delivery of city centre cycle parking should also be secured to provide facilities for cyclists from surrounding areas who would like to cycle to the city centre for employment, retail or leisure and to support growth in cycle mode share.

[5] Written Statement HWC488 – Parking: helping local shops and preventing congestion

Non-car modes

5.66 It should be made easier for people – particularly occupants of new developments – to make an informed choice between using the private car or making alternative journeys by public transport, walking or cycling.

5.67 Developers should demonstrate, through their Travel Plans, real commitment to promoting non-car modes. In the case of public transport, and particularly bus, it is recommend that developers are encouraged to offer more than just Travel Passes over the first few months of a development. Section 106 or Section 278 contributions should be pursued towards the cost of new services, bus priority at key junctions and better bus stops.

5.68 Developers should also ensure that all major developments are 'PT ready' – ie the internal network is designed with a hierarchy of roads, designed to accommodate bus movements. Similarly, all development proposals should demonstrate, or enhance, strong connections to local walking and cycling networks.

Funding

5.69 Section 106 and Section 278 contributions should be used to fund the requirements of individual development sites. For wider mitigation, which is only identified when a number of development proposals are considered together, a more holistic approach to funding is required.

5.70 Schemes to be delivered through the WY_TF have been discussed earlier. New funding opportunities are likely to come forward, which could be pursued to deliver those schemes not dealt with by the West Yorkshire Plus Transport Fund.

5.71 A more appropriate, or at least alternative, approach might be to secure contributions from developers of future sites against the cost of scheme delivery. Work is ongoing[6] to prepare viability evidence on behalf of the Council towards the preparation of a Community Infrastructure Levy (CIL). Future developments would incur planning obligations to fund 'their share' of district-wide transport initiatives corresponding to the value of each particular site.

5.72 A number of local authorities are taking the CIL approach, and it is considered an appropriate approach for Bradford to secure the projects required to deliver the proposed growth in the AAP areas to 2030, and beyond.

[6] **http://www.bradfordchamber.co.uk/wp-content/uploads/CoreStrat-CIL-ViabilityConsultation-Sep14.pdf**

6 Delivery Plan

Programme for Delivery

Short term interventions

6.1 There are a number of interventions that can be delivered at relatively low cost and offer early 'wins' within the next 1-2 years.

6.2 A number of City Centre interventions should be programmed for delivery in the shorter term.

- Restricting all vehicles except buses and cycles from Lower Kirkgate will reduce traffic levels passing the northern edge of the site and ease the passage of shopper pedestrians between the shopping centre and Forster Square station.
- Limiting access to Kirkgate, and on to Piccadilly and Dale Street, through introduction of a new one-way system and widening the footway on Kirkgate would capitalise on the above and provide a reduced traffic link between Broadway and the rest of the town centre shopping area.

6.3 Once restrictions are in place on Lower Kirkgate, it should be relatively straight forward to impose the same restriction on the section of Valley Road passing the sorting office site. Restriction to bus and cycle use only on both Canal Road and Lower Kirkgate would, in the most part, provide the continuation of the City Connect cycle route into City Park. It would also provide an alternative car free route between the city centre and St Blaise Way providing easy access for cyclists to Forster Square railway station.

6.4 It should be noted that restrictions on this section of Valley Road would require access conditions to be imposed on future development of the sorting office site.

Medium/longer term interventions

6.5 In the medium term, the Hall Ings / Bridge Street junction should be reconfigured to provide improved crossings for pedestrians, particularly between Bradford Interchange railway station and the City Centre. The work should be programmed to maximise proposed work on city centre stations access, currently the subject of a separate study.

6.6 Existing proposals are in development for the implementation of the John Street Bus Gate scheme. Combined with exclusion of private vehicles from the eastbound side of John Street, between James Street and Rawson Square, the scheme also facilitates the creation of a new pedestrian zone on Duke Street, alongside the Kirkgate Shopping Centre. This section of Duke Street is one of the areas in the city centre where clusters of pedestrian accidents have been observed in recent years. Removal of all traffic from this area will minimise the risk of further conflict between pedestrians and motor vehicles.

6.7 Also in the medium term, the aim should be to complete the cycle route between the city centre and Shipley, partly already provided by the Greenway. Improvement to the section between the city centre and the City Connect cycle route, linking Bradford to Leeds, is addressed above.

6.8 In addition, a proposal for a Bradford West Cycle Route, using Thornton Road, was included in the Leeds City Region SEP submission for Single Local Growth Finding but was unsuccessful. Alternative funding for this scheme should continue to be sought.

6.9 Funding has also been allocated in the Council's capital plan to support the delivery of an extension to the City Ring Road and support for land assembly for this scheme was sought from the Single Local Growth Fund but was unsuccessful. This scheme would extend from Westgate/Drewton Road across to Thornton Road, allowing for measures to restrict cars from using Westgate as a through route.

6.10 Analysis of this option has illustrated positive and negative aspects of its delivery. Reduction in traffic along the city end of Westgate would improve conditions for pedestrians and help tackle existing safety issues in this area. However, this is countered by increased traffic along Thornton Road, one of the areas of the city with significant air quality concerns. Further consideration of the City Ring Road proposals should be undertaken, but the scheme should remain in consideration in the longer term.

6.11 There follows a table summarising the delivery proposals for proposed interventions in transport provision in the City Centre AAP area. For each intervention, an indication of the scale of cost is also provided although in each case more detailed analysis of costs should be undertaken.

Table 6.1: Summary Delivery Plan – City Centre Schemes

Intervention / Timing	Comments	Indicative Cost
Short Term		
Lower Kirkgate conversion to bus and cycle only	Improved connectivity between Broadway Shopping Centre and rest of the city centre	£
Kirkgate / Piccadilly / Dale Street one-way and footway widening	As above	£
Medium/longer term		
Hall Ings / Bridge Street junctions and reductions in capacity	Primarily aimed to improve conditions for pedestrians crossing between the City Centre and Bradford Interchange; timing should aim to coincide with proposed Bradford Interchange and Forster Square Masterplan improvements.	£/££
John Street Bus Gate	Existing proposals; pedestrian zone introduced in area of high pedestrian accidents	£
Bradford West Cycle Route	Continue to seek funding for a route west of City Park along Thornton Road	££
City Ring Road Extension	Further analysis recommended, and appraisal must weigh potential improvements in pedestrian safety along Westgate against increased traffic through the Thornton Road air quality management area.	£££

City Plan

6.12 This study links into delivery of the City Plan, and the interventions identified in this report will help delivery the transport aspects of the City Plan Vision

> Bradford city centre will have a well connected and adaptable transport system where people have a choice of quality travel options. The city will have a more efficient and reliable network with enhanced legibility to help people move about more freely than they do today. Perhaps most importantly, Bradford will be a more pedestrian and bike friendly city with an outstanding public realm and quality living environment.

6.13 The interventions identified in this report will play their part in delivering the three key transport policies:

- A well connected and adaptable city
- An efficient and legible city
- Creating a walkable and bike friendly city

6.14 However, the City Plan also includes a number of additional transport proposals which have not been included in this assessment of issues and options relating specifically to the City Centre AAP.

6.15 The City Plan supports the redevelopment of Bradford Interchange and Forster Square railway stations, and improvements to pedestrian and cycle links between the stations. Station Masterplan proposals are currently being prepared.

6.16 The City Plan also promotes the delivery of a Variable Message Sign system which will help reduce congestion in the city centre and make the city centre more accessible for car drivers and, alongside this, seeks to deliver a new way-finding strategy for the city centre to improve the legibility of city streets.

6.17 Finally, a review of car parking across the city is required, to consider location of parking, cost and the quality of car parking as the first experience some visitors might have of the city.

7 Recommendations

7.1 In a number of cases, there has been a limit to the level of detailed analysis that could be undertaken as part of this study, and areas for further work have been identified. In some cases, restrictions are linked to the age of the district traffic model, where in other cases work is outside the scope of the current study.

7.2 Aside from recommendations for additional analysis, it is also recommended detailed transport planning (including highways development control) commentary is added to each site allocation's proposal statement, to address site specific impacts upon the highway, pedestrian, cycling and public transport network. This will give developers and landowners sufficient guidance on any potential impact of a development scheme and how best to overcome it.

Better Models

7.3 The SATURN model used as the basis of much of the analysis is getting old. In Appendix B it is acknowledged that there are some significant differences between observed and model flows on City Centre links, with the model generally overestimating flow. In addition, traffic count data made available to the study has been collected in different years. While it has been recognised that model flows are higher than observed when predicting growth in traffic levels to 2030, an upgrade to the model should be considered. Ideally the upgrade should include highways, public transport and mode shift, but it should be possible to upgrade in stages, starting with the highway model.

7.4 Model upgrades can involve significant levels of data collection, such as traffic counts on links and junctions, origin-destination surveys and journey time surveys. While this can be costly and time consuming, progress in the use and understanding of 'big data' to create a pattern of traffic conditions across an defined area should present opportunities for reductions in costs over time.

7.5 There is also merit in further analysis of impacts of growth on individual junctions. Our analysis of key traffic routes through the city centre has highlighted that Shipley Airedale Road will become more congested by 2030, particularly on approaches to the Barkerend Road junction. This is busy junction today, and built up an all sides. A more detailed study of current operation, through new surveys and more detailed modelling, is recommended to establish any scope for increasing capacity through reconfiguration of signal timings or to establish the amount of land required to accommodate future growth in traffic in this part of the network.

7.6 Similarly, an updated model could be used to better understand any impact of wider-District WY+TF schemes on city centre traffic conditions.

Complementary Studies

City Centre car parking

7.7 The City Plan identified the need to devise and deliver a Car Parking Strategy for the city centre. The last major parking study was undertaken in 2007/08. While it is envisaged that the Council's in-house resources would be able to carry out surveys of parking supply and demand, a more detailed study should focus on:

- analysis and presentation of the survey results,
- review of access to car parks – for vehicles and pedestrians,
- parking charges,
- methods of parking control,
- overall quality/condition/safety of car parks, and the impression given to visitors, and
- review of signing/wayfinding.

7.8 The study should consider both off-street and on-street supply. Off-street parking should include council run, private run and private office/business parking. The study would also need to consider loss of parking through sites earmarked for development, and also new parking associated with Broadway Shopping Centre.

7.9 The results of the study should be used to inform future parking policy and the policy should be benchmarked against best practice and other Local Authorities. The results should also be used to inform any changes required to current development control car parking standards.

Legible Bradford

7.10 The City Plan also commits to delivery of a modern pedestrian way-finding strategy.

7.11 The Evidence Baseline identifies that pedestrian and cycling signage within the city centre is of a mixed standard, delivered to serve different needs. For example, the new national cycle route signs are very different to the pedestrian signage found within the Heritage Streets area.

7.12 It is understood that a review of city centre signing and wayfinding is currently in progress.

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Appendices

A Future Demand for Travel

Growth in Demand

A.1 For the City Centre AAP and the Shipley and Canal Road Corridor AAP, City of Bradford MDC published an Issues and Options Report in March 2013 which identified numerous sites for development in each of the areas.

