

Bradford District-Wide Transport Study in Support of the Core Strategy

Final Report

Report

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Prepared for:

City of Bradford Metropolitan District Council

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EXECUTIVE SUMMARY

As part of CMBDC's ongoing production of the Core Strategy of the Local Development Framework (LDF), four options for the spatial pattern of land allocations were originally identified as representing possible development strategies up to 2026. Each option, whilst having common elements, has a distinct spatial strategy:

- Option 1: Full compliance with the Regional Spatial Strategy
- Option 2: Continuation of the Revised Unitary Development Plan
- Option 3: Focussed growth points
- Option 4: Dispersed growth points

The aim has been to compare and contrast the four Core Strategy options, and to provide independent transport advice towards the development of a Preferred Option which could either be one of the original four proposals or a composite spatial strategy.

One of the biggest challenges in the District is road traffic growth and the dominance of the private car as the main mode of travel. Without careful planning, this could be exacerbated by the amount of new development planned. Through the Regional Spatial Strategy, Bradford was set a target to provide 50,000 new dwellings by 2026, and although since this study was completed the Regional Spatial Strategy has been revoked, the target for the district remains of the same magnitude.

The results of this study will be used as part of the transport evidence base for the Core Strategy submission, and to inform the ongoing development of the Infrastructure Delivery Plan.

It is important that development options progressed through the Core Strategy have been engineered using a thorough, transparent and robust methodology which is defensible and understandable to a variety of audiences.

There is a focus within national and regional policy on aspirations for sustainable development options and in local policy the reality is that planning for sustainable development has to be set in context of the reality of local conditions and the needs of the local population. Consultation with neighbouring districts has also allowed the study to take account of wider transport issues such as cross-border travel patterns, public transport corridors and concerns over child safety..

To allow a quantitative comparison of the transport impacts of each option, CMBDC's multi-modal transport model has been used. An existing model was first updated and enhanced to reflect base conditions in 2009.

Rather than compare traffic conditions associated with each option against 2009 conditions, an interim state has been developed, the Reference Case, which represents a level of development that it is believed can be developed through the Strategic Housing Land Allocation Assessment. This represents a level of housing development, in excess of 20,000 new dwellings, that could conceivably be developed outside of the Local Development Framework. The challenge, therefore, is to identify the most appropriate spatial strategy for delivery of the remaining 30,000 of the target housing for the District.

Early analysis of the four Core Strategy options established the following:

- The district-wide differences in transport performance between the four options were very small, and no particular spatial arrangement of new development appeared to offer significant benefit over another.
- In options where development was to be concentrated in specific areas, such as Keighley, Esholt and Holmewood, then significant local impacts were identified which may need mitigation if development at that scale were to go ahead in the future.
- Any option taken forward would cause significant impacts on the transport network which will require mitigation in terms of improvements to the public transport network and in some cases improvements to the highway network.

Accommodation of almost 50,000 new dwellings in Bradford will create significant levels of increased transport demand and there is no realistic way to arrange this level of new development that reduces the impacts to an extent that any option becomes a clear winner. Transport is just one of many local factors to be considered, albeit a very important one.

With this in mind, the most important factor becomes land availability, both in terms of actual availability of land for development and the potential for that land to be developed commercially. As such the Council has defined a composite Preferred Option which can be characterised as follows:

- Bradford taking the greatest proportion of development in the District, generally spread evenly across the city but with a concentration in the Canal Road corridor.
- Significant concentration of development along the Airedale corridor from Steeton/Silsden through Keighley, Bingley and Shipley.
- Lesser, but still significant, amount of development along the Wharfedale corridor from Addingham through Ilkley, Burley and Menston.
- Some development spread around local service centres in the western part of the district.

The final analysis then concentrated on an assessment of the Preferred Option in relation to the existing transport networks, the potential for realistic improvements to those networks, supported by evidence from the transport model.

The assessment focused on ten corridors, agreed with the client team, and for each identified the problems to be resolved and a range of potential solutions, low cost where appropriate, for both highways and public transport networks.

The opportunities for significant additional transport infrastructure appear limited at this time; new highway infrastructure is generally not a sustainable option, reallocation of road space to public transport is often difficult to achieve when corridors are heavily congested and the provision of new highway for bus lane can be costly, and rail is limited by location and accessibility of stations. An additional problem will be the squeeze on government spending over the next 5-10 years.

For Bradford to deliver an effective and sustainable transport system to support the amount of development proposed, the following principles will need to be adopted:

- To develop where there are opportunities for employment, leisure, retail and education accessible by non-car modes.
- To pursue options for developer contributions to fund new infrastructure schemes.
- To manage and enhance the future public transport infrastructure, including improvements to the Airedale corridor, a new station at Low Moor and improving the bus offer across the district.

Further more radical, and sometimes uncomfortable, solutions will also need to be explored as time progresses to seek to manage demand as development expands. A certain amount of 'natural' demand management will occur as roads become more congested over time and trips are either made by other modes, made at other times of the day or suppressed altogether. To encourage shift away from the car, the cost of using the car must increase relative to the cost of, say, using public transport. While not popular, increasing parking costs across the district and particularly in Bradford city centre for long stay parking may have to be considered.

GLOSSARY

TRIPS. A public transport network model.

SATURN. A highways traffic assignment model.

Metro. The West Yorkshire Integrated Transport Authority and West Yorkshire Passenger Transport Executive.

GIS. Geographic Information System.

Furnessing. A mathematical procedure used in transport modelling to match the growth in trip origins with the growth in trip destinations.

TRICS. The national system of trip generation analysis.

Tempro. Provides a summary of the National Trip End Model forecast data for transport planning purposes.

Experian. Provides forecasts of local, national and global economic conditions.

National Travel Survey. A database of information on personal travel in Great Britain.

Accession. A travel access and travel time mapping software package.

AQMA. Air Quality Management Area.

COBA. Cost Benefit Analysis.

1 Introduction

- 1.1 Steer Davies Gleave (SDG) was commissioned by City of Bradford Metropolitan District Council (CBMDC) to undertake the ‘Bradford District-Wide Transport Study in Support of the Core Strategy’ in May 2009.
- 1.2 City of Bradford Metropolitan District Council is currently preparing its Local Development Framework (LDF). This will replace the District’s Replacement Unitary Development Plan (RUDP), adopted in 2005.
- 1.3 The principal document in the LDF will be the Core Strategy. The Core Strategy will identify the Council’s vision for the development of Bradford until 2026, setting out the spatial strategies and core policies that will guide the amount, scale, location and type of development in the District.
- 1.4 The Core Strategy will set out the major residential and employment growth required for the period of the LDF.
- 1.5 As part of CBMDC’s ongoing production of the Core Strategy, four options for the spatial pattern of land allocations were identified as representing possible development strategies up to 2026. Each option, whilst having common elements, has a distinct spatial strategy:
 - Option 1: Full compliance with Regional Spatial Strategy;
 - Option 2: Continuation of Revised Unitary Development Plan;
 - Option 3: Focussed growth points;
 - Option 4: Dispersed growth points.
- 1.6 Transport will be a critical element of the Core Strategy, to allow and support this proposed growth. To this end a comprehensive Transport Study is required, to enable the transport impacts of the Core Strategy to be evaluated; to ensure that growth can be accommodated in a sustainable way; to ensure that the Core Strategy is a sound document; and to satisfy and inform other relevant authorities and agencies, namely the West Yorkshire Integrated Transport Authority (Metro), the Highways Agency and neighbouring Councils.
- 1.7 The Transport Study will fulfil two key objectives:
 - To establish the strategic impacts, in both absolute and relative terms, of the Core Strategy proposals on the highway and public transport networks throughout the Bradford District, and on an intra-district level where relevant.
 - To provide an assessment of specific measures needed to mitigate the key impacts of the Core Strategy proposals. This will identify the transport improvements, including measures to encourage modal shift away from the car, required to implement the Core Strategy without unacceptable impacts on the highway network and ensuring accessibility by public transport and other non-car modes.
- 1.8 The outcomes of the Transport Study will inform the LDF Infrastructure Plan, and may also be used to inform future bids for transport funding.

1.9 This Final Report describes the process by which the transport impacts of the five Core Strategy options were assessed, and provides a summary of our findings and our recommendations for how this work is used to inform the ongoing development of the Core Strategy Preferred Option and Infrastructure Delivery Plan. The following reports have also been prepared during the course of the study.

- Model Review Note June 2009
- Local Model Validation Report September 2009
- Interim Report December 2009

1.10 The structure of this report is as follows:

- Chapter 2 sets out the policy background used to inform the study;
- Chapter 3 describes the overall methodology used for the study;
- Chapter 4 describes the stakeholder consultation process;
- Chapter 5 details the development of each Core Strategy scenario for assessment;
- Chapter 6 presents our appraisal of each option;
- Chapter 7 explores the transport impacts of the Preferred Option in more detail;
- Chapter 8 provides a summary and conclusions to the study.

2 Policy Context

- 2.1 In this section we briefly describe the relevant policy and how it sets the context for the study, and more specifically, how it sets the context for our proposed methodology.

Study Area: Key Issues and Local Context

- 2.2 Bradford District covers an area of 366 square kilometres (141 square miles; 36,642 hectares) and has a varied environment which ranges from moorlands in the north and west of the District, to the valleys and floodplains formed by the river systems flowing through the District. The topography means that most of the industrial and residential development has taken place along the valley bottoms, with the majority of the population living in the urban centres of Bradford, Shipley, Bingley, Keighley and Ilkley.
- 2.3 The transport network in the urban area of Bradford is strongly characterised by a radial pattern of routes leading to the city centre. These routes are busy for most of the day and heavily congested in the peak periods. The heaviest flows of traffic occur between Airedale and the national motorway network. There is a limited but well used local rail system serving a few major corridors and a high level of bus use throughout the urban area.

Transport Trends

- 2.4 Between 1991 and 2001, the total number of cars owned in Bradford rose by 28% (the national figure was 23%). The proportion of households with no car fell from 41% to 33%, over the same period, compared to 27% nationally. Forecasts for car ownership show that this trend is set to continue - between 2001 and 2015 car ownership is set to rise by 28% in Bradford compared with a national forecast of around 23%.
- 2.5 Trend data on traffic volumes within the Bradford urban area (measured from the Bradford Monitoring Cordon) shows that between 1979 and 1999 all day traffic in Bradford District increased significantly (approximately 50%); traffic volumes then reduced 5.6% between 1999 and 2009. Peak traffic levels have also reduced over the same period, with a 6% and 4% reduction, in the am and pm peak, respectively.
- 2.6 Census data indicates that journey lengths for commuters increased significantly between 1991 and 2001, with Bradford workers travelling an average 21% greater distances over that period, but below the West Yorkshire figure of 25%. This trend is expected to continue into the future.
- 2.7 Although traffic has been reducing over the past 10 years, forecasts indicate that car journeys between 2010 and 2020 could increase by 15% in Bradford District, compared to 13% in West Yorkshire and 9% nationally.
- 2.8 One of the biggest challenges in the district is road traffic growth and the dominance of the car as the main mode of travel. This reflects current usage patterns and will be exacerbated by the amount of new development that is expected. Census 2001 figures show that the vast majority of commuting in the district is undertaken by car (71.0%) - higher than the national average (63.1%). A comparison of mode of travel to Bradford City Centre (from city centre cordon

surveys) over the last 10 years shows only a slight reduction in car journeys (see Table 2.1).

- 2.9 This puts a considerable strain on our highway network with some parts identified as being at capacity during many parts of the day. Major delays are experienced on radial routes to Bradford City Centre, on the A6177 Outer Ring Road, on the A650 Tong Street, and on routes through Shipley and Keighley Town Centre. Buses are also affected by this delay as they are unable to avoid the queues due to a lack of priority measures. The scope to implement bus priority measures is restricted on some routes by a lack of available road space and land constraints.