A.2 Although this report is specifically concerned with transport issues for the City Centre AAP, the level of development proposed in the adjacent Shipley and Canal Road Corridor cannot be ignored as it will generate new trips which interact with city centre traffic. As such, this chapter provides details of development in each AAP area.

A.3 There follows a list of those development proposals to which specific quantum of changes in land-use, and associated increase in demand, can be allocated.

- City Centre
  - Various residential development sites
  - Broadway Shopping Centre development
- Shipley and Canal Road Corridor
  - New Bolton Woods development
  - Bolton Woods Quarry (1000 homes)
  - Shipley East residential proposals (100 homes)
  - Dockfield Road Area proposals (400 homes)
  - Mixed use development in Shipley town centre (150 homes)

A.4 Included in the list, are a number of potential sites identified in the SHLAA for residential development in the City Centre. The distribution of these sites across the city, as provided by CBMDC, is shown in Figure A.1.

A.5 By 2030, it is predicted that there will be 4,894 new residential units in the city centre spread over a total of 38 different locations. The number of new units at each site ranges from just 5 to as many as 480. The five largest sites, all delivering in excess of 250 new homes, are:

- CC/022 Midland Mills, Cape Street Trajectory yield = 304 units
- CC/024 Thornton Road Car Park 400 units
- CC/039 Former Yorkshire Water Depot, Leeds Road 400 units
- CC/045 Wharf Street/Canal Road 480 units
- CC/072 Sunbridge Road 400 units

Specific development trips

A.6 To estimate the number of trips associated with this level of new development, TRICS has been used to select residential development sites for a mix of tenures in the Yorkshire region. It is not known what type of residential development is proposed for each zone, so a weighted

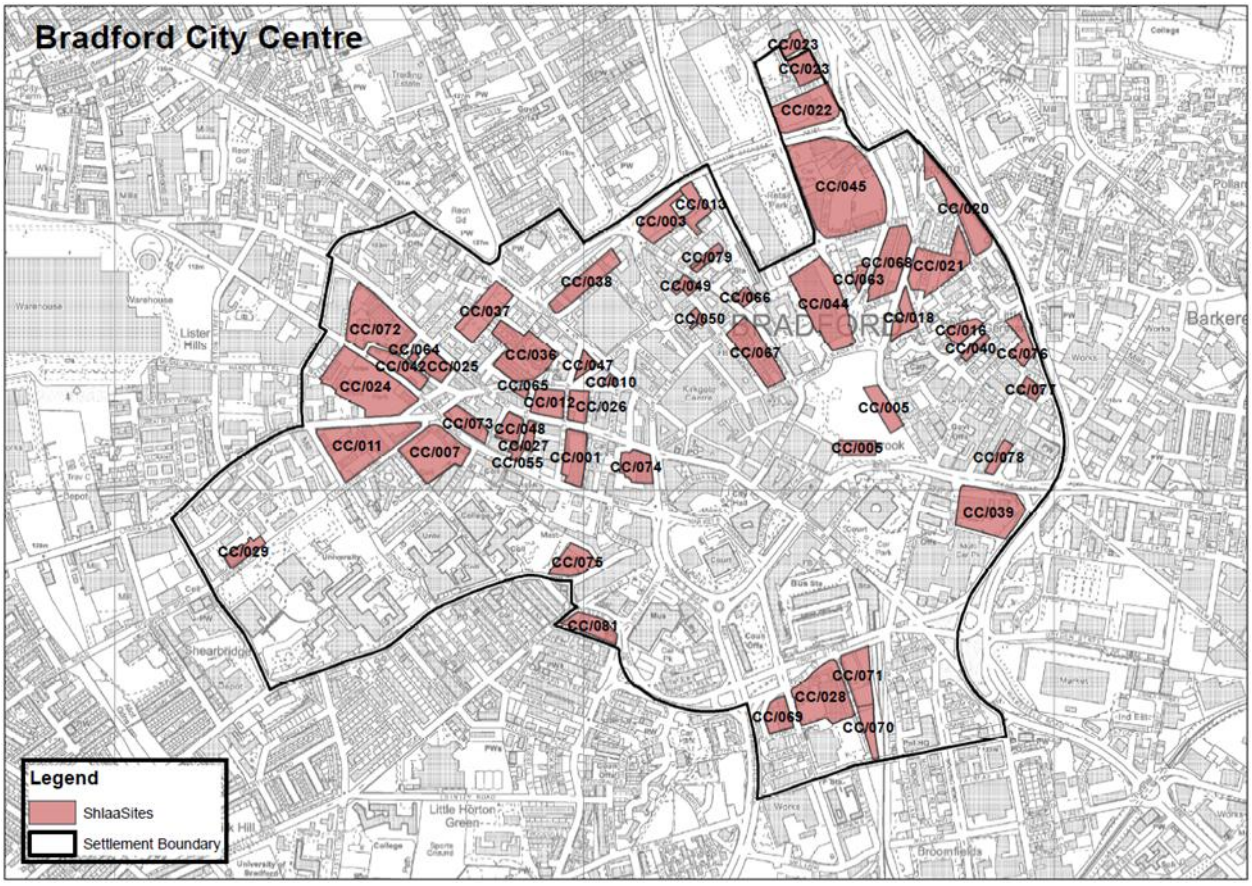
average trip rate has been derived across houses, flats and mixed use sites, both private and for rent. The following table provides the resulting vehicle trip rates, per unit, derived.

Table A.1: Trip rates – residential developments

Trip rates, per unit - residential	IN	OUT
AM peak	0.088	0.217
PM peak	0.189	0.150

A.7 The above trip rates are relatively low for residential developments. However, it is reasonable to expect that car trips to/from the city centre will be low given the level of public transport accessibility, closeness to jobs and services and, it is assumed, limited parking.

Figure A.1: Sites identified for potential residential development in the City Centre



A.8 Application of the trip rates in Table A.1 across all city centre residential sites is expected to generate the following numbers of additional trips. As shown, the greatest impact is expected in the PM peak.

Table A.2: City Centre trips – residential sites

Total trips – city centre residential	IN	OUT
AM peak	432	1061
PM peak	927	735

A.9 Total trips to and from the Broadway Shopping Centre development have been taken directly from the 2011 transport Assessment prepared by WSP[7], and it has been agreed that the distribution of those trips should be based on trips to and from the Forster Square Retail Park.

Table A.3: City Centre trips – Broadway Shopping Centre

Broadway trip generation	IN	OUT
AM peak	160	1
PM peak	94	433

A.10 The main development along the Canal Road corridor is New Bolton Woods, which will deliver 1200 new homes, 3000m2 GFA of new retail, 1500m2 commercial and a new school for 200 pupils. The most recent analysis of the development's impacts on Canal Road is described in Fore Consulting's Aimsun Modelling Report from June 2014[8] and includes the following trip forecasts.

Table A.4: Canal Road trips – New Bolton Woods development

New Bolton Woods Trip Generation	IN	OUT
AM peak	278	519
PM peak	564	397

A.11 The modelling of these trips has assumed the distribution to/from the site described in the same Aimsun modelling report. The same proportions are assumed for each peak and for each direction of travel.

Table A.5: Trip distribution – New Bolton Woods development

Route Section	%
North via Canal Road	25
North and east via Gaisby Lane	10
East via Kings Road	15
South via Canal Road	40
West via Frizinghall Road	10
Total	**100**

A.12 The Aimsun report provides trip rates for the residential elements of the New Bolton Woods development. These have been used to derive forecast of the number of trips to and from the proposed Bolton Woods Quarry site, a longer term proposal for 1000 new homes to the north-east of New Bolton Woods.

Table A.6: Canal Road trips – Bolton Woods Quarry development

Bolton Woods Quarry Trip Generation	IN	OUT
AM peak	158	393
PM peak	372	226

[7] Westfield Shoppingtowns Limited – Broadway, Bradford – Transport Assessment (WSP, July 2011)

[8] New Bolton Woods Development, Aimsun Modelling Report, Version 0.1, Draft (Fore, June 2014)

A.13 Finally, guidance on other development in the Shipley and Canal Road Corridor AAP area has been taken from the Issues And Options Report.

A.14 For Shipley Town Centre, the stated proposals are largely for "increases" in the retail, leisure and business offer. However, 150 new residential units are identified as part of mixed use redevelopments which will be added as specific growth in the town centre.

A.15 At Shipley East, there are proposals for up to 100 new homes to the east of the rail station, with a further 400 homes in the Dockfield Road area to the north east of the town centre. Again, these will be added to the model as specific growth zones.

A.16 The trip rates for those increases in residential development outlined above, are taken from those used in the New Bolton Woods analysis and result in the following increase in demand.

Table A.7: Shipley trips – residential sites

Total trips – Shipley residential	IN	OUT
AM peak	103	255
PM peak	242	147

A.17 Overall, the numbers of trips associated with specific developments in each of the two AAP areas is summarised in Table 3.8.

Table A.8: Total trips – all specific development combined

Total trips – AAP developments	IN	OUT
AM peak	1131	2229
PM peak	2199	1938

A.18 Although these forecasts seemingly represent a significant amount of additional traffic, the forecasts need to be considered alongside general predictions of traffic growth over the period between now and 2030. Where significant growth is concentrated in a relatively small number of sites, there is greater potential for impacts to be mitigated through the planning process and requirements for adequate access arrangements, contributions to public transport provision and the promotion of non-car modes of travel.

Background growth

A.19 It has been agreed that the future year for assessment should be 2030.

A.20 The cap on growth at a district level has been set in accordance with TAG Unit M4 guidance, where NTM growth for Yorkshire and The Humber has been adjusted by local TEMPRO 6.2 growth forecasts to derive the following values.

Table A.9: District level growth – 2014 to 2030

Peak Period	NTM/TEMPRO Growth factor
AM peak	1.350
PM peak	1.350

A.21 Prior to applying the peak hour growth factors to levels of demand in the SATURN model the number of trips associated with specific developments, presented in Table 3.8, must be taken into account and the factors adjusted accordingly.

A.22 When accounting for development trips already added, the growth factor is reduced further to 1.26 in the morning and 1.21 in the evening peak. The revised factors are applied only to those zones not directly impacted by new development.

A.23 In effect, this demonstrates that while growth in the two AAP areas will increase demand for travel in those specific areas, the new trips associated with these proposals fall comfortably within the overall growth expected to be delivered in the district over the assessment period.

Non-car modes

A.24 Background growth and growth associated with specific development sites will impact on public transport demand as well as the number of future car trips on the network.

A.25 In 2013, the following table shows the number of people crossing the cordon by different modes.

Table A.10: City Centre cordon, by mode, 2013

	Pedestrians	Cyclists	Motorcycle	Car	Bus	Train
AM Peak						
City Cordon	2456	202	178	38888	8582	3811
PM Peak						
City Cordon	2039	171	144	37918	9032	4708

A.26 General traffic growth across the district up to 2030 is predicted to be +35% in the AM peak and PM peak. Applying these to current bus and rail demand across the cordon sites gives the following predictions of overall increases in peak hour trips. The morning peak period represents 0700-0930 and the PM peak is 1600-1800.

Table A.11: Predicted increase City Centre bus and train use, 2030

	Peak Period		Peak hour	
	Bus	Train	Bus	Train
AM Peak increase				
City Cordon	3004	1334	1201	534
PM Peak increase				
City Cordon	3161	1648	1581	824

A.27 These forecast present a significant increase in bus and rail passengers by 2030, in both the AM and PM peak hour.