TABLE 2.1 JOURNEY TO WORK BY BRADFORD RESIDENTS

Mode	Census (district wide)	Bradford City Centre Cordon Surveys	
	2001	2000	2009
Car	71%	73.7%	71.6%
Bus	12.6%	16.7%	16.0%
Train	2.2%	5.1%	7.2%
Cycle	0.9%	0.3%	0.3%
Walk	11.6%	3.9%	4.7%

- 2.10 A particular issue is the quality of the A6177 Outer Ring Road and its significant junctions with major radial routes. The congestion at these junctions creates delays for buses, road safety problems, pollution, severance, and causes traffic to seek alternative routes through environmentally sensitive residential areas. Opportunities for improving these junctions to cater for all users, particularly for pedestrians and buses, without significant highway improvements, are limited.
- 2.11 Road traffic is the main source of air-borne pollution in Bradford. The Government estimates that air pollution in the UK kills between 12,000 and 24,000 people prematurely each year. Bradford experiences an average of 6 days each year when pollution is classified as "moderate or higher". The Council has established 4 Air Quality Management Areas at the following localities where levels of Nitrogen Oxide were found to be higher than acceptable:
- Mayo Avenue / Manchester Road Junction, Bradford;
 - Thornton Road, Bradford (between Godwin Street and Listerhills Road);
 - Manningham Lane / Queens Road Junction, Bradford;
 - Shipley Airedale Road / Barkerend Road junction, Bradford.
- 2.12 The location of all the AQMAs identified experience significant levels of traffic congestion. The large volume and varied types of vehicular traffic are the major sources of this pollutant at those sites. Measures to try and improve air quality in these locations are being considered through an air quality action plan.
- 2.13 There are key services, employment and areas in Bradford, which are poorly served by public transport, cycling and walking. These include employment sites such as East Bowling in the M606 corridor, some housing sites in Bingley and Thornton and

areas on the Outer Ring Road. Bradford Royal Infirmary for instance though served by buses from Bradford City Centre, is poorly accessed by direct bus services from adjacent residential areas, and areas to the north of the district.

Regeneration and Growth

- 2.14 Bradford is anticipated to experience strong employment growth as the economy recovers, facilitated by specific initiatives including work to regenerate the city centre, the Bradford-Shipley Canal Road Corridor, Airedale and Manningham areas. Bradford has also been set a target by government to provide 50,000 new dwellings by 2026.
- 2.15 Trends show that the district is unlikely to create enough jobs on its own to meet the demands of a growing workforce. Links with neighbouring districts will be increasingly important to connect people with training and employment. For some, the urban centres of Leeds will provide these opportunities, but for many of Bradford's rural communities, Craven is more important.
- 2.16 It is clear that housing and employment growth will significantly affect travel patterns and lead to increased traffic movements. Major regeneration projects, particularly in the city centre itself are likely to lead to increased traffic movements on inner and outer ring roads. Employment growth in the M606 corridor is likely to lead to increased congestion in this sector of the district. Future growth in the numbers of jobs and housing in the Airedale Corridor will put increased pressure on road and rail capacity in this corridor.
- 2.17 An integrated strategy for providing housing and employment growth in optimum locations will reduce number and length of car journeys and maximise opportunities to encourage the use of sustainable modes of transport. This will assist in reducing the impact of transport on the environment, especially with regard to its effect on air quality and its contribution to climate change.

Transport Strategy

- 2.18 Accessibility and transport are key elements of the LDF Core Strategy and the Council will update the current District Transport Strategy as part of the Local Development Framework. The updated Transport Strategy will accord with the now revoked Regional Transport Strategy, the Leeds City Region Transport Strategy and the emerging third Local Transport Plan.
- 2.19 The current Bradford District Transport Strategy 2006-2021 has identified key investment gaps and set out investment priorities for infrastructure development across different parts of the district. The strategy recognises the role of demand management as a complementary approach to overcome the deficiency but urges that this alone is not a convincing approach and direct investment into key transport infrastructure is therefore essential. The infrastructure and investment priorities as set out in the current Transport Strategy are given in the tables below. As stated earlier the Strategy is due to be reviewed and will take into account the government's DaSTS policy or any new transport policy that might be introduced by the new coalition government and the limited funding opportunities that will exist over the next decade. The need to make better use of existing transport infrastructure is likely to be a strong theme in the revised District Transport Strategy.

2.20 A summary of the key investment gaps and priorities for transport infrastructure as identified in the Bradford District Transport Strategy 2006-2021 is set out in Tables 2.2 and 2.3 below:

TABLE 2.2 INVESTMENT GAPS AND PRIORITIES BY AREA

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Investment gaps and priorities for transport infrastructure as identified in the Bradford District Transport Strategy 2006-2021
Investment gaps
<p><u>Bradford Urban area</u></p> <ul style="list-style-type: none"> • Comprehensive improvement to outer ring road junctions to reduce congestion, improve public transport and safety • Selective improvements for orbital traffic where the diverse movements involved are not well served by bus routes and where access to the strategic road network is an important consideration • Improvement to performance of high frequency radial bus corridors • Opening of new rail stations <p><u>City Centre</u></p> <ul style="list-style-type: none"> • Agreement upon City Ring Road West preferred option, funding and implementation plan • Public transport access • Public realm traffic management measures • Public realm environment <p><u>Interchange and park and ride</u></p> <ul style="list-style-type: none"> • Improvements to facilitate interchange at Shipley and Bingley • Additional parking at rail stations • Coordination of local bus networks with interchanges and rail stations <p><u>Airedale</u></p> <ul style="list-style-type: none"> • Agreement upon A650 Shipley / Saltaire / Cottingley preferred option, funding and implementation plan • Shipley Eastern Link Road and Canal Road improvement • Shipley Station integrated transport interchange • Hard Ings Road, Keighley • Park and Ride • Bingley Station Interchange <p><u>Wharfedale</u></p> <ul style="list-style-type: none"> • Shipley Eastern Link Road and Canal Road improvement • Shipley Station integrated transport interchange • Park and Ride • Long distance routes <p><u>Rural areas</u></p> <ul style="list-style-type: none"> • Improved local accessibility for communities whose activities are based in the more isolated areas of the District. <p><u>Leeds Bradford International Airport and other airports</u></p> <ul style="list-style-type: none"> • A658 Greengates junction improvement

TABLE 2.3 INFRASTRUCTURE INVESTMENT PRIORITIES

<p>Highways:</p> <p><u>Regional / inter-regional</u></p> <ul style="list-style-type: none"> • Completion of A650 Shipley - Saltaire - Cottingley • Hard Ings Road, Keighley <p><u>City Region</u></p> <ul style="list-style-type: none"> • Canal Road Improvement / Shipley Eastern Link Road • Thornbury – Dudley Hill • M606 Staygate – final stage <p><u>District wide</u></p> <ul style="list-style-type: none"> • Bradford Outer Ring Road junctions • Bradford City Centre West • A647 alternative • Keighley Eastern Relief Road <p>Public Transport:</p> <p><u>Bus</u></p> <ul style="list-style-type: none"> • Strategic Bus Corridors to connect Bradford with Leeds, Wakefield and Huddersfield. • Outer ring road junction priorities <p><u>Interchange</u></p> <ul style="list-style-type: none"> • Improved interchange facilities at Shipley and Bingley • Develop further park and ride at appropriate locations <p><u>Rail</u></p> <ul style="list-style-type: none"> • Improved ‘connectivity’ between Bradford and Leeds on both Airedale and Caldervale routes including new stations at Manningham and Apperley Bridge and at Low Moor, additional park and ride. • Lobbying for better service provision in the Inter City East Coast franchise, especially in Airedale • Supporting open access services where this is in the district’s interest. • Support for city region Caldervale (Bradford Interchange) electrification; development of ‘tram/train’ network (including access to airport); links with north east and central Lancashire <p>Other investment:</p> <p><u>Leeds Bradford International Airport</u></p> <ul style="list-style-type: none"> • Implement improvement to Greengates junction (A658). <p><u>Cycling</u></p> <ul style="list-style-type: none"> • Complete long distance cycle routes through the district <p><u>Bradford Canal</u></p> <ul style="list-style-type: none"> • Prepare an implementation plan for the delivery of the Bradford Canal

National Planning Policy

- 2.21 At a national level, the UK Government has produced a number of **Planning Policy Guidelines** (PPGs) which are in the process of being updated and replaced by **Planning Policy Statements** (PPSs). These documents are prepared following public consultation to explain statutory provisions and provide guidance on planning policy to local authorities and other interested parties.
- 2.22 The national planning policies which have a particular impact on the shaping of highways and public transport networks within the context of local planning are as follows:
- **PPS1: Delivering Sustainable Development** (with its supplement **Planning and Climate Change**);
 - **PPS12: Local Spatial Planning**; and
 - **PPG13: Transport**.
- 2.23 In general, the plans encourage regional and local planning bodies and authorities to ensure that all development contributes to global sustainability through policies which reduce energy use and emissions. There is also a focus on inclusion and accessibility to break down unnecessary barriers.
- 2.24 **PPS12** describes the spatial planning process and specifically sets out the government policy on the Local Development Frameworks (LDF). The development plan is made up of the Regional Spatial Strategy (RSS) which covers the whole region and a number of Development Plan Documents (DPD) including the Core Strategy which are produced by local authorities. The Core Strategy sets out how much development is intended to happen where, when and by what means and is subject to independent examination to ensure that it is “sound” through being “justified, effective and consistent with national policy.”
- 2.25 The Planning Advisory Service has produced an “Evidence Based Tool” in order to assist in the examination of the “soundness” of the Core Strategy whereby evidence should be given to support answers to a number of questions asked of the strategy.
- 2.26 It is important, therefore, to ensure that development options put forward in the Core Strategy have been engineered using a thorough, transparent and robust methodology which is defensible and understandable to a variety of audiences.
- 2.27 **Delivering a Sustainable Transport Strategy (DaSTS)** is the latest stage in the Government’s approach to longer term strategic transport planning and helps to set transport in a wider context, considering how it contributes to wider outcomes.
- Originates from the Eddington study in 2006 that considered the long term links between transport and economic productivity;
 - Also in 2006 the Stern report considered the economics of climate change;
 - Government’s response to both studies was “Towards a Sustainable Transport System” (TaSTS) in 2007;
 - Following consultation Government produced “Delivering a Sustainable Transport System” (DaSTS) in 2008;

- I DaSTS set out five goals for transport which will be key to both transport planning and development of schemes over the short, medium and long term;
 - I Transport schemes should be developed as a direct response to a specific problem, rather than problems being retrofitted to schemes to provide justification for them.

2.28 The five goals are as follows but in reality they are focusing on the challenge of delivering strong economic growth while at the same time reducing greenhouse gas emissions:

 - I to support national economic competitiveness and growth, by delivering reliable and efficient transport networks;
 - I to reduce transport's emissions of carbon dioxide and other greenhouse gases, with the desired outcome of tackling climate change;
 - I to contribute to better safety, security and health and longer life expectancy by reducing the risk of death, injury or illness arising from transport, and by promoting travel modes that are beneficial to health;
 - I to promote greater equality of opportunity for all citizens, with the desired outcome of achieving a fairer society; and
 - I to improve quality of life for transport users and non-transport users, and to promote a healthy natural environment.

2.29 DfT is dealing with the national networks and the regions are dealing with the city and regional networks. The region has confirmed its priorities in advice to DfT earlier in the summer. Through consensus **our region has identified (and agreed) a total of six challenges it faces as a priority:**

 - I Contribute to the reduction in transport related carbon dioxide emissions;
 - I Reduce lost productive time including maintaining or improving the reliability and predictability of journey times on key regional and city region routes for business, commuting and freight;
 - I Improve the connectivity and access to labour of key business centres;
 - I Support the delivery of sustainable housing through the provision of transport;
 - I Enabling social inclusion and the regeneration of deprived or remote areas by enabling disadvantaged people to connect with employment opportunities, key local services, social network and goods through improving accessibility, availability, affordability and acceptability;
 - I Reduce risk of death due to transport accidents.

2.30 The **Guidance on Transport Assessments** (GTA) document produced by the Department for Transport sets out a framework for assessing the transport impacts of developments which is consistent with the April 2009 'refresh' of **New Approach To Appraisal** (NATA) and the emerging challenges and objectives identified in the regional **DaSTS** research.

2.31 The GTA and NATA set out five main objectives against which transport impacts of development should be assessed:

- Environment - involves reducing the direct and indirect impacts of transport facilities on the environment of both users and non-users;
 - Safety - is concerned with reducing the loss of life, injuries and damage to property resulting from transport incidents and crime;
 - Economy - is concerned with improving the economic efficiency of transport.
 - Accessibility - is concerned with the ability with which people can reach different locations and facilities by different modes;
 - Integration - aims to ensure that all decisions are taken in the context of the Government's integrated transport policy.
- 2.32 Although the GTA document is principally used in relation to assessing the transport impacts of individual developments, guidance on preparing LDF submissions suggests that the principles of the GTA are applicable to testing Core Strategy Options.

Regional Planning Policy

- 2.33 In 2008, the Government Office for Yorkshire and The Humber published “**The Yorkshire and Humber Plan Regional Spatial Strategy to 2026**” (YHRSS). Although now revoked by the new incoming coalition government, the spatial strategy set out the then Secretary of State for Communities and Local Government's policies in relation to the development of land within the region. The Plan embodied the Regional Transport Strategy and had to be taken into account by local authorities in preparing their Local Development Frameworks and Local Transport Plans.
- 2.34 The plan worked towards the achievement of sustainable development focussing on regeneration, economic growth, protection of environmental resources, the limiting of environmental threats, and ensuring that transport management and investment decisions support the YHRSS. These principles still apply.
- 2.35 The **Regional Transport Strategy** included within the plan has also been revoked. It supported a modal shift from use of the car in order to reduce congestion and focused on improving public transport and accessibility, listing a number of “Transport Investment and Management Priorities” as outcomes to be progressed by first maximising use of existing infrastructure, and then potentially by schemes and projects as necessary at later stages. The priorities provide a regional and sub-regional context for Local Transport Plans and a policy framework for the identification of priorities that will be included in individual authorities' LTPs.
- 2.36 It remains important in this study to ensure that any emerging options and/or supporting infrastructure found necessary for development fit into this regional policy framework. In particular it is likely that an emphasis on sustainable public transport and options designed to encourage modal shift, rather than significant new highway infrastructure, will help achieve the wider objectives in the region.
- 2.37 The **Leeds City Region Partnership** comprises of eleven local authorities - Barnsley, Bradford, Calderdale, Craven, Harrogate, Kirklees, Leeds, Selby, Wakefield, York and North Yorkshire County Council working together toward a common prosperous and sustainable city region in areas such as transport, skills, housing, spatial planning and innovation.
- 2.38 The **Leeds City Region Transport Strategy** was launched in November 2009 and has received positive feedback from the Department for Transport (DfT). The Strategy

followed an approach based on the principles of ‘Delivering a Sustainable Transport System’ (DaSTS) and through engagement with stakeholders and the DfT.

- 2.39 The Transport Strategy recognised the importance of Bradford as a Regional City and prioritised the links from Bradford to Leeds and Leeds Bradford International Airport as well as those from the City Region to London and to the Manchester and Sheffield City Regions. The importance of other links to surrounding districts and from Bradford and Leeds City Centres to Airedale were also recognised.
- 2.40 The **Connectivity Study** builds on and moves towards the delivery of the LCR Transport Strategy. It includes a detailed review of the evidence base to confirm the main challenges and spatial priorities identified in the Transport Strategy. Phase 1 of the Study, which was submitted to the DfT in June 2010, has identified, through a ‘high level sift’ process, a number of priority interventions that need to be delivered in the short (2015 - 2019), medium (2020 - 2024) and long (2025 and beyond) term to deliver the housing and jobs growth required in the LCR whilst controlling carbon emissions. Schemes prioritised for Bradford in the short and medium term include
- Connecting Airedale Stage 1 (Shipley highway network improvements)
 - Connecting Airedale Stage 2 (Manningham Rail Station)
 - Connecting Airedale Stage 3 (low cost measures) - Canal Road improvements
 - Keighley Transport Improvements
 - Bradford City Centre network improvements
 - Bradford Interchange and Forster Square Station Improvements
 - Leeds - Bradford Corridor Improvements
 - Outer Ring Road Improvements
 - A658 (Bradford - Leeds Bradford International Airport) improvements
 - Capacity and quality improvements on the Caldervale Line.
- 2.41 As well as the above, generic improvements proposed for the City Region include transformational improvements to bus services, integrated ticketing, strategic cycle networks, freight routing strategies, highway safety improvements, smarter choices programmes and accessibility improvements.
- 2.42 Phase 2 of the study is subject to funding confirmation from the DfT (or alternatively the City Region partners). If it proceeds the prioritised projects will be packaged and tested with the City Region Urban Dynamic Model to determine which combination of projects have the best outcomes in relation to the delivery objectives referred to above. Phase 2 is currently programmed for completion at the end of 2010 subject to funding availability.
- 2.43 Work has also been undertaken as part of this study to identify potential funding sources for schemes ultimately prioritised by Phase 2 and to provide a framework for scheme appraisal by the LCR using the new flexibility permitted under the Forerunner Status granted to the City Region.
- 2.44 As well as the LCR Connectivity Study and number of other National and Regional Studies are being undertaken which will have implications for Bradford. These are:

- Transpennine Study
- London - North Study
- National Freight Study
- Road Safety Study
- Land Use and Accessibility Study
- Regional Urban Dynamic Model Study

Local Planning Policy

- 2.45 There are a number of Local Planning, Transport, Economic Development and Regeneration Policies in place which also need to be taken into account when developing the LDF and more specifically, the Core Strategy proposals on the highway and public transport networks. These include the Transport Plan and Strategy for West Yorkshire and Bradford respectively, the Replacement Unitary Development Plan (RUDP) for the Bradford District, and also a number of area masterplans:

West Yorkshire Local Transport Plan 2011-2026

- 2.46 The West Yorkshire LTP will be a 15 year Strategy supported by three year Implementation Plans for delivering West Yorkshire-wide strategic improvements and localised maintenance and enhancements to the transport system.
- 2.47 Under the Local Transport Act 2008 the development of the third WY LTP is the responsibility of the WYITA (Metro) working in partnership with district authorities (Bradford, Calderdale, Kirklees, Leeds and Wakefield).
- 2.48 The LTP will cover the whole integrated transport system and work in conjunction with other plans and strategies around health, the environment, the economy, communities, etc. WY LTP is one of four LTPs that will help to deliver the Leeds City Region Transport Strategy on a local level.
- 2.49 Progress to June 2010 can be summarised as follows:
- Engagement with partners and stakeholders from transport, regeneration, environment, business, health, community and other sectors to identify key priorities, plans, strategies and evidence
 - Consultation with partners and stakeholders on Draft Vision and Outline Strategy (feed back now being fed into further development)
 - Public given opportunity to put forward comments specifically on LTP and more general transport issues in their districts through various consultation opportunities
 - Working group set up to advise on assessment of plan (Integrated Sustainability Appraisal)
 - Objectives identified and Strategic Principles drafted / being refined in collaboration with partners

2.50 The shape of the Plan follows the following three stages.

1. Vision - where we want to be						
National goals			West Yorkshire objectives			
Tackle climate change			Reducing Emissions			
			Ensuring Resilience			
Boost economic growth			Improving Accessibility			
			Reducing Congestion			
			Maximising Capacity			
			Managing Demand			
Improve health, safety and security			Improving Health			
			Maintaining Safety			
Promote equal opportunities			Promoting Equality			
Improve quality of life			Improving Connectivity			
			Providing Quality			
2. Strategy - how we will get there						
Strategic Principles organised under 4 Themes:						
Transport Asset & Network Management		Travel Choices & Behaviour		Access to the Transport System		Transport Networks & Services
Preferred Strategic Approach						
3. Delivery - what we will do to deliver Preferred Strategy						
Implementation Plans 2011-14						
Bus	Rail	Active Travel	Personal motorised vehicles	Freight	Travel Choices and Behaviour	Local maintenance

2.51 Further stakeholder engagement is planned over 2010 and early 2011 to develop strategic principles and implementation priorities before the final Plan comes into effect in April 2011. The Leeds City Region Transport Strategy and Connectivity Study, and the emerging spatial and policy proposals in the LDF will inform this process.

Bradford Transport Strategy 2006-2021

- 2.52 The more localised Bradford Transport Strategy (BTS) makes the case for a “step change” in investment in the district. The document, as previously referenced in paragraph 2.19, includes the context for the district’s transport network, the strategy including key investment and actions to be sought with partners. The strategy reviews the schemes proposed in the existing policy and identifies a number of investment gaps and recommendations for Bradford’s transport network.
- 2.53 The key objective of the strategy is to address the issues of connectivity and congestion. The strategy will be refreshed to reflect the emerging policy objectives of the LDF and LTP3.

Bradford City Centre Masterplan

- 2.54 In September 2002, the Government granted approval for the establishment of an Urban Regeneration Company for Bradford City Centre. This company was established in February 2003 under the name Bradford Centre Regeneration (BCR). It was jointly funded by City of Bradford Metropolitan District Council, Yorkshire Forward (the Regional Development Agency) and English Partnerships (the national regeneration agency).
- 2.55 The key role of BCR was to engage the public and private sectors in order to transform the city centre.
- 2.56 In February 2003, Alsop Architects were appointed to prepare a Masterplan for the Bradford City Centre. This was published in September 2003 and set out a new vision for the future of the city centre.
- 2.57 The big idea of the Masterplan is to create a new city centre park that will change people’s perceptions of Bradford and differentiate it from other cities. The idea is based on exploiting Bradford’s topography - the city lies in a bowl formed by the valley of Bradford Beck. The Masterplan proposes rediscovering the ‘Bradford Bowl’ by getting rid of poor quality buildings which are no longer needed and forming a new city centre park.
- 2.58 This would be a series of linked spaces, landscapes and water features, which breathes new life into the city’s historic fabric.
- 2.59 The Masterplan identifies four separate neighbourhoods or ‘fingers of intervention’:
- The Bowl - proposes a large pool of water outside City Hall at the centre of the new park. Radiating out from the Pool are, a Pier attached to the National Museum, a new Business Forest, and the other three neighbourhoods.
 - The Channel - proposes reintroducing the Bradford Canal to the city centre alongside which is a new canalside community.
 - The Market - proposes an alternative multi-cultural retail offer with new public spaces.
 - The Valley - proposes bringing Bradford Beck back to the surface, with a green corridor along Thornton Road including Wetlands and an Orchard.
- 2.60 The aim of this approach is to promote a step change in the economy, inspire better quality development, and create a city centre that is used and cared for by all of the city’s different cultures.

- 2.61 On 14th October 2003, City of Bradford Metropolitan District Council's Executive welcomed the Masterplan for the city centre. Subsequently at the meeting of the Executive on 9th March 2004 it was resolved that the Council would:
- Prepare a replacement planning document for the Bradford Centre Regeneration area as a high priority.
 - Co-operate with BCR in the commissioning of studies and project plans.
- 2.62 At the meeting of the City of Bradford Metropolitan District Council Regulatory and Appeals Committee on 8th March 2005 it was resolved that: The Masterplan for Bradford City Centre be treated as a material consideration in the determination of planning applications.
- 2.63 The Council and BCR in 2005 and 2006 commissioned consultants to produce the following:
- City Centre Design Guide;
 - City Centre Streetscape Manual;
 - Neighbourhood Development Framework (NDF) for each of the four neighbourhoods identified in the Masterplan.
- 2.64 The purpose of these documents is to take forward the vision of the Masterplan and demonstrate how it can be delivered.
- 2.65 On 16th January 2007, the City of Bradford Metropolitan District Council considered consultation responses to the NDFs and resolved that comments would be accepted as evidence for inclusion in the preparation of the City Centre Area Action Plan.
- 2.66 On 7th February 2007, the City of Bradford Metropolitan District Council's Regulatory & Appeals Committee resolved that: the four Draft Neighbourhood Development Frameworks for the City Centre be treated as material considerations in the determination of planning applications pending the adoption of the Bradford City Centre Action Area Plan.
- Manningham Masterplan***
- 2.67 This masterplan envisages improving the link between Manningham and the City Centre. It identifies that Drewton Street and Hamm Strasse form a large physical barrier between Manningham and the city centre. The link is a large, busy road corridor, which has no active frontage and is surrounded on both sides by high retaining walls and planting. The entrance to Manningham Lane currently creates a negative impression, dominated by traffic and road infrastructure, with numerous lighting columns, signals and signs.
- 2.68 The Masterplan proposes a mixed used development to replace the existing shops on this corner to satisfy the following objectives:
- Be of a scale large enough to sit comfortably next to the vast road junction;
 - Relate to the city centre buildings adjacent ;
 - Have a high quality design to raise the prominence of this gateway location into Manningham;
 - Suit the distinctive character that Manningham possesses.