A.28 In addition, these forecasts are based on the assumption that current mode shares will remain unchanged in future years. Of course, if we are successful in reducing car use there will be an uplift in the predictions in over time.

A.29 It is expected that the majority of this growth in city centre public transport use will be linked to specific developments. As shown in Table 3.8, development related growth is predicted to add an additional 3360 AM peak car trips onto Bradford's road network. Taking the latest car

occupancy values of 1.28 people per car observed during the 2014 cordon survey, and assuming that these continue to remain relatively constant over time, it can be calculated that the number of additional people travelling by car is expected to be in the region of 4300. Again, the latest cordon information suggests that car represents 75.2% of all trips with the majority of the remainder by bus or rail. Although a crude methodology, If these mode share proportions are applied to new development trips, we might expect the AAP developments to generate some 1420 new public transport trips in the AM peak hour.

A.30 Similar calculations for the PM peak suggest an increase of 1680 additional public transport trips.

A.31 For these forecasts of additional public transport demand to be realised, investment in new public transport capacity will be required. Mitigation of future demand growth will also play a part in achieving the West Yorkshire Local Transport Plan (LTP3) target of keeping the number of car journeys made each year by West Yorkshire people at current (2011) levels.

Impact of growth

Impact on the roads

A.32 The Bradford SATURN model has been used to assess the impact of growth in demand on the highway network in 2030. Assessment has been undertaken for both the AM and PM peak hour and it has been observed that flows in the base year model are high compared to current traffic levels. This has been acknowledged when applying growth.

A.33 Trips associated with specific developments have been added directly to the appropriate model zone, and growth factors are applied to non-development zones such that total growth in each peak hour period is capped to the rates described earlier.

A.34 In addition, specific infrastructure proposals associated with the Broadway Shopping Centre, New Bolton Woods and Shipley East developments are included in the model network. It was stated earlier that there will be interaction between new traffic generated y new development in both the City Centre and the Shipley and Canal Road Corridor. As the highway impacts of those major developments in the AAP areas cannot be looked at in isolation, neither can the infrastructure proposals to overcome those issues.

A.35 These can be summarised as:

- Broadway Shopping Centre
  - A new signalised junction on Hall Ings to provide access and egress to/from the Broadway car park;
- New Bolton Woods
  - A6037 Canal Road / Stanley Road junction – signalisation and provision of pedestrian crossing facilities, and provision of additional lane on Stanley Road approach and two lanes for through traffic on each of the Canal Road approaches (this is being delivered);
  - A new access to the site via an upgrade of the A6037 Canal Road/Hillam Road junction to provide signal control and a new approach road from the site, with right turn lanes in both directions from Canal Road; and
- Shipley East
  - A6037 Canal Road / A6038 Otley Road junction – additional right turn lane on Canal Road approach to provide double right turn to Otley Road.

A.36 A more detailed description of the use of the SATURN model is provided in Appendix B.

A.37 Assigning updated 2030 demand to the existing network, updated to reflect specific infrastructure improvements associated with Broadway, New Bolton Woods and Shipley East, results in increased demand on most routes within the City Centre AAP and Shipley and Canal Road Corridor AAP areas.

A.38 This initial assignment of future year demands identified a number of locations where significant queues/delays would arise if growth was permitted without mitigation. In the most extreme cases definite proposals can be identified, as described below, and these have been included in all future modelling. In other cases, major land take would be required to increase physical capacity at junctions and, apart from optimisation of signal timings where applicable, no solutions are proposed at this stage. A discussion of base mitigation required to accommodate growth is provided below.

- Canal Road – increases in flows along the Canal Road Corridor creates additional pressure on the Canal Road/Hillam Road junction as proposed as part of the New Bolton Woods development. Given the widening already being delivered on approach to the Stanley Road junction, the most appropriate solution is to dual Canal Road between the Stanley Road and Hillam Road junctions, rather than introduce further isolated widening at the Hillam Road junction alone.
- The Queen's Road/Manningham Lane and Shipley-Airedale Road/Bolton Road junctions would both benefit from an optimisation of signal timings, without the need for any physical reconfiguration, in the evening peak in future years.

A.39 Increased demand for the Shipley-Airedale Road/Barkerend Road and Godwin Street/ Thornton Road junctions is also identified, but no obvious improvements can be identified without the need for significant land-take and demolition. In the case of the Thornton Road junction, this helps make the case for the City Ring Road Extension proposals outlined later in this report.

A.40 It is recommended that further monitoring and analysis of the performance of each of these junctions is carried out as development starts to be delivered over the coming years.

A.41 The following figures show differences in flow in the City Centre AAP area between the Base Year and the 2030 Forecast Year for the AM and PM peak hour periods respectively.

A.42 For each time period, the model predicts that additional demand will be generally spread across the City Centre network. There are some parts of the model, such as around Sunbridge Road to the west of the city and around Little Germany and the Shipley Airedale Road / Barkerend Road junction, where the model starts to become unstable and predicts changes in routes between model scenarios, in some cases suggesting reductions in flow.

Figure A.2: Difference in flow – 2030Forecast year minus Base Year – AM peak hour

Figure A.3: Differences in flow – 2030 Forecast Yea minus Base Year – PM peak hour

A.43 Table A.12 provides a summary of changes in AM and PM peak hour flow on selected key routes within the two AAP areas and, in the case of Manningham Lane, competing routes.

Table A.12: Impact of growth on key routes

Key Routes	AM Peak flow (2-way)			PM peak flow (2-way)		
	Base	2030	Diff.	Base	2030	Diff.
City Centre						
Hall Ings, west of Bridge Street	1650	1880	230	1440	1920	480
Leeds Road, west of Shipley Airedale Road	1060	1740	680	1780	2510	730
Godwin Street, south of Thornton Road	3720	4460	740	3820	3880	60
Croft Street	3240	3930	690	2880	2990	110
Shipley Airedale Road, north of Barkerend Road	5010	5010	0	5110	5260	150
Hamm Strasse	2150	2320	170	2230	2460	230
Westgate	1910	2530	620	1970	2630	660
Thornton Road	1460	1810	350	1450	1570	120
Sunbridge Road	560	320	-240	490	600	110
Shipley and Canal Road Corridor						
Canal Road, south of Queen's Road	4150	4900	750	4500	4840	340
Valley Road, south of Queen's Road	340	270	-70	280	370	90
Manningham Lane south of Queen's Road	1600	1930	330	1830	2030	200
Canal Road, north of Queen's Road	2700	3200	500	3150	3340	190
Keighley Road, north of Queen's Road	2290	2750	460	2450	2740	290
Otley Road, Keighley Road-Valley Road	1500	1830	330	1520	1740	220
Bingley Road, north of Otley Road	1930	2230	300	2030	2600	570
Saltaire Road, Shipley	1720	1850	130	1890	1970	80
Briggate, Shipley	1990	2220	230	2230	2620	390

A.44 The following figures show those parts of the network where the model predicts changes in delay. The figures suggest some increases in delay in the wider district, away from the two AAP areas under consideration. It is likely that these result from the application of growth in demand across the wider area. For this study, these impacts are noted but there has been no further analysis of the reasons for these delays.

A.45 In the City Centre, there are generally increases in delay across much of the network but the most significant impacts are around the Barkerend Road and Harris Street area, immediately adjacent to Shipley Airedale Road. It has already been recommended that further monitoring and analysis of the performance of the Barkerend Road junction is carried out as development starts to be delivered over the coming years. Delays are also shown at junctions along the border of the Market and Learning Quarter neighbourhoods, where a number of city centre residential sites are located, and it must be ensured that appropriate mitigation is conditioned as part of the planning approval process.

A.46 In summary, the modelling indicates that the City Centre network is likely to be able to accommodate the level of development proposed in both AAPs, although there will be impacts on certain junctions which will require future interventions or mitigation.

Figure A.3: Difference in delay (secs) – 2030 Forecast Year minus Base Year – AM peak hour