- 2.69 It is also proposed to encourage positive development on derelict and disused sites on the road frontage and improve the appearance of the existing shop and business facades.
- Airedale Corridor Masterplan***
- 2.70 The Airedale Partnership was established in February 2003 to provide strategic leadership for the regeneration of Airedale. This grouping of leaders from business, education and the community, in conjunction with Bradford Council and Yorkshire Forward, saw the need for a strategic masterplan to deliver the aspirations of the Bradford 2020 Vision for Airedale.
- 2.71 The aim of the masterplan and strategy is to establish a framework that will deliver a step-change in the local economy that benefits local people and protects and enhances the environment. It will advise future planning frameworks and investment plans for the Bradford District and the wider region.
- 2.72 The key aspects of the brief were to establish how to deliver the Bradford 2020 Vision in Airedale and:
- Stimulate economic growth;
 - Support the development of key employment sites;
 - Encourage the renaissance of the town centres;
 - Promote e-business technologies;
 - Support skill development;
 - Connect local people to economic opportunity;
 - Support the rural economy;
 - Develop cross boundary initiatives.
- 2.73 Airedale masterplan has a particular role in supporting the city centre initiatives, including transport connectivity and developments along the line of the proposed Bradford Canal that forms a green link between Airedale, Manningham and the city centre. Integration of the thinking behind the Airedale, Manningham and Bradford city centre masterplans will deliver major benefits to Bradford District, and together they will help to provide the evidence base that will shape the future Local Development Framework.
- Leeds-Bradford Corridor Study***
- 2.74 The Leeds Bradford Corridor covers a nine-mile area joining Bradford and Leeds city centres. The project aims to revitalise the neighbourhoods, employment opportunities, environment and transport links in the corridor, connecting people living there to the growing economies in the two cities.
- 2.75 The Corridor represents a key transformational project which will build on the growing linkages between the two cities and the objectives of the Northern Way strategy to boost the economies in the north of England. The joint working between Bradford and Leeds within the corridor area is one part of a wider project of collaboration between the two districts.
- 2.76 Based on a feasibility study (Leeds-Bradford Corridor Study by WYG) completed in summer 2007, work has been underway to develop and deliver activity under the following thematic strands:
- Employment sites and economic development;

- Local connectivity and transport;
 - Future housing growth and affordability;
 - Skills and employment.
- 2.77 An officer steering group and thematic task groups have been established, overseen by the two portfolio holders for Bradford and Leeds. Delivery to date has included:
- Business engagement event;
 - Business needs survey;
 - Employment land mapping;
 - Cycle network mapping;
 - Regional Housing Board tour;
 - Logistics academy bid;
 - Job brokerage / housing services project development.
- 2.78 They key aims of the study partnership are:
- To enhance economic development and employment opportunities that would support existing businesses and encourage new employers to the area.
 - To enhance and improve transport quality and connectivity in order to improve the quality of transport between the two city centres and enable better connectivity to employment and business opportunities.
 - To improve housing quality and choice that is available for local people, that will attract new households, respond to changing demand for housing and that will support any future economic growth.
 - To improve the image and appearance of the Leeds-Bradford Corridor.
- 2.79 While these studies were being developed, Leeds and Bradford councils arranged a series of practice forums (Leeds-Bradford Masterclasses) between April and July 2008 in order to facilitate effective networking between prominent officers and elected members in both cities and to highlight that this potential could not be realised without deeper and wider cooperation between the two authorities.
- 2.80 The presentations at the seven practice forums, combined with the reflections of discussion groups at each event, provided a significant body of evidence of thinking and practice from around the UK. Staff from both cities had the opportunity to enhance their knowledge of key policy areas affecting them, and draw on the experience of practitioners who had grappled with comparable issues. Bradford and Leeds are already taking forward key learning points from the events, both at a strategic level and in operational terms. A Project Board has now been set up to further develop and monitor projects in the Leeds-Bradford corridor.
- Shingley Town Centre and Canal Road Corridor Masterplan***
- 2.81 As part of the regeneration activities occurring throughout the Bradford District, and specifically, within the three key masterplan areas of the City Centre, Airedale and Manningham, the Council is take forward the fourth masterplan initiative, Shingley Town Centre and Canal Road Corridor.
- 2.82 The Corridor is being promoted as a potential Eco Settlement as part of the Leeds City Regions Development Programme. The Council is in the process of commissioning consultants to prepare the masterplan for the corridor. It is anticipated that the corridor masterplan will be published in late 2011 and will inform the Shingley Canal Road Corridor AAP.

Leeds Bradford International Airport

- 2.83 Links to Leeds Bradford International Airport from Leeds and Bradford are given high priority in the Leeds City Region Transport Strategy. The Airport is a major international gateway for the LCR and contributes to the economic performance of the Region. Local businesses have commented that surface access to the Airport is generally poor and that both road and public transport access should be improved. Planned future expansion of the airport as the country emerges from the recession will require improvements to the local transport network to enhance access for passengers and staff and a range of projects have been recommended for implementation over different timescales in the LCR Connectivity Study.

Informing the Study Methodology

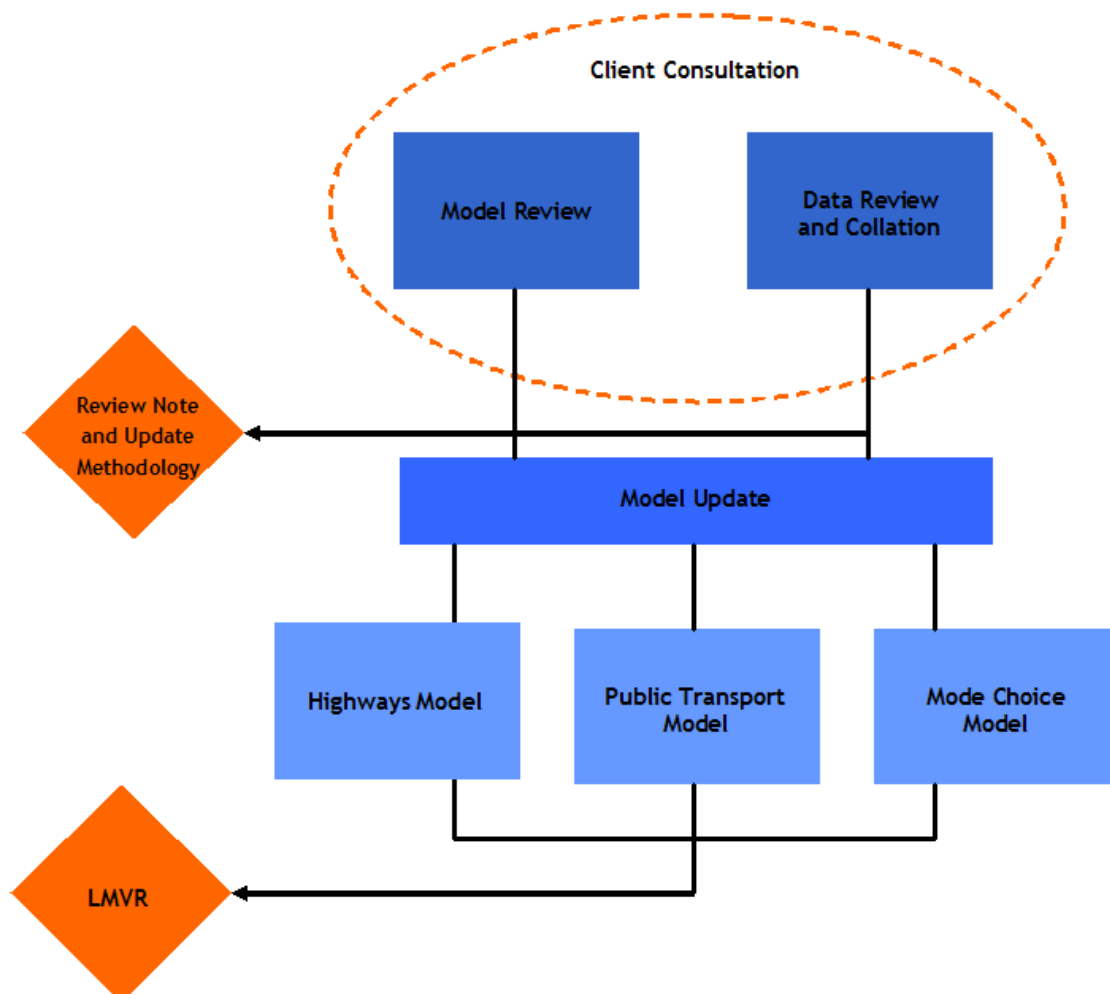
- 2.84 A hierarchy of national, regional and local policy and guidance forms the policy context to guide the LDF process. A key challenge is to make sure that the ‘top-down’ national policy meshes well with the more ‘bottom-up’ local policy to produce workable strategies for the area.
- 2.85 As indicated in the paragraphs above, there is a focus within the national and regional policy on the aspiration for sustainable development options; in local policy the reality is that planning for sustainable development has to be set in the context of the reality of local conditions and the needs of the local population.
- 2.86 Ongoing work by CBMDC has already informed a number of key transport investment gaps and infrastructure priorities. As part of our analysis in this work, we will examine the fit between the existing transport infrastructure plan and the projected LDF development. We will indicate where the development and transport plan support each other, and also where the transport plan may need updating to better reflect the ongoing development of the LDF Core Strategy.
- 2.87 The framework set out in the GTA is broadly consistent with the other national, regional and local transport planning policy, and in the absence of the awaited Guidance on the Transport Evidence Base document, will be used to form the guiding principles used in this study.
- 2.88 The five NATA objectives of Environment, Safety, Economy, Accessibility and Integration will form the appraisal framework against which each of the Core Strategy Options is tested.
- 2.89 By using the GTA and NATA principles, which are themselves consistent with the DaSTS national and emerging regional objectives, the elements of the transport evidence base for the Core Strategy will be themselves consistent with existing and emerging policy and objectives.

3 Methodology

Phase 1: Model Update

- 3.1 CBMDC has a multi-modal transport model of the district comprising:
 - a public transport model (TRIPS);
 - a traffic model (SATURN); and
 - a mode-choice model (TRIPS);
- 3.2 As part of the commission the models have been updated to better reflect 2009 conditions following the methodology shown in Figure 3.1.
- 3.3 A model review was undertaken to ascertain the state of the models, and the most efficient procedures for updating the models for use in this Core Strategy study. The model review process is reported in the separate report “Model Review Note: June 2009”.
- 3.4 Following this, a model update was performed and is reported in the separate report “Local Model Validation Report: September 2009”.

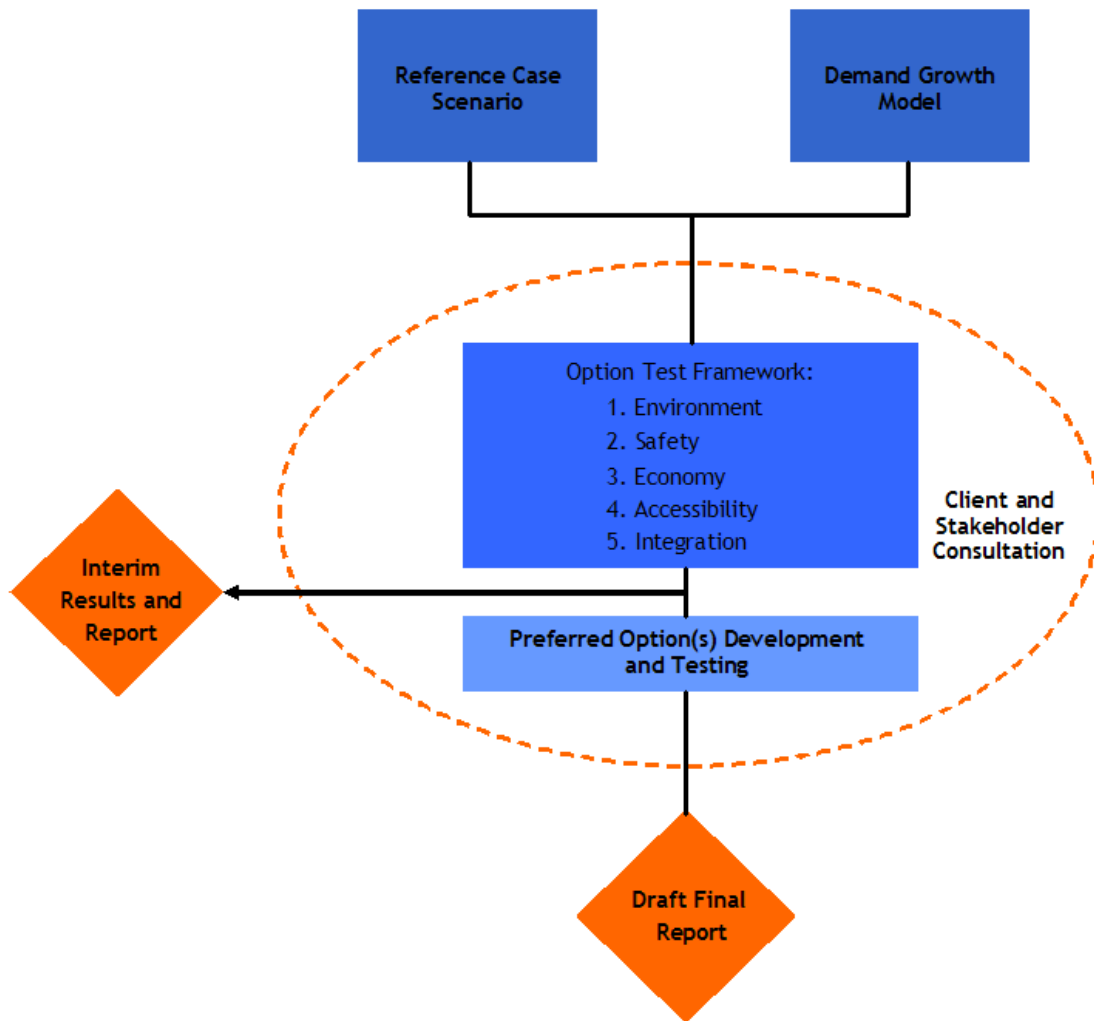
FIGURE 3.1 METHODOLOGY PHASE 1: MODEL UPDATE



Phase 2: Option Testing and Appraisal

- 3.5 A consultation process was entered into with the other districts and bodies/ organisations in West Yorkshire, including North Yorkshire County Council, Craven District Council, METRO and the Highways Agency. The objectives of the consultation were to inform stakeholders about the study, seek agreement and input into the study methodology being used, allow stakeholder input into the Option Appraisal Framework, and give an opportunity for stakeholders to inform us of wider transport issues. The consultation process and results are detailed in Chapter 4 of this report.
- 3.6 In tandem with the consultation process, a set of scenarios representing the Core Strategy Options and a Reference Case were developed for testing in the updated multi-modal transport model. The overall methodology for this phase is outlined in Figure 3.2. This process includes a sophisticated trip generation, trip purpose, modal split and assignment analysis (the Demand Growth Model), and is fully detailed in Chapter 5 of this report.
- 3.7 Finally, the various scenarios developed in the Demand Growth Model were run in the multi-modal transport model, and outputs were extracted into the Appraisal Framework to assess the transport impacts of each Core Strategy Option as detailed in Chapter 6 of this report.

FIGURE 3.2 METHODOLOGY PHASE 2: OPTION TESTING AND APPRAISAL



4 Stakeholder Consultation

General Approach

- 4.1 CBMDC supplied us with a list of stakeholders comprising the surrounding districts in West Yorkshire and the relevant transport bodies:
- Calderdale Metropolitan Borough Council;
 - Kirklees Metropolitan Council;
 - Leeds City Council;
 - Wakefield Metropolitan District Council;
 - Craven District Council;
 - North Yorkshire County Council;
 - METRO;
 - Highways Agency.
- 4.2 Although CBMDC have conducted their own bi-lateral and multi-lateral meetings with the above stakeholders throughout their LDF process, we contacted each stakeholder and arranged a separate stream of consultation meetings without the presence of personnel from CBMDC to ensure an independent and unbiased exchange of views and information.
- 4.3 Each stakeholder was sent a short presentation outlining the study and the questions we hoped to answer from the consultation process, which were:
- Any transport comments or concerns related to highways or public transport that could inform the development of Bradford's Core Strategy?
 - Any comments or concerns on the methodology employed for the study?
 - Any other transport issues that should be taken into account in the study?
 - Any other wider issues that could be pertinent not covered by the above?

Stakeholder Views

- 4.4 Full notes of each stakeholder meeting are provided in Appendix A1. The following is a brief summary of the key points made by each of the stakeholders that are of importance regarding Bradford's Core Strategy:

Calderdale MBC

- Most of the housing growth in Calderdale will be focussed in the east of the district around Halifax, Elland and Brighouse.
- The main transport consideration in Calderdale relevant to this study is the highway constraint posed by the Hipperholme Crossroads junction.
- There may be opportunities to improve bus priority on the Huddersfield-Bradford route through Brighouse.

- There is a lot of SHLAA land identified in the Northowram-Shelf corridor, and if brought forward there will be a need to review this link into Bradford and to investigate the opportunities for public transport improvements.

Kirklees MC

- Kirklees would like to see the various Districts working together to develop joint schemes; both infrastructure schemes and traffic management schemes.
- There is congestion along specific corridors in Kirklees, and although traffic is busiest in North Kirklees, there is a view that the severity of the problem is relative, and not as severe as elsewhere in the region.
- Bus currently competes with rail for trips between the Districts. Opening Low Moor station would improve the rail 'offer' assuming connections can be made. Capacity at Bradford Interchange is now available to support extra demand from Low Moor.
- There is a need to compare cross-boundary growth predictions, both between each District and with the Highways Agency. There should be some agreement over the assumptions taken forward for assessment.

Leeds CC

- LCC is interested in how highway infrastructure can be delivered to support the growth point in Holmewood, without impacting on the green areas around Tong Village.
- Access to Leeds-Bradford airport from Bradford should be considered.
- A strategic view is needed on how overall growth can be delivered, rather than progressing a series of smaller developments independently. As an example, growth in Esholt and a new station at Apperley Bridge might be a solution for new residents in that particular area, but to what extent will this have a knock on impact on existing rail users currently joining the service downstream?

Wakefield MDC

- Wakefield decided not to meet us as their relative location to Bradford meant that they had few concerns about Bradford's Core Strategy. They also stated that they had no concerns with our study methodology.

Craven DC

- Craven would have concerns over any development close to the South Craven border in terms of settlements merging together as well as in terms of any additional impact on the highway network in and around the South Craven Ward villages of Crosshills, Sutton and Glusburn.
- Transport issues in Craven can be summarised as the desire for a new rail station at Cross Hills, improved rail based Park and Ride facilities, the need to do something about the level crossing at Kildwick and HGV pressure on the A6068 route into Lancashire.
- Transport interaction with Bradford includes out-commuting to Bradford and Leeds and in-commuting to Skipton, busy trains and inadequate PnR parking to

support the level of commuting. There is no economic benefit to use Metro Zone 7.

- Road traffic problems in Craven are more localised than a cross border issue.

North Yorkshire CC

- North Yorkshire decided not to meet us but informed us of their own modelling work.

METRO

- Metro's preliminary view is that development should focus on existing public transport corridors, to keep good corridors protected, but not to the extent that, without intervention, conditions on those corridors are worsened.
- Access from Bradford district to Leeds-Bradford airport should be considered.
- First Bradford has introduced significant cutbacks in Bradford. Approximately 6% of services will be affected. Cutbacks are to both number of services and frequencies.
- Generally, bus reliability (lower variance in journey times) is seen as a key future deliverable in terms of improving the PT offer. This can be achieved using, eg ITS, to manage the journey, and is less expensive than achieving absolute reductions in journey times.
- Environment - should consider how carbon emissions could be included within the allocation determination process.
- Congestion - to investigate the potential for using Traffic Master data to identify indicators of congestion, particularly for the 3 routes included in the Urban Congestion Target Reduction Plan. There is also a need to be able to evaluate public transport congestion in terms of passenger numbers, and reliability is a big issue for public transport users.
- Safety - specific consideration of accidents involving children.

Highways Agency

- The base 2007 flows used in the Highways Agency's model for the strategic road network are observed values and can be used in this study to validate the Bradford highway model in these areas.
- Initial results of the Highways Agency modelling work show that there is little difference in impact on the strategic road network between the four Core Strategy options.
- It was agreed that it makes sense to share our work on trip rates to aim for a level of consistency with those used by the Highways Agency. There may be an opportunity to share the results emerging from the growth model work in Bradford as they will provide a detailed assessment of cross-boundary trips resulting from each of the Core Strategy options.

Summary

- 4.5 In addition to providing CBMDC with additional information with which to inform the development of their Core Strategy, the consultation exercise has been used to inform the methodology used in this study.
- 4.6 In particular, the following themes drawn from the consultation were used to inform development of the appraisal framework:
- Concern about changes in cross-border travel patterns - we have included in the 'Integration' objective of the appraisal framework a measure of the impact on the connecting roads between Bradford and the surrounding districts.
 - Concern about public transport corridors within Bradford - we have included in the 'Economy' objective of the appraisal framework measures of journey times on each individual radial transport corridor in Bradford.
 - Concern about safety considerations for children - we have included in the 'Safety' objective of the appraisal framework measures looking at the impact on roads that currently have high accident rates in Bradford.

5 Option Testing

Introduction

- 5.1 This section describes the methodology adopted to evaluate the LDF settlement options presented by CBMDC. This section does not cover the update of the base year model that is described in detail in the Bradford Multi Modal Model “Local Model Validation Report: September 2009”.