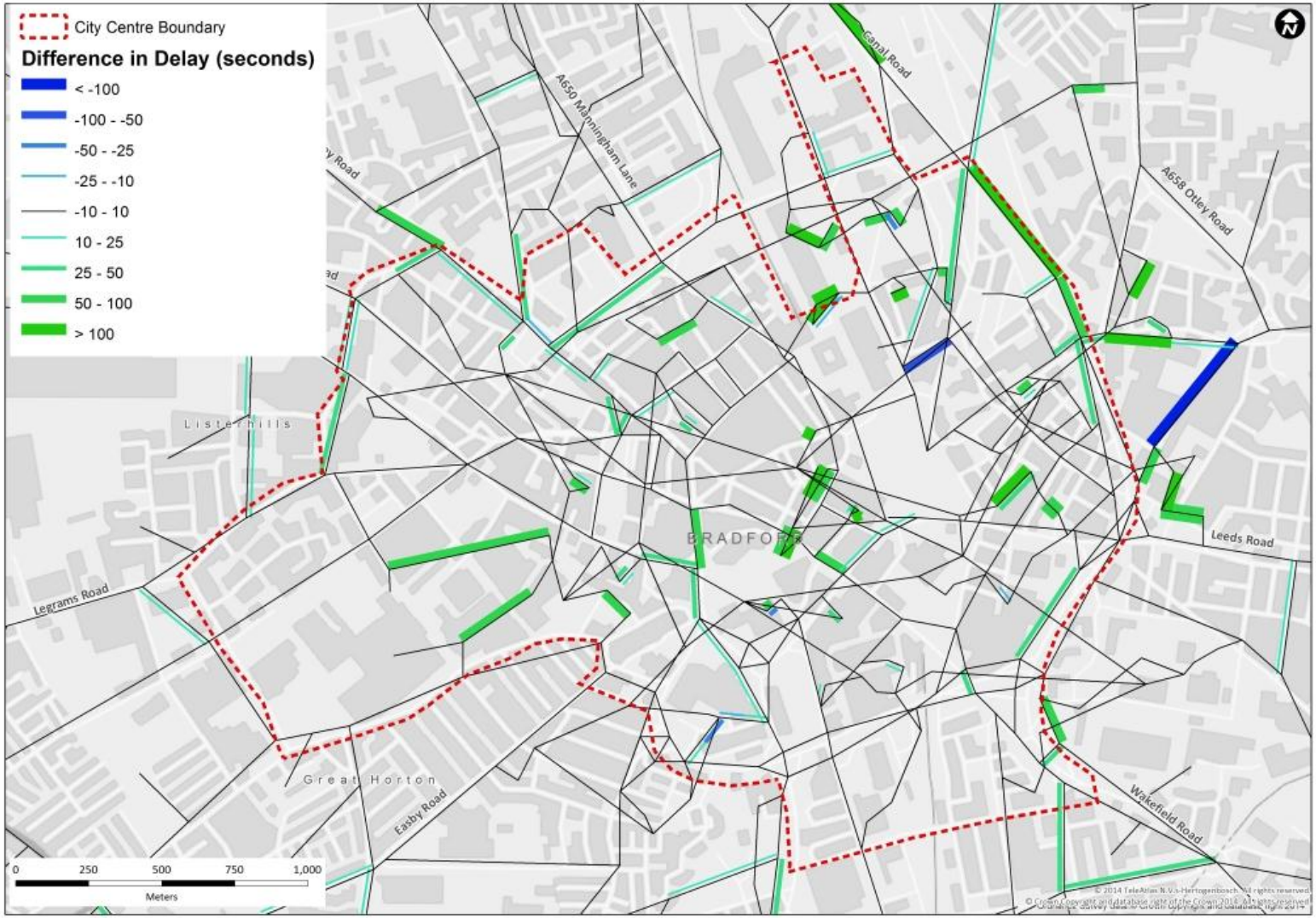
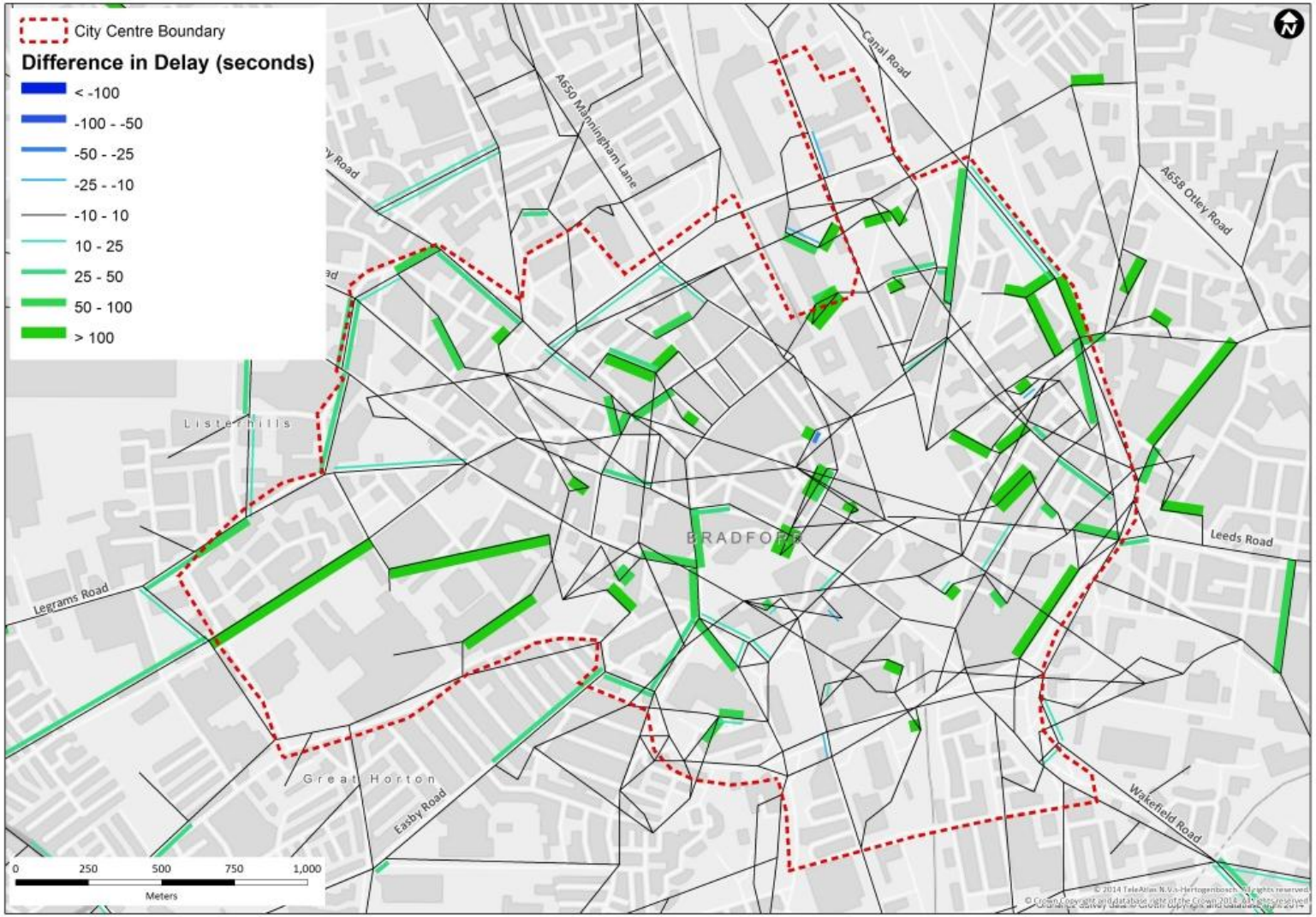


Figure A.4: Difference in delay (secs) – 2030 Forecast Year minus Base Year – PM peak hour



Impact on public transport and walking/cycling networks

A.47 Earlier in this chapter we provide broad estimates of future public transport demand and conclude that investment in public transport capacity will be required for these forecasts to be realised. There is every reason to also assume that AAP development sites will generate additional walking and cycle trips too.

A.48 This, of course, relies on the mode shares in Bradford remaining at current levels. Analysis contained in the Baseline Evidence Report describes how the percentage of peak hour movements by bus has remained within 15-20% since 2000, although there was evidence that the bus share in the morning peak has 'caught up' with other time periods in the latest 2014 data. If mode share bus remains constant to 2030, and up to 20% of new development trips by bus can be achieved, this would result in some 1150 additional bus trips in the morning peak and 1470 in the PM peak. Taking the higher of the two forecasts in the PM peak, and assuming an average number of peak hour passengers per bus of 50, this could be interpreted as requiring close to 30 additional peak hour buses on the network by 2030.

A.49 The share by rail has increased by approximately 2.5%, to around 7%, in the 14 years up to 2014. If a further 2.5% can be achieved in the 16 years to 2030, the rail share could be as high as 9.5%.

A.50 The numbers of cyclists observed crossing the City Centre cordon has also grown, particularly since an early decline in numbers was addressed in around 2006. If the same level of growth can be maintained to 2030, we would see an additional 200 cyclists entering/leaving the City Centre in either peak, increasing demand for new cycle routes and cycle parking.

A.51 The provision of extra peak hour buses and improved cycle connections to and from the City Centre should be funded by developer contributions. Opportunity may have been lost for those sites with existing planning consents, but it is recommended that Section 106 contributions are secured from new sites, or those currently in the planning process, to support the delivery of initiatives required to promote the continued growth in non-car modes of transport.

Summary of key issues relating to increased demand for travel

- Movements into and out of the City from the north will become restricted without additional capacity provided on Canal Road, particularly between Stanley Road and Hillam Road.
- A number of key junction should be further investigated to identify potential re-configuration, to accommodate increased traffic.
  - Shipley Airedale Road / Bolton Road
  - Shipley Airedale Road / Barkerend Road
  - Queen's Road / Manningham Lane
  - Thornton Road / Godwin Street
- There is a need for additional peak hour bus capacity to maintain a level of 20% of all trips into and out of the City Centre to be made by bus.
- There is a need for improved cycle connections to and from the City Centre, to encourage cycle use and to maintain growth in numbers of cyclists in the City Centre.

B Use of the SATURN Model

The Base Model

B.1 The Base Model provided by CBMDC for use in this study represents AM (08:00-09:00) and PM (17:00-1800) conditions in 2013. Although the model is set up to represent 3 user classes (UC), the third class is blank. Effectively the model includes cars and vans as UC1 and heavy goods vehicles as UC2.

Time period	AM Peak	PM Peak
Matrix Filename	BW_A_2013_DN.ufm	BW_P_2013_DN.ufm
UC1 trips	96253.7	121313.7
UC2 trips	33113.1	42502.5
UC3 trips	0	0
Total Base Demand	129366.8	163816.2

B.2 The following table presents summary statistics from the Base Model.

Time period	AM Peak	PM Peak
Total Travel Time (pcu hrs)	39,467	50,702
Ave time per trip (hrs)	0.31	0.31
Total Travel Distance (pcu kms)	1,727,237	2,244,650
Ave distance per trip (kms)	13.35	13.70
Average Speed (kph)	43.8	44.3

Base Model Validation

B.3 Although total time and distance on the network is greater in the PM peak than the AM peak, this is totally a result of the greater overall matrix demand; average values per trip are essentially the same in each time period. The average journey time is 0.3 hours (18 minutes) and the average distance is between 13 and 14 km.

B.4 In addition to the model, CBMDC provided a collection of traffic counts over a period between 2010 and 2013.

B.5 The following table provides a summary comparison of model flows against observed data for parts of the network in both the City Centre and along the Canal Rd corridor.

B.6 As shown, there are some significant differences between observed and model flows on City Centre links, with the model generally overestimating flow even accounting for differences in the year of each count.

B.7 Along the Canal Road corridor, a much closer match is achieved.

City Centre

			A-node	B-node	AM Obs	AM Mod	Abs	%	geh	PM Obs	PM Mod	Abs	%	geh
Bolton Lane	Sep-10	EB	1789	7106	141	16	-125	-89%	14.11	332	19	-313	-94%	23.63
		WB	7106	1789	82	2	-80	-98%	12.34	32	6	-26	-81%	5.96
Skipton Rd slip	Apr-11	NB	1759	1789	202	94	-108	-53%	8.88	122	75	-47	-39%	4.74
		SB	1789	1759	75	1	-74	-99%	12.00	89	7	-82	-92%	11.84
Canal Rd, s of A6177	Apr-12	NB	1737	1759	1309	1751	442	34%	11.30	1150	1988	838	73%	21.16
		SB	1759	1737	1208	1061	-147	-12%	4.36	1050	1057	7	1%	0.22
Canal Rd, s of King's l	Oct-13	NB	2296	1741	1591	1832	241	15%	5.83	1483	2652	1169	79%	25.71
		SB	1741	2296	1820	2233	413	23%	9.17	1471	1794	323	22%	7.99
Canal Rd, s of Valley l	May-12	NB	2295	2296	1536	1778	242	16%	5.95	1751	2108	357	20%	8.13
		SB	2296	2290	1844	1634	-210	-11%	5.04	1531	1871	340	22%	8.24
Hamm Strasse	Nov-13	EB	2034	2031	656	405	-251	-38%	10.90	939	286	-653	-70%	26.39
		WB	2031	2034	785	698	-87	-11%	3.19	852	308	-544	-64%	22.59
Shipley Airedale	Mar-12	NB	2292	2294	1939	2268	329	17%	7.17	2312	2602	290	13%	5.85
		SB	2294	2292	2355	2394	39	2%	0.80	1835	2284	449	24%	9.89
Shipley Airedale	May-13	NB	2276	2281	2492	2280	-212	-9%	4.34	2343	1853	-490	-21%	10.70
		SB	2281	2280	2411	2655	244	10%	4.85	2351	2346	-5	0%	0.10
Wakefield Rd	Nov-13	NB	7150	1607	2018	2000	-18	-1%	0.40	1534	1922	388	25%	9.33
		SB	1607	7150	1356	1631	275	20%	7.12	1795	1773	-22	-1%	0.52
Godwin St	Nov-13	NB	2044	2060	992	978	-14	-1%	0.45	1011	978	-33	-3%	1.05
		SB	2060	2044	1005	1373	368	37%	10.67	1073	1407	334	31%	9.48
Hall Ings	Sep-10	EB	1989	1969	670	1032	362	54%	12.41	595	943	348	58%	12.55
		WB	1969	1987	527	416	-111	-21%	5.11	576	683	107	19%	4.26
Croft St wb only	Nov-13	WB	2273	1985	1466	1316	-150	-10%	4.02	1498	1812	314	21%	7.72

Canal Road Corridor

Keighley Rd	Oct-11	NB	2166	4271	699	761	62	9%	2.29	927	913	-14	-2%	0.46
		SB	4271	2166	1072	1011	-61	-6%	1.89	864	708	-156	-18%	5.56
Bradford Rd	2013	NB	2167	2238	1005	913	-92	-9%	2.97	740	917	177	24%	6.15
		SB	2238	2167	341	1089	748	219%	27.97	628	796	168	27%	6.30
Valley Rd	2013	NB	1774	1775	951	1113	162	17%	5.04	1081	1482	401	37%	11.20
		SB	1775	1774	821	868	47	6%	1.62	961	1111	150	16%	4.66
Otley Rd	Jun-10	EB	2239	7380	511	607	96	19%	4.06	666	656	-10	-2%	0.39
		WB	7380	2239	675	947	272	40%	9.55	676	859	183	27%	6.61
Brigate	Sep-08	EB	1794	7624	879	949	70	8%	2.32	970	1075	105	11%	3.28
		WB	7624	1794	958	1041	83	9%	2.63	1081	1140	59	5%	1.77
Bingley Rd	May-10	EB	2173	7780	1361	1196	-165	-12%	4.61	1240	1155	-85	-7%	2.46
		WB	7780	2173	1137	1179	42	4%	1.23	1323	1636	313	24%	8.14

B.8 It has been agreed that the purpose of this study is not to revalidate the base model, but to understand any weaknesses and to recognise those weaknesses in future analyses.

B.9 In the morning peak, it has been calculated that model flows are approximately 5% greater than observed 2013 data, and this 'head start' is reflected when applying future growth to the base matrices. The corresponding figure in the PM peak is 8%.

Little Germany

B.10 The only update to the Base Model has been to better reflect network conditions in Little Germany (undertaken in respect of a separate query by Members with regards to flows in this part of the City).

B.11 The original Base Model network did not include the Vicar Lane connection between Leeds Road, Peckover Street (via Burnett Street) and Barkerend Road. This has now been included in the Base Model, as has the extension of Upper Park Gate to connect to Barkerend Road. Slightly further north, the Holdsworth Street connection between Canal Road and Bolton Road has also been added.

B.12 Although the changes made to the network obviously impact on traffic routeing through the Little Germany area, through the inclusion of additional model links, as shown below the impact on summary statistics across the network is negligible.

Time period	AM Peak	PM Peak
Total Travel Time (pcu hrs)	39,412	50,639
Ave time per trip (hrs)	0.30	0.31
Total Travel Distance (pcu kms)	1,727,741	2,245,114
Ave distance per trip (kms)	13.36	13.71
Average Speed (kph)	43.8	44.3

Future Year – Demand

B.13 During the course of the study it has been agreed to model a future year representing 2030 conditions.

B.14 For each of the future year development proposals described in Section 2, trips are added to the demand matrices according to the following summary table.

Development Proposal	AM in	AM out	PM in	PM out
City Centre – residential	432	1061	927	735
City Centre – Broadway Shopping Centre	160	1	94	433
Corridor - New Bolton Woods	278	519	564	397
Corridor – Bolton Woods Quarry	158	393	372	226
Corridor – Shipley	103	255	242	147
TOTAL	**1131**	**2229**	**2199**	**1938**

B.15 By 2030, it is predicted that there will be 4,894 new residential units in the City Centre. For each site, the corresponding SATURN model zone is identified, and the relevant number of trips added to/from that zone.

B.16 The City Centre zones to which development trips are added are:

5, 7, 12, 14-22, 27-29, 39, 41, 42, 422 and 423

B.17 For all but one site, the distribution of new trips is assumed to according to the relevant existing zone to which the development is added. The large site on Sunbridge Road (CC/072, 400 dwellings) has been added to the model as a new zone (zone 431), on the basis that none of the existing zones adequately addressed the likely connection from that site onto the road network. The distribution of trips to that new zone is copied from an adjacent zone.

B.18 The only commercial site to be considered in this analysis is the Broadway Shopping Centre development and total peak hour trip forecasts are taken from the 2011 Transport Assessment report prepared by WSP. Trips are added as a new zone 432.

B.19 The TA report does not provide adequate information relating to the distribution of those trips and, as such, model distributions are taken from the Forster Square Retail Park zones. These zones provide a fairly wide spread of origins and destinations, including a proportion external to city, similar to what we might expect for Broadway. The Kirkgate Centre and other city

centre retail zones were also considered, but in each case the modelled distribution was more localised.

B.20 In the Shipley and Canal Road Corridor the New Bolton Woods development will be added to the SATURN model as a new zone (433).

B.21 Distribution of trips to/from the New Bolton Woods site has been taken from previous studies and are summarised in the table below. The same proportions are assumed for each peak and for each direction of travel, and these distributions are added to the SATURN model based on select link analyses on the relevant route section.

Route Section	%
North via Canal Road	25
North and east via Gaisby Lane	10
East via Kings Road	15
South via Canal Road	40
West via Frizinghall Road	10
Total	**100**

B.22 New demand associated with the Bolton Woods Quarry deposit are also added as a new zone number 435. The distribution of those trips follows the pattern of trips to/from existing zone 101, representing established residential areas to the south of Wrose Road.

B.23 For Shipley Town Centre, the stated proposals are largely for “increases” in the retail, leisure and business offer. However, 150 new residential units are identified as part of mixed use redevelopments which are added to zone 173 as specific growth in the town centre.

B.24 At Shipley East, there are proposals for up to 100 new homes to the east of the rail station, with a further 400 homes in the Dockfield Road area to the north east of the town centre. Shipley East is added as new zone 434 and development at Dockfield Road is split equally between existing zones 220 and 419.

Future Year – Growth

B.25 In addition to new trips associated with the major developments outlined above, there will be also be more general background growth in traffic across the district.

B.26 TEMPRO Dataset 62 has been used to derive local production-attraction growth factors for car drivers in Bradford. In accordance with TAG Unit M4 guidance, these local factors are used to adjust NTM Regional Forecasts to derive factors for use in the 2030 modelling. The TAG formula is:

Local Growth = NTM Region * (peak local / average day region)

B.27 The following table presents the various factors used and the resulting growth forecasts between 2014 and 2030 of 1.350 for each of the morning and evening peaks.

	AM Peak			PM Peak			Average Weekday		
	Prod	Att	Ave.	Prod	Att	Ave.	Prod	Att	Ave.
TEMPRO-Bradford	1.213	1.189	1.201	1.211	1.192	1.201	-	-	-
TEMPRO - Y&H	-	-	-	-	-	-	1.156	1.156	1.156
NTM – Y&H					1.300				
Growth Factor		1.350			1.350			-	

B.28 Before applying background growth, consideration must be given both to discrepancies between model flows and observed count data, and trips already added for major development proposals. In effect, the above factors represent a cap on growth in the district between 2014 and 2030.

B.29 Model flows are calculated to be 5% and 8% higher than observed in the morning and evening peak respectively. This has the effect of reducing the growth cap from 1.350 to 1.288 in the morning peak and 1.244 in the evening peak.

B.30 When accounting for development trips already added, the growth factor is reduced further to 1.26 in the morning and 1.21 in the evening. These factors are applied only to those zones to which specific new development related trips have not been allocated.

Future Year – Network

B.31 Inclusion of the Broadway Centre, and its associated access, requires the addition of a new signalised junction to be added to the model to reflect access to the centre car park off Hall Ings.

B.32 There are two committed highway schemes in the Shipley & Canal Road Corridor which are included in the future year network.

- A6037 Canal Road / Stanley Road junction – signalisation and provision of pedestrian crossing facilities, and provision of additional lane on Stanley Road approach and two lanes for through traffic on each of the Canal Road approaches
- A6037 Canal Road / A6038 Otley Road junction – additional right turn lane on Canal Road approach to provide double right turn to Otley Road

B.33 The New Bolton Woods development is added to the SATURN model as a new zone connecting to Stanley Road, Gaisby Lane, Kings Road and a new junction opposite Hillam Road.

B.34 Junctions to be improved as part of the proposals, and to be reflected in the future year model, are described in the Fore report as:

- A6037 Canal Road / Gaisby Lane
- A6037 Canal Road / Hillam Road
- A6037 Canal Road / Bolton Lane

B.35 The Bolton Woods Quarry site has been connected to the network at Gaisby Lane, Wrose Road and King's Road.

B.36 Development in Shipley Town Centre and at Dockfield Road is added to existing zones and no additions to the network are required. At Shipley East, trips are assumed to assign along Crag Road.

Future Year – Assignment

B.37 An initial assignment of the resulting future year model identified a number of 'hot spots' where improved highway infrastructure is considered critical to support growth in demand across the City Centre and Shipley & Canal Road Corridor network.

- Canal Road – dualling between the Stanley Road and Hillam Road junctions
- Leeds Road/Crag Road junction – without mitigation, significant increases in queues and delay are proposed at this junction. An option should be found to reconfigure the layout and increase capacity at this junction, perhaps involving land-take at the west side of Crag Road.
- The Queens's Road/Manningham Lane junction and Shipley-Airedale Road/ Bolton Road junction both benefit from signal optimisation, without the need for any reconfiguration, in the PM peak.

B.38 Increased demand for the Shipley-Airedale Road/Barkerend Road and Godwin Street/Thornton Road junctions is also identified, but no obvious improvements can be identified without the need for significant land-take and demolition. In the case of the Thornton Road junction, this helps make the case for the City Ring Road Extension proposals outlined below.

B.39 The impact of future growth, and mitigation proposals, results in average speeds across the network reducing from 44kph to 40kph. The average time per trip increases slightly from around 18 minutes to 20 minutes, despite the average trip length reducing slightly across all trips.