Methodology Overview

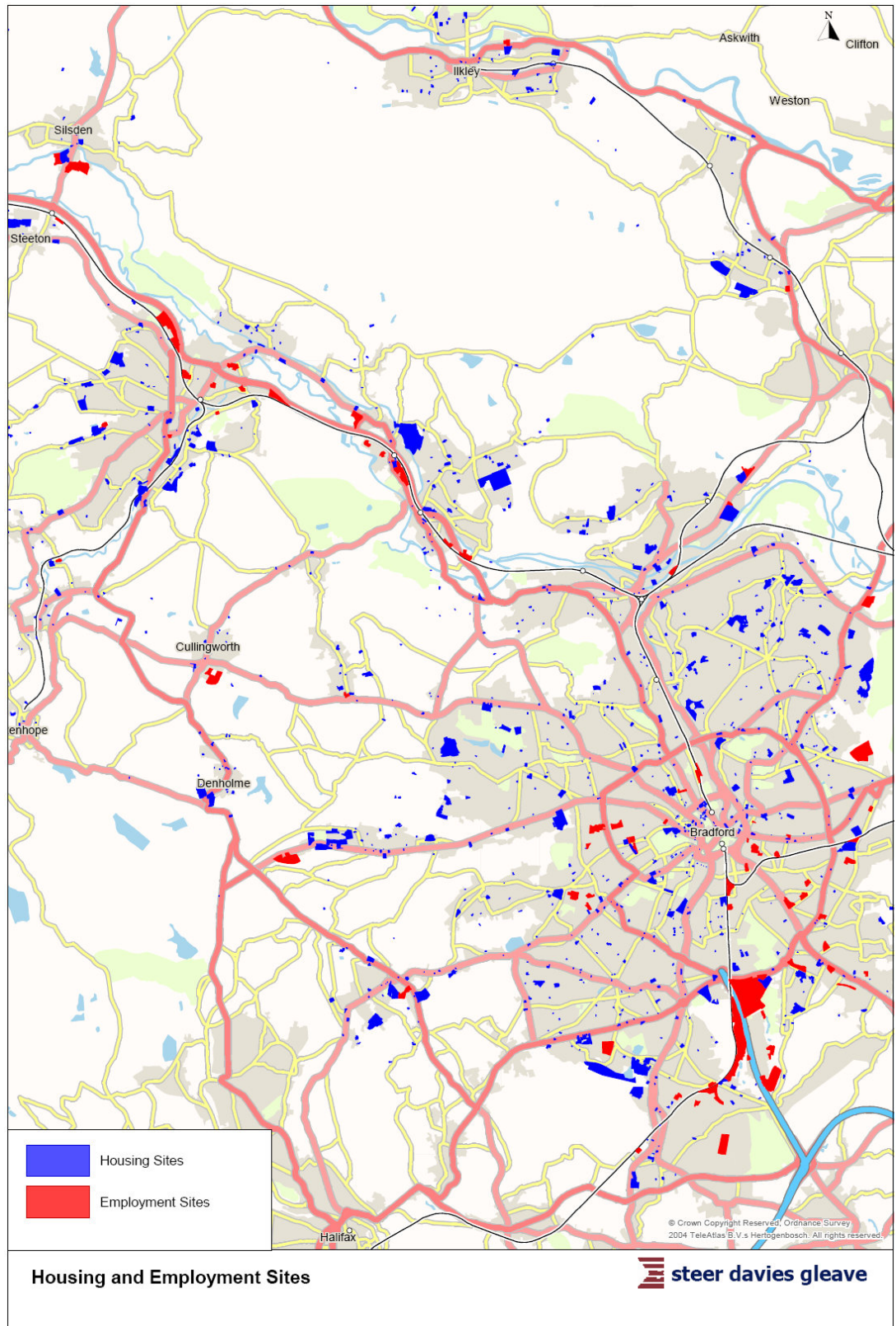
- 5.2 The approach to growth forecasting aimed to use the best available land use allocations that could be provided by CBMDC planners to produce forecasts that are consistent with the Regional Spatial Strategy (RSS).
- 5.3 The Yorkshire and Humber RSS (May 2008) specified the construction of 2,740 new net dwellings per year from 2008 until 2026 (the last year of the plan) that means 49,320 net new dwellings by the forecast year of 2026. Although the specific targets contained within the RSS are no longer being enforced by the current government, the rate of growth assumed for Bradford corresponds with latest CBMDC thinking.
- 5.4 The existing land allocations for housing and employment are identified in planning data supplied by CMBDC. The existing land allocations fall short of providing for the number of dwellings required by the RSS.
- 5.5 For the development of the forecasts of trip growth, five scenarios were developed. The first was a “**reference case**”, which was developed to reflect the existing land use allocations and the four Options that satisfy the “**RSS**” requirements. The reference case forms a step in the process to produce the growth forecasts that have been applied.
- 5.6 The following key assumption is made that is at the heart of the growth forecasts:
- The forecast growth in trips is constrained to the trips generated by the assumed net increase in the number of dwellings. It is further assumed that if the dwellings are built and occupied there will be employment to support the additional population.
- 5.7 In summary, the process for production of the Bradford RSS growth forecast was:
- Receive current land allocations from CMBDC planners for:
 - Employment land; and
 - Housing land.
 - Apply trip generation rates to the number of net new dwellings in each forecast year and produce “production” trip ends by journey purpose and time of day;
 - Allocate the additional “production” and “attraction” trip ends to the appropriate geographical origins and destinations;
 - Split the additional trip ends by the time of day model period;
 - Apply mode split assumptions to the additional trip ends;

- Add the new trip ends to the base year matrices and produce new distribution and forecast year matrices.
- Assign the new forecast year matrices to the public transport and highways model assignment models and the mode choice model.

Data Supplied by Bradford

- 5.8 Three types of data were supplied by CBMDC during the early stages of this study and they were:
- Existing housing land allocations;
 - Existing employment land allocations;
 - Future RSS compliant dwelling allocations for 2026.
- 5.9 The **existing housing land allocations** were provided on the 2nd July 2009 in the form of an extract from the Housing Land Register. Supporting GIS files were provided. The data also included an estimated yield which indicated land was available for an additional 20,702 dwellings. These dwellings associated with existing allocations underpin the reference case forecast.
- 5.10 The **existing employment land allocations** were provided on the 28th May 2009 in the form of a spreadsheet and supporting GIS files. The spreadsheet provided a site by site breakdown of existing employment land allocations that included the total undeveloped site areas. The sites were not specifically categorised by the expected form of development other than we were informed that most of the sites have been employed for any of the following:
- B1 office development;
 - B2 manufacturing;
 - B8 warehousing.
- 5.11 The land use type is important to the trip generation rate that is applied to the development. In the absence of specific site by site categorisation we assumed sites in the centre of Bradford would be B1, peripheral sites (e.g. the development site on the M606) would be B2 and B8 and all other sites would be an average of all three types.
- 5.12 The full selection of existing housing and employment sites is displayed in Figure 5.1.
- 5.13 The **RSS compliant settlement allocations** were supplied by Bradford on the 5th June 2009 for the four Options, with subsequent data provided for the Preferred Option in January 2010. The data existed at two levels. At the higher level the assumed 49,320 net dwellings are allocated to regional centres, principle towns and local service centres. At the lower level Bradford provided a split of dwellings by the zones that formed the geographical summaries presented at the higher level.
- 5.14 The lower figures were expressed at a zonal level with a categorisation of likelihood of a site being taken up that was expressed as High, Medium or Low. We have converted this categorisation into an index describing the likely amount of development within each zone by assuming High = 60%, Medium = 30% and Low = 10%.

FIGURE 5.1 EXISTING ALLOCATION OF HOUSING AND EMPLOYMENT SITES IN THE BRADFORD DISTRICT



- 5.15 These high level figures are summarised in Table 5.1 and represented graphically in Figures 5.2 to 5.6 for Options 1 to 4 and the Preferred Option respectively. Note that whilst a rounded figure of 50,000 net dwellings is assumed in Table 5.1 the actual number applied in the 2026 forecast is 49,320 dwellings, as indicated in paragraph 5.3 earlier, calculated as 18 years times the 2,740 target net annual dwelling build from the base year of 2008. The number of dwellings in the Preferred Option, is slightly lower because the draft Housing Trajectory now factors in dwellings already completed.

TABLE 5.1 DWELLING ALLOCATIONS

Settlement Category	Settlement	Dwellings				
		OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
Bradford	City Centre	5,000	7,500	7,500	7,500	5,000
	Canal Rd	2,750	2,500	3,750	3,750	5,000
	North East/Esholt	7,500	3,750	7,000	4,500	5,000
	South East/Holmewood	7,500	3,750	9,500	9,500	5,000
	South West	3,500	2,500	1,750	1,750	4,000
	Noth West	3,500	2,500	1,750	1,750	5,000
	Shipley	2,750	2,500	3,750	3,750	2,000
Principal towns	Ilkley	5,000	3,000	5,000	2,500	1,750
	Keighley	10,000	7,000	5,000	2,500	4,000
	Bingley	675	5,000	750	2,500	1,500
Local Growth Centres	Burley	50	800	350	1,500	500
	Menston	450	1,000	550	1,500	1,000
	Queensbury	400	500	500	500	1,500
	Silsden	50	4,000	350	2,000	1,750
	Steeton	225	1,000	1,000	1,700	800
	Thornton	225	500	250	350	700
Local Service Centres	Addingham	25	100	100	150	350
	Baildon	175	300	250	250	450
	Cottingley	25	200	100	250	300
	Cullingworth	25	200	100	250	350
	Denholme	25	350	100	250	400
	East Morton	25	100	100	150	150
	Harden	25	200	100	250	150
	Haworth	25	250	100	250	400
	Oakworth	25	200	100	250	200
	Oxenhope	25	100	100	150	100
	Wilsden	25	200	100	250	350
SUMMARY						
Bradford		32,500	25,000	35,000	32,500	31,000
Principal towns		15,675	15,000	10,750	7,500	7,250
Local Growth Centres		1,400	7,800	3,000	7,550	6,250
Local Service Centres		425	2,200	1,250	2,450	3,200
ALL		50,000	50,000	50,000	50,000	47,700

- 5.16 For clarity please note that in Table 5.1 and the associated diagrams Bingley appears as a Local Growth Centre in Options 1, 3 and 4. In Option 2, Bingley is designated a Principal Town.