Time period/Year	AM Peak		PM Peak	
	Base	2030	Base	2030
Total Travel Time (pcu hrs)	39,412	54,103	50,639	67,015
Ave time per trip (hrs)	0.30	0.33	0.31	0.33
Total Travel Distance (pcu kms)	1,727,741	2,152,063	2,245,114	2,687,899
Ave distance per trip (kms)	13.36	13.12	13.71	13.36
Average Speed (kph)	43.8	39.8	44.3	40.1

C Test of Interventions

C.1 A small number of highway options have been tested – as described in Chapter 5 of the main report – summarised as:

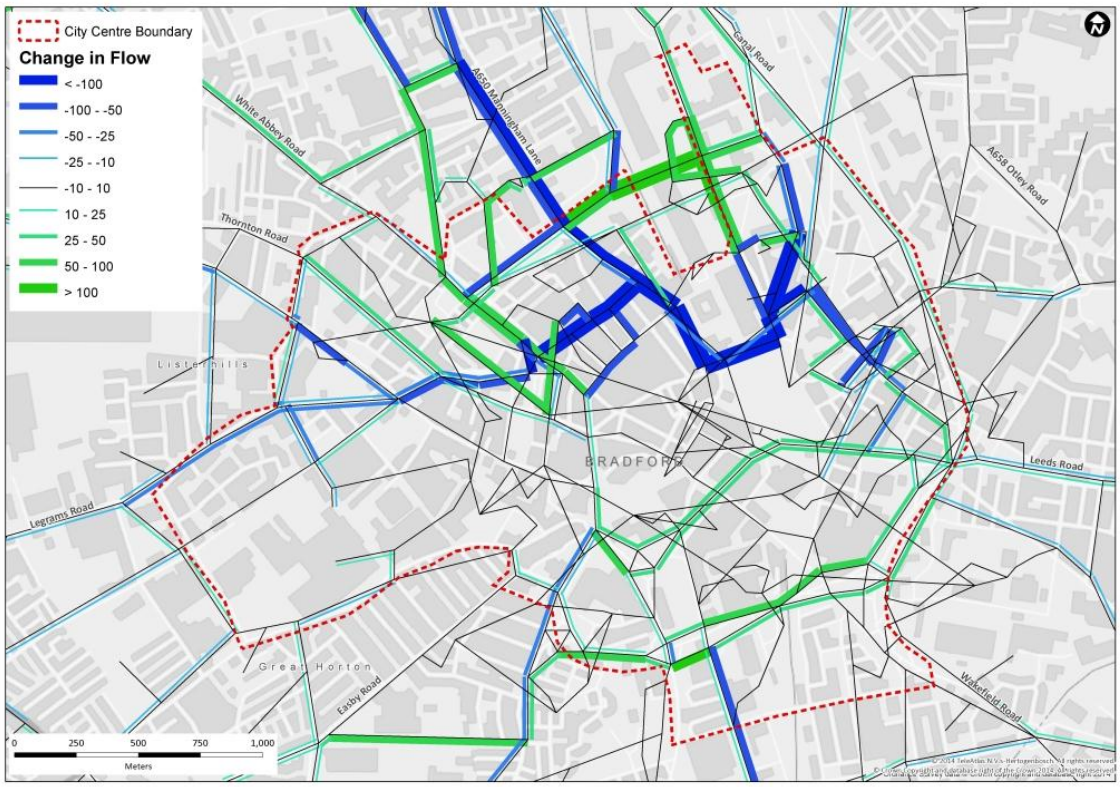
- Option 1 – Lower Kirkgate Restrictions
- Option 2 – Hall Ings/Leeds Road Constraints
- Option 3 – City Ring Road Extension
- Option 4 – John Street Bus Gate
- All Combined

C.2 The implications for each future year option test, for each time period, is outlined below.

Test 1 – Lower Kirkgate Restrictions

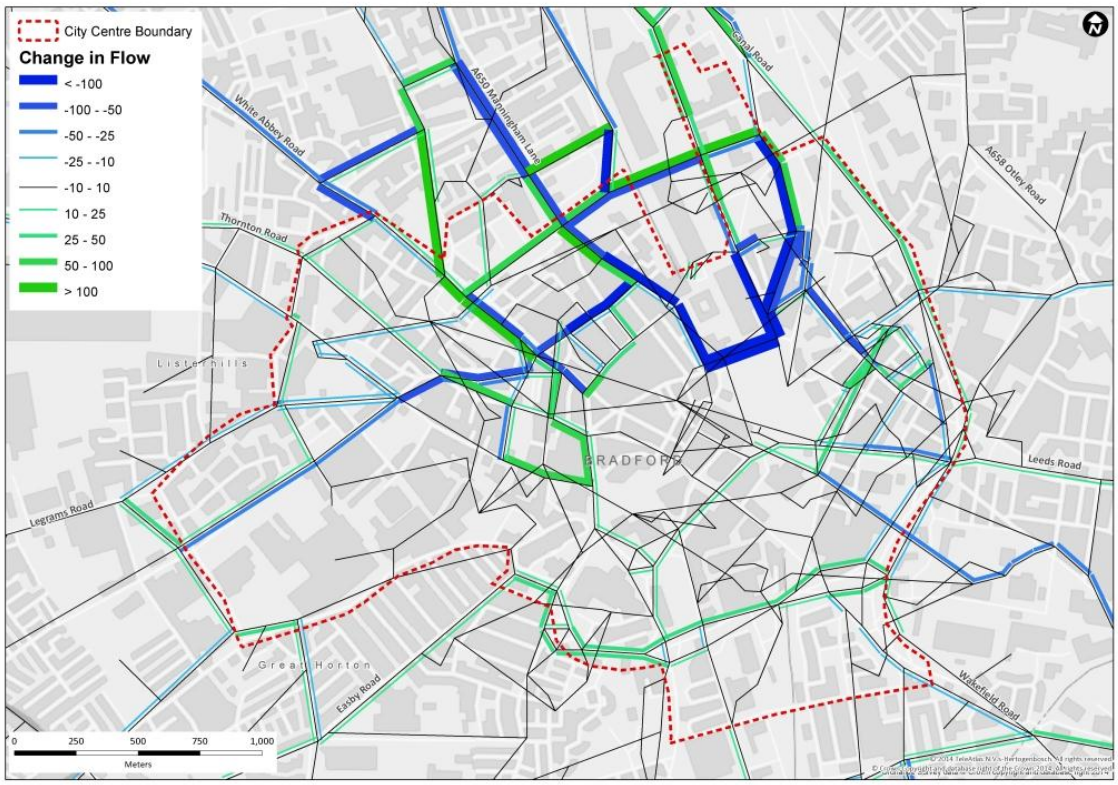
AM Peak

- Main impacts restricted to City Centre
- Obvious reduction on traffic, both directions, on Lower Kirkgate (>300) and Cheapside(~300); also restrictions through John Street (Ref: Test 5)
- Main switch is north to Hamm Strasse (>100 each way) with switch to south more evenly spread between Leeds Road and Croft Street.
- Restricted access to Cheapside/Manor Row has knock on impact of reductions along Manningham Lane – northbound direct switch to Lumb Lane, southbound split between Lumb Lane and Valley Road.
- Minor impact on delays and queues – some adverse impact on westbound Drewton Road approach to Westgate.



PM Peak

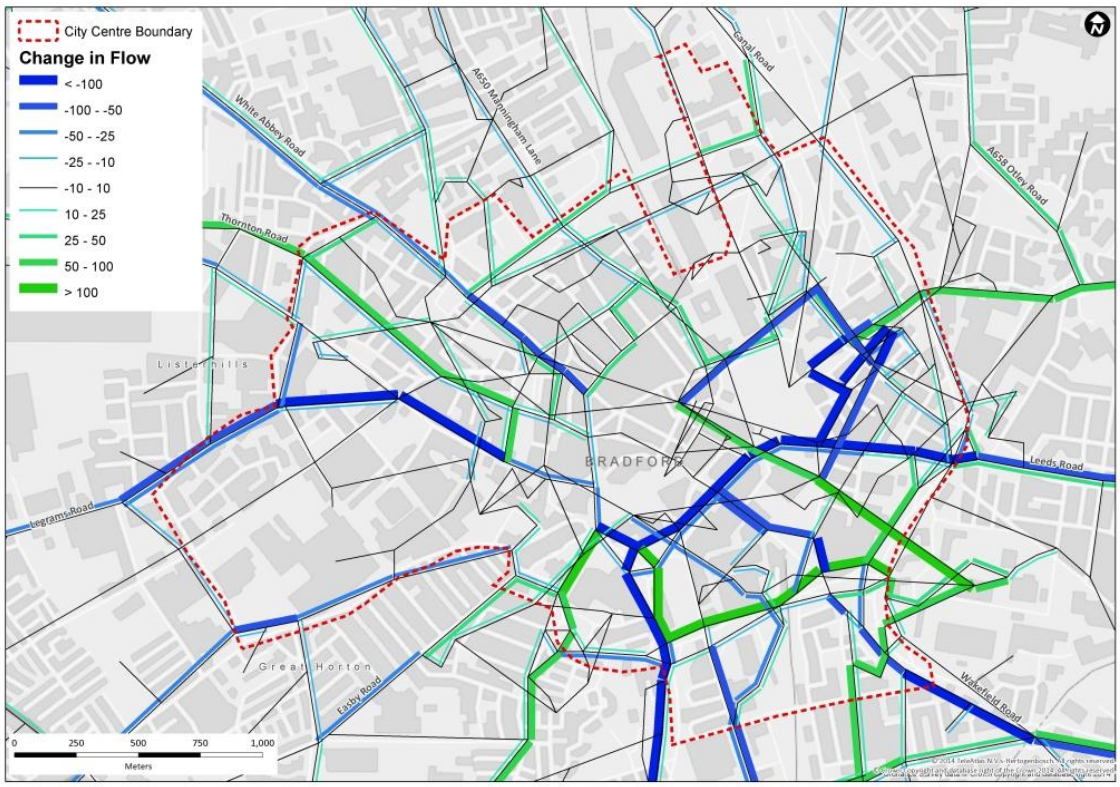
- Similar picture to AM peak – impacts mainly restricted to City Centre but relatively small (1 per minute) southbound increase on Valley Road. Potential concern over capacity for access to Hamm Strasse from the west, with unexpected use of Trafalgar Street/Midland Road shown in model output. Again, we see increase in demand for southern part of Lumb Lane.
- Issue at Hamm Strasse/Manningham Lane junction supported by increase in delay and queues outbound from the City.



Test 2 – Hall Ings/Leeds Road Constraints

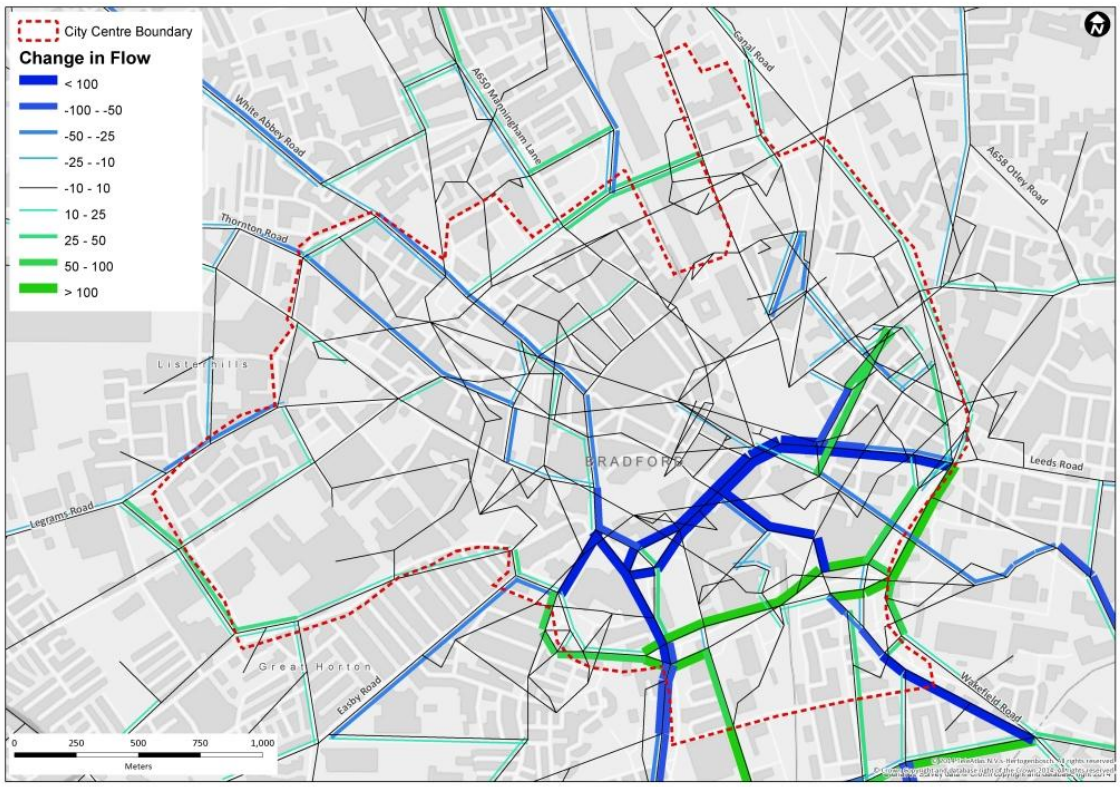
AM Peak

- Impacts constrained to City Centre network.
- Significant reduction (>500) can be achieved eastbound along Hall Ings/Leeds Road and through Little Germany, with main switch to the south along Croft Street (+300). Potential for some eastbound trips to divert further south to Mill Lane, mainly for those heading out of the City along Bowling Back Lane.
- Elsewhere, little impact – eastbound transfer from Thornton Road to Sunbridge Road more likely to be a 'general modelling issue' than a direct consequence of Test2.
- Transfer to Croft Street does result in modest increase in queues (~20) northbound on Shipley-Airedale Road towards Leeds Road junction