FIGURE 5.2 DWELLING ALLOCATIONS - OPTION 1

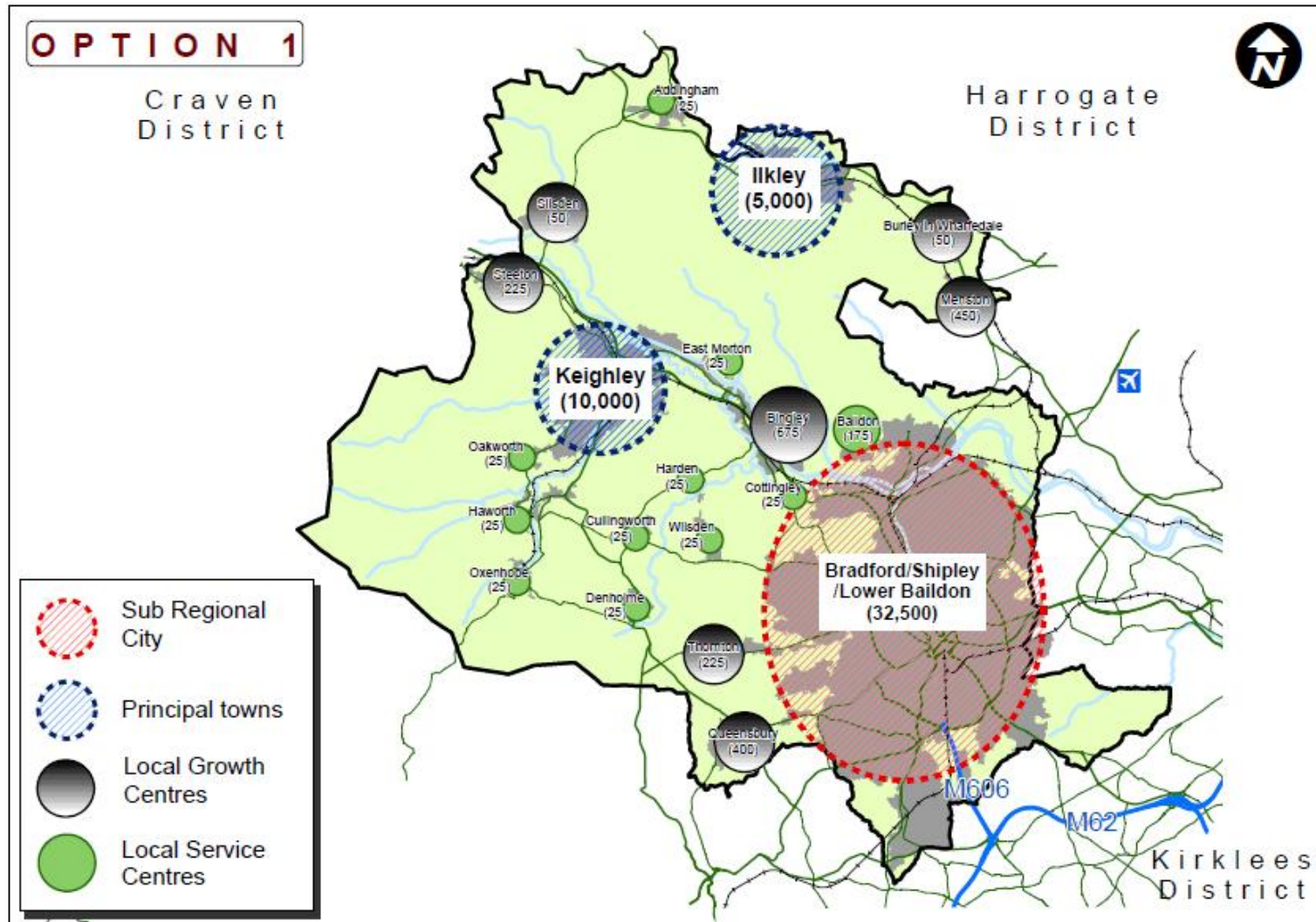


FIGURE 5.3 DWELLING ALLOCATIONS - OPTION 2

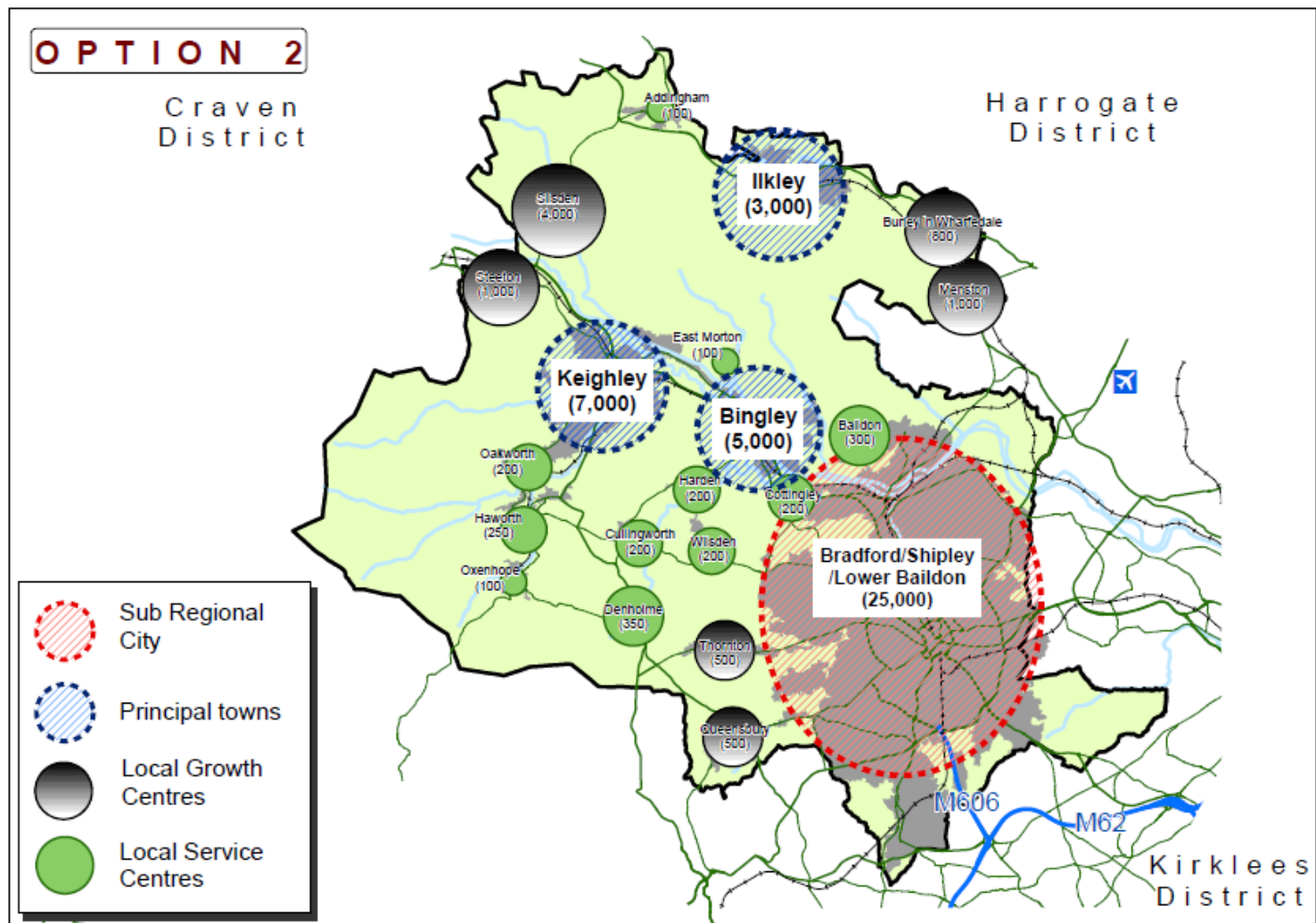


FIGURE 5.4 DWELLING ALLOCATIONS - OPTION 3

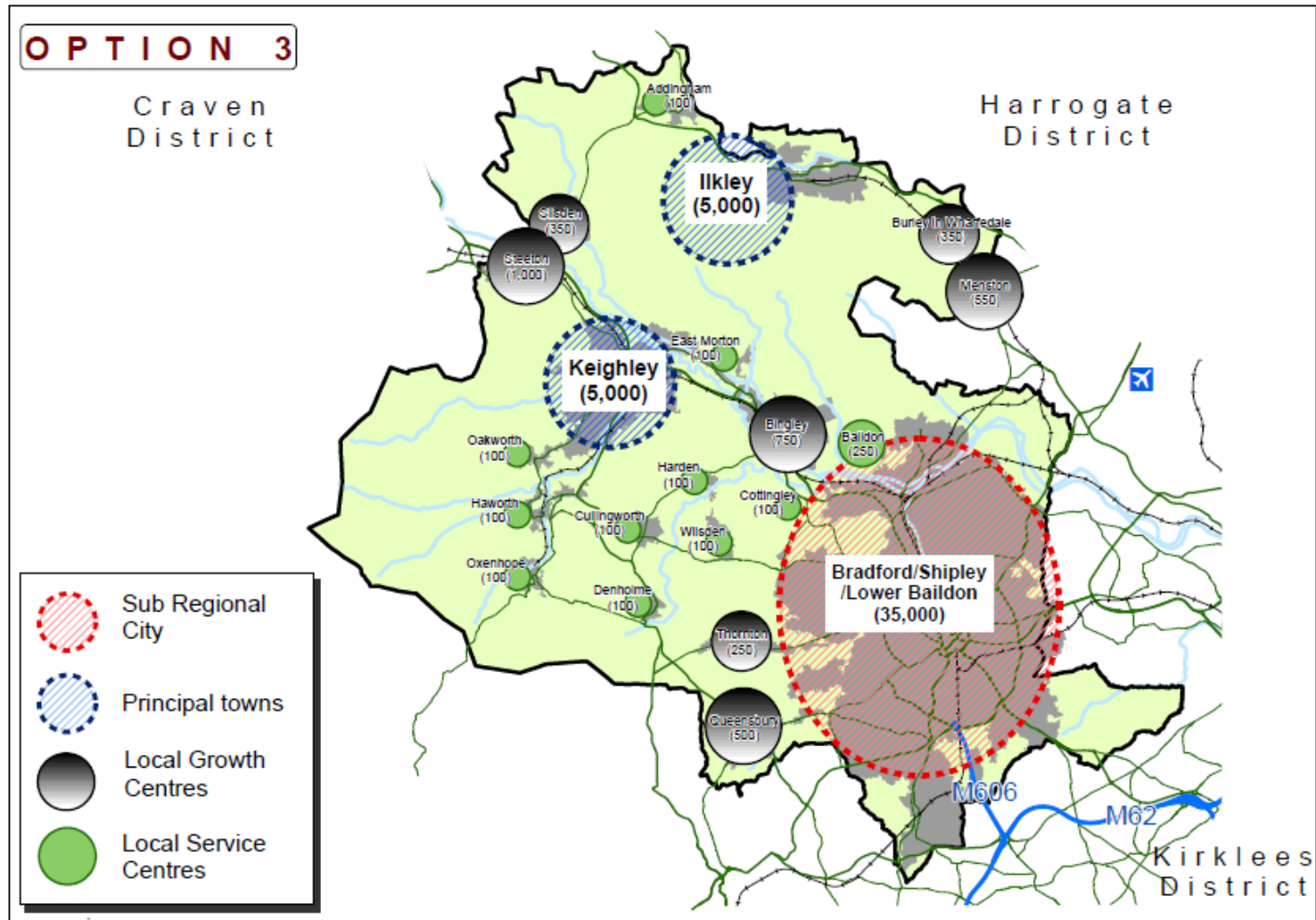


FIGURE 5.5 DWELLING ALLOCATIONS - OPTION 4

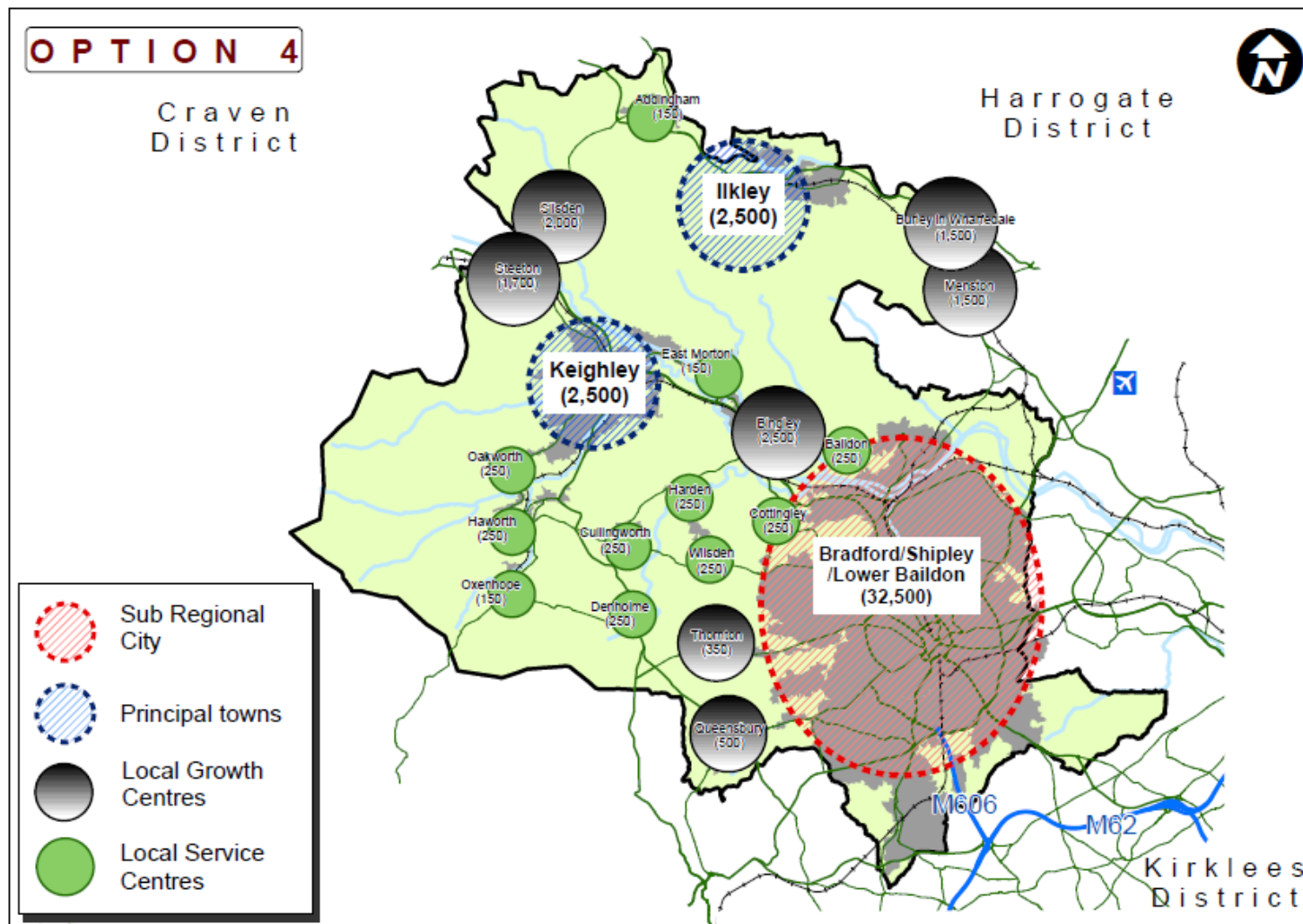
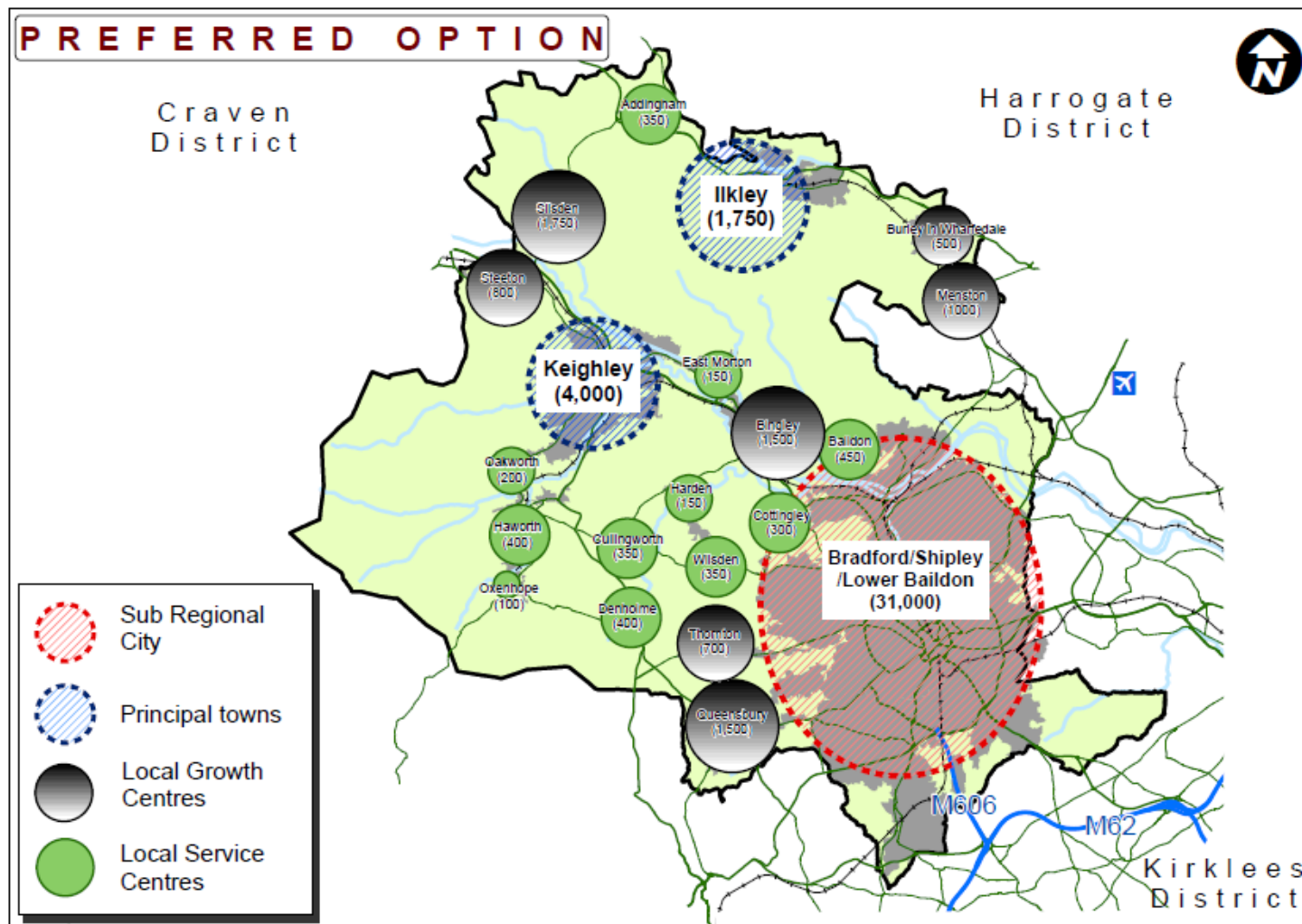