PM Peak

- More equal spread in reductions on Hall Ings between each direction. Again, transfer is predominantly to Croft Street for eastbound movements, but Mill Lane for westbound.
- Modest switch in outbound flow to south-west from Morley Street to Trinity Road also forecast.
- Although reduction in flow generally on eastbound approach to Jacob's Well roundabout, there is an increase in traffic heading towards Croft Street rather than Hall Ings. This results in a change in lane use on this approach and gives small increases in queues and delay.



Test 3 – City Ring Road Extension

AM Peak

C.3 Not surprisingly, this has the greatest impact of all the tests, to the extent that changes in flow occur both in the City and along Canal Road.

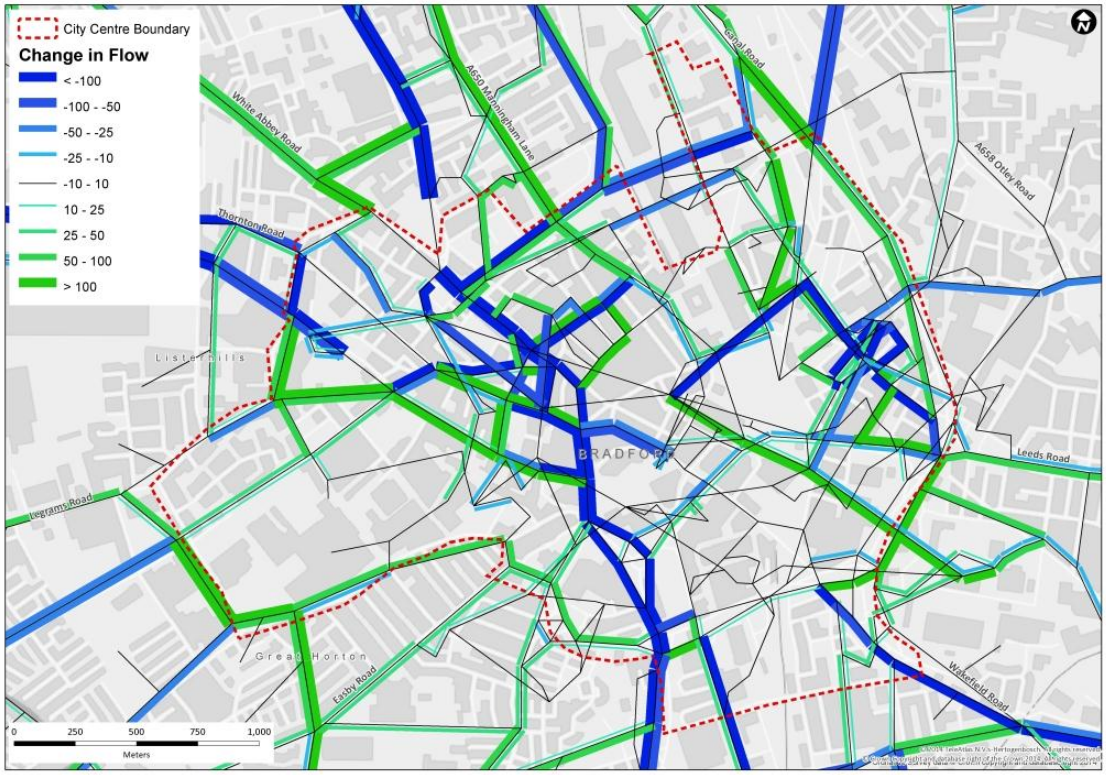
C.4 The majority of impacts are clearly going to be felt westbound along Thornton Road and eastbound along Sunbridge Road through formation of the new gyratory system, with intended reductions in traffic predicted in both directions along Westgate. We also see significant reduction in demand along Godwin Street, between Thornton Road and Drewton Road.

C.5 While there will be benefits to pedestrians, and pedestrian safety, through the reduction of traffic on Westgate and Godwin Street, this will need to weighed against increases in traffic along Thornton Road, one of key areas of concern for air quality in the city.

C.6 Knock on impacts are seen on routes around the new Ring Road extension. Traffic to and from the western side of the city is reduced from the south, along Prince's Way and Manchester Road. Trips no longer passing *through* this part of the city are pushed mainly west, away from the city along Shearbridge Road, Whetley Lane and further west to Cemetery Road. Some traffic also crosses the city to the east, partly along Shipley-Airedale Road but also through Little Germany, and we predict significant increases in flow into the City along Manningham Lane (~300) and Midland Road (~100), with corresponding reductions along Lumb Lane.

C.7 The change in road use allocations are leading to forecasts of increased delay at the Godwin Street/Sunbridge Road junction, and small modest (+16) increases in queues. We also see

increases in delay at junctions further to the north-west of the City, along Thornton Road, at junctions with Jowett Street and Listerhills that might warrant further investigation.

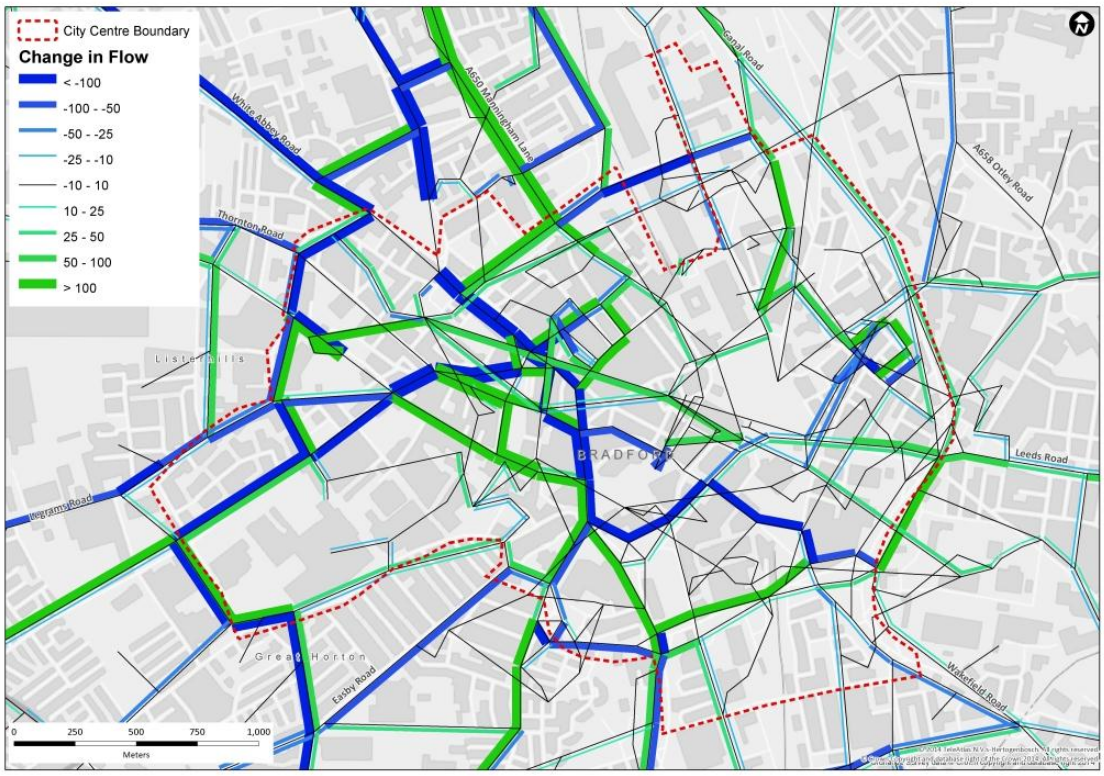


PM Peak

C.8 Impacts on Thornton Road, Sunbridge Road and Westgate are, as expected, repeated in the PM peak. However, the wider impacts are slightly different.

C.9 We still see increases along Mannigham Lane and reductions along Lumb Lane, but the impacts of redistributed through trips to the west and east of the City are less apparent.

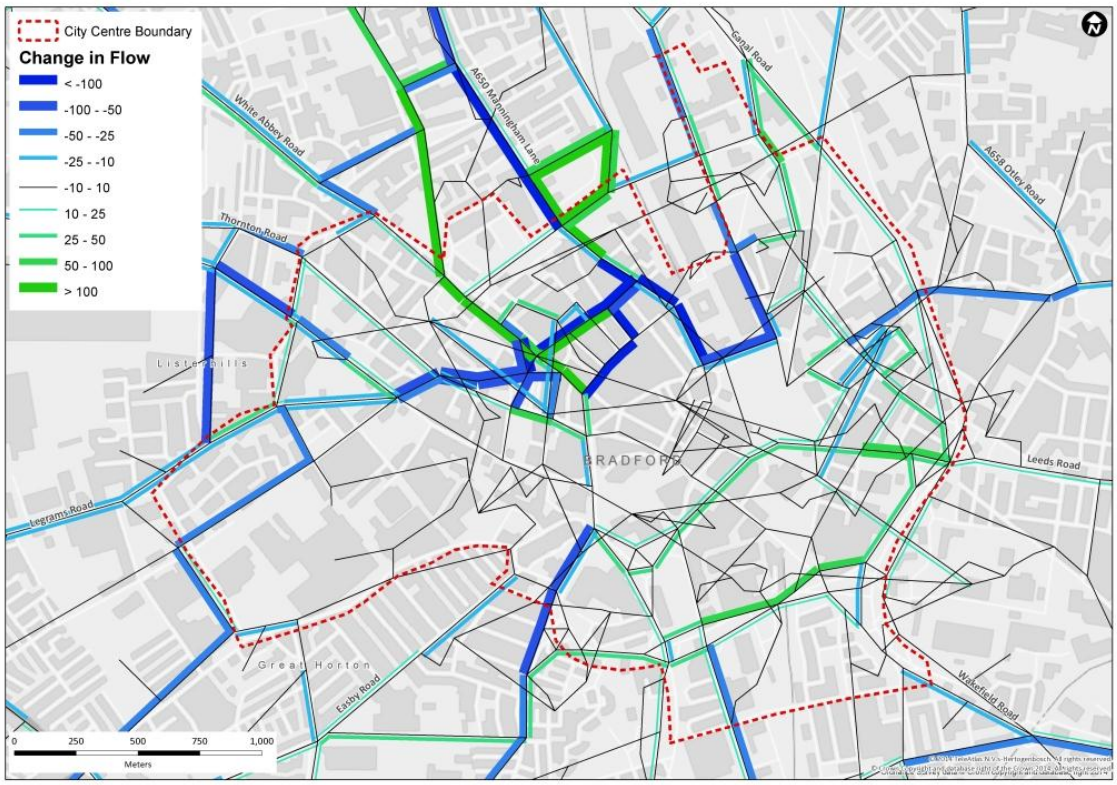
C.10 Excessive delays at the Godwin Street/Sunbridge Road junction, particularly for traffic exiting the city centre along Bridge Street, can be mostly mitigated by signal optimisation so as not to create delays for buses.



Test 4 – John Street Bus Gate

AM Peak

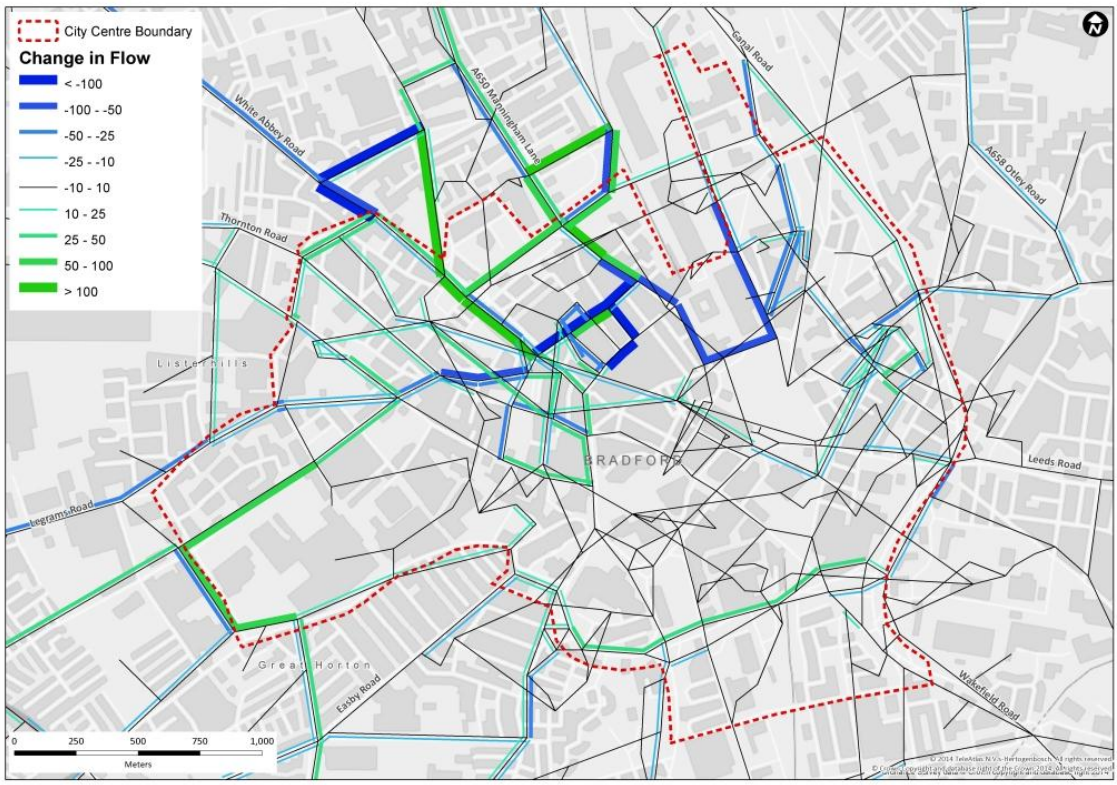
- The impacts around John Street and Godwin Street are as expected, given the nature of the proposals – ie reduced traffic west to east as the bus lane is introduced and a direct transfer from Godwin Street to John Street for the westbound trips. The restriction on eastbound moves is reflected in traffic leaving the City continuing north along Westgate (and on to Lumb Lane) rather than cutting across to Manor Row to access Manningham Lane.
- Impact on Canal Road corridor itself is minor, but we do see this transfer of northbound traffic from Manningham Lane to Lumb Lane, to the immediate west of the corridor.



- Little of note with respect to changes in queues and delays.

PM Peak

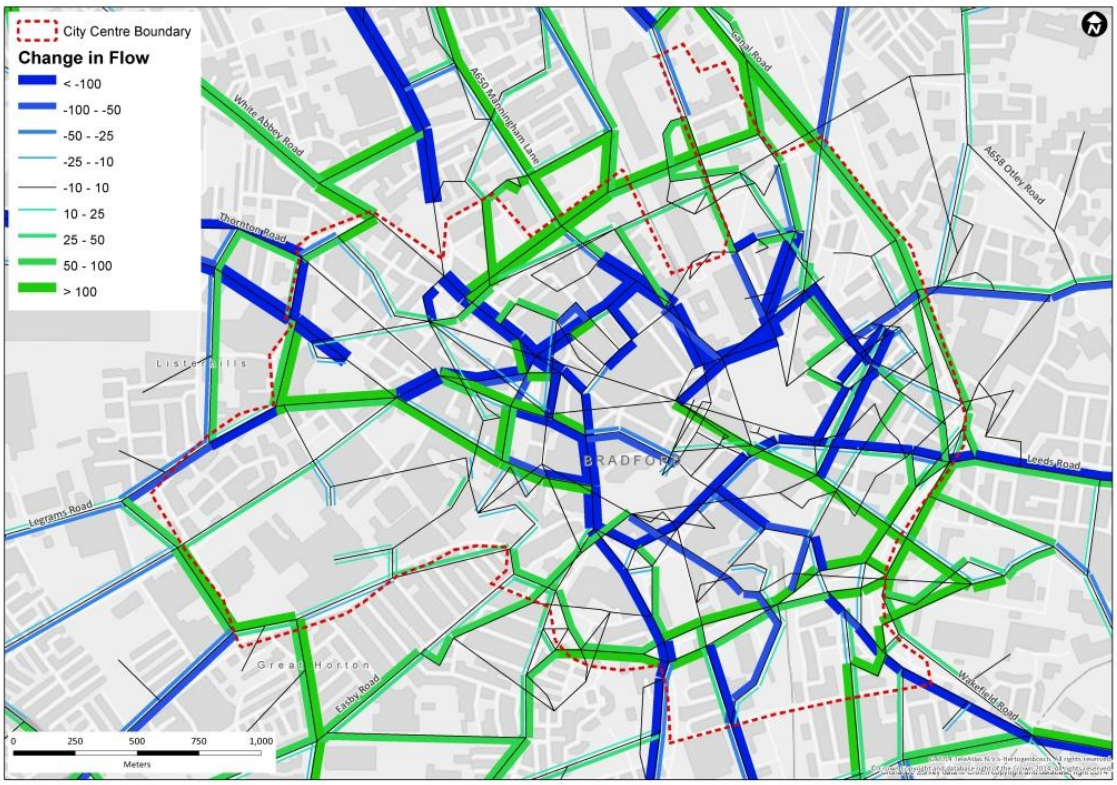
- As with AM regarding links affected by the proposals. Impact outbound from the City still sees continuation along Westgate, but traffic intended for Manningham Lane get back 'on route' sooner – ie small increases eastbound along Drewton Road and Bowland Street.
- Even less to say about delays and queues.



Combined Test – All 4

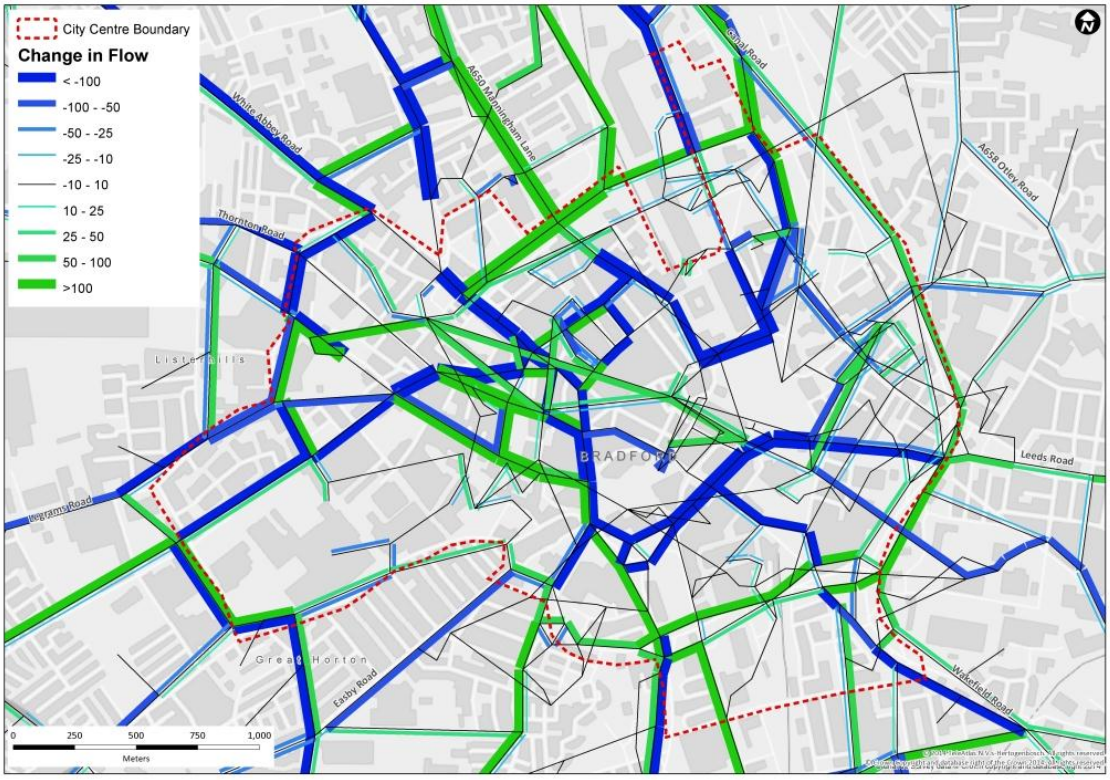
AM Peak

- Combining all 4 of the above Tests shows results dominated by the City Ring Road Extension (Test 3), but we can still clearly identify the separate impacts in the City Centre of closing Lower Kirkgate (Test 1) and reducing capacity along Hall Ings/ Leeds Road (Test 2).
- In terms of delay, the majority impacts are reported above for the independent tests.



PM Peak

- Again, both in the City Centre and along Canal Road Corridor the impacts are dominated by Test3, but effects of each other test can also be seen.



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