FIGURE 5.6 DWELLING ALLOCATIONS - PREFERRED OPTION



Trip Generation

Employment Densities

- 5.17 The first step in the process to convert employment land allocations to trips was to move from projections of floor space to projections of number of employees. To estimate the employment generated by the expected business developments average employment densities by development type have been used.
- 5.18 The employment land allocations provided only site areas, rather than floor space that is essential for trip generation. In the absence of suitable corresponding information specific to Bradford, a method of estimating floor space from site area was imported from relationships identified in analysis of Leeds land use data. These ratios are summarised in Table 5.2, although not all employment types have been used in this study.
- 5.19 This table shows that for all employment development sites other than offices there is less floor space than site area. For offices, there is greater floor area than site area, reflecting the multi-storey nature of typical office developments.

TABLE 5.2 FLOOR SPACE AREA ASSUMPTIONS BASED ON SITE AREA

Employment Type	planned floor space area (m ²) per site area (m ²)
Business Uses	0.272
General Industry	0.325
Light Industry	0.382
Offices	1.149
Waste Transfer Station	0.038
Warehousing & Distribution	0.371
Vehicle Servicing & Related	0.038

Residential Trip Rate Assumptions

- 5.20 Daily trip rates for housing sites were derived by Mouchel for previous work in West Yorkshire and these were verified by producing an independent set of trip rate outputs from TRICS and comparing the results for London, West Yorkshire and UK overall. This independent analysis gave similar trip rates to those of Mouchel, therefore it was deemed appropriate to use the Mouchel trip rates. The trip rate is summarized in Table 5.3.

TABLE 5.3 MOTORIZED TRIP GENERATION RATES BY DEVELOPMENT

Development Type	Daily Trip Rate
Residential (trips / hhd)	3.80

- 5.21 The residential trip rate was chosen carefully, since in TRICS this is split into categories such as: flats privately owned; houses privately owned; mixed private housing; sheltered housing, and nurses' homes. For the overall residential trip, the trip rate for mixed private housing rate was used. This represents a mix of 10% flats and 90% houses and has been assumed to be the overall mix of future developments in Bradford.

Employment Assumptions

- 5.22 To estimate the number of jobs generated by the expected business developments average employment densities by development type have been used and they are summarised in Table 5.4.

TABLE 5.4 EMPLOYMENT DENSITIES (SQM PER EMPLOYEES)

Employment Type	employment densities (sqm per employee)
Business Uses	34
General Industry	34
Light Industry	42
Offices	22
Waste Transfer Station	80
Warehousing & Distribution	65
Vehicle Servicing & Related	34

Source: *Employment Densities: A full Guide, Final Report, English Partnerships & the Regional Development Agencies, Arup Economics & Planning.*

Dwelling and Employment Forecasts

- 5.23 Before describing the trip forecasts in detail it is worthwhile considering some of the headline forecasts at this stage. Table 5.5 compares the reference case and options forecasts with TEMPRO v5.4 for the forecast year 2026 and the year 2019 that provides a useful reference point for other data sources.

TABLE 5.5 DWELLING FORECASTS

	2019	2026
Reference Case	20,702	20,702
Options 1-4	30,140	49,320
TEMPRO v5.4	35,367	57,558

- 5.24 The reference case forecast of dwellings remains the same for both forecast years as this is the summation of dwellings in the existing land allocations that is irrespective of a timescale. It is simply the number of dwellings that can be found in the existing allocations.

- 5.25 The Option forecasts include the Reference Case values in the total. For example, the target 49,320 dwellings for 2026 include the 20,702 Reference Case dwellings. This means that if there were no more land available beyond the existing land allocations there would be a shortfall of $49,320 - 20,702 = 28,618$ dwellings. This illustrates the scale of challenge presented in finding the additional space to meet the RSS requirements.
- 5.26 TEMPRO is the output portal of DfT's National Trip End Model (NTEM). NTEM is DfT's own forecasting tool that provides standard forecasts of growth in population, housing, jobs and trips. For any future application for major scheme funding from the DfT, their support will depend on promoters demonstrating that their forecasts are consistent with NTEM/TEMPRO forecasts. This is not the case for this planning exercise but it should be borne in mind for future applications of the Bradford multi-modal model. The TEMPRO dwellings forecast are presented here to provide a point of comparison for the RSS forecasts.
- 5.27 Table 5.6 presents several independent employment forecasts from different sources, the origins of which are described in more detail below.

TABLE 5.6 EMPLOYMENT FORECASTS (JOBS)

	2019	2026
Regional Spatial Strategy	51,920	84,960
Experian (workforce)	12,870	21,060
Employment Land Review	19,374	31,703
TEMPRO v5.4	14,382	29,089

- 5.28 As can be seen, there is a wide range in the number of jobs forecast between the different information sources. It was agreed, in consultation with the client, to proceed with the Employment Land Review (ELR) forecast as it was local and the most up-to-date of the forecasts presented.
- 5.29 It was deemed to be wise to remain consistent with TEMPRO but independent of it.
- 5.30 The RSS forecast was rejected as it benchmarked poorly against all of the other forecasts and the assumptions behind it, for example the timescale of the assumed rate of jobs growth, were not clear.
- 5.31 Experian provides forecasts of the level of labour force in Bradford on a year by year basis and the figures reported in the above table reflect the predicted difference in the size of labour force between the forecast year and base year forecasts from 2008. In discussion with the client it was agreed that the Experian forecasts were based on out of date assumptions which typically provide low figures for our region. On this basis it was agreed that these were weaker than the ELR forecasts.
- 5.32 The adoption of the ELR forecast implies that 31,703 new jobs will be created in Bradford by 2026. The calculation is based on initial forecasts of 25,901 new jobs by 2016 which, in agreement with the client, have been constrained to a figure of around 23,000 new jobs by 2019. Expanding the growth pro rata provides a forecast

of 31,703 by 2026. These jobs are taken up by a balance between employees from the new dwellings and employees travelling into Bradford from the surrounding areas.

Trips Forecasts

- 5.33 Having determined the overall volume of dwellings and employment the next task is to generate the resulting trip volumes by journey purpose.
- 5.34 For the four options the net dwellings that are processed are those that are required on top of those that are generated by the reference case. This was illustrated in Table 5.5 in which the net new dwellings for the Options were $49,320 - 20,702 = 28,618$ dwellings. The process illustrated here is the same as the process applied to the Reference Case.
- 5.35 The 28,618 dwellings when multiplied through by the one-way trip generation rate of 3.8 trips per dwelling gives us 108,748 household based one way trips per day.
- 5.36 These trips will exclude the non-home based (NHB) trips and these are estimated by using journey purpose splits that are imported from the 2008 Merseyside Household Information Survey (HIS). This data provides more detailed journey purpose splits than can be provided by the National Travel Survey (NTS). The data is being imported from a city of similar economic performance to Bradford and has been validated at an aggregate level against NTS data for West Yorkshire as illustrated below.
- 5.37 The journey purpose split data for Merseyside was validated to demonstrate its suitability for use in Bradford by inferring which journey purposes in the NTS data for West Yorkshire are home based and non-home based although this would not be a perfect comparison. The validation results are presented in Table 5.7 that demonstrate that the use of the Merseyside data is reasonable.

TABLE 5.7 JOURNEY PURPOSE SPLIT VALIDATION

	Merseyside HIS	West Yorkshire NTS
Home based commute	23.7%	22.9%
Employer's business	5.4%	3.9%
Other	70.9%	73.3%

- 5.38 Table 5.8 shows how the net additional dwellings for the four options are converted into trip end attractions. The 108,748 trip ends generated by the 28,618 dwellings becomes 121,472 trip ends once the 10% additional NHB trips are factored in.

TABLE 5.8 OPTIONS 1-4 TRIP GENERATION BY JOURNEY PURPOSE

Journey Purpose	Journey Purpose Split	Trips
Home based commute	24%	28,771
Home based education	16%	19,807
Home based shopping	19%	23,083
Home based other	29%	34,706
Home based employer's business	2%	2,382
Non home based employer's business	3%	4,162
Non home based other	7%	8,561
Total all trips	100%	121,472

Source: Merseyside Household Information Survey (2008)

Production and Attraction Balancing

- 5.39 Having identified the target trip end totals these were then allocated to the appropriate geography, that is household sites, employment sites or, for those journey purposes for which we have no specific data such as NHB, then the existing trip distribution in the Bradford Multi Modal model is adopted. These allocations are illustrated in Table 5.9 below.
- 5.40 Having forecast the all day productions and attractions by journey purpose and origin it was then possible to make sure the Production-Attraction linkage is plausible and so the appropriate geographical records are expanded to the appropriate trip ends. For example, for a commuting trip to work the housing production trip end is allocated to housing sites data and the employment attraction trip end is allocated to employment sites.
- 5.41 The values illustrated so far are all-day one way trips and the reverse leg is applied during the processing that follows. In this example at this stage we have forecast $121,472 \times 2\text{-way} = 242,944$ trips overall.

TABLE 5.9 2026 ALLOCATIONS OF TRIPS TO GEOGRAPHY BY JOURNEY PURPOSE

Purpose	Production			Total	Attraction			Total
	Housing	Employment	Existing		Housing	Employment	Existing	
HB Commute	28,771			28,771		28,771		28,771
HB Education	19,807			19,807			19,807	19,807
HB Shopping	23,083			23,083			23,083	23,083
HB Other	34,706			34,706			34,706	34,706
HB EB	2,382			2,382		2,382		2,382
NHB EB		4,162		4,162		2,081	2,081	4,162
NHB Other		4,281	4,281	8,562		4,281	4,281	8,562
Sub Total	108,748	8,443	4,281	121,472		37,515	83,957	121,472

Time of Day Split

- 5.42 Having identified the all day trip end totals and to which geographical locations they should be applied the journey purpose splits tabulated below have been applied. The time of day splits have been imported from the Merseyside Household Information surveys (2008).

TABLE 5.10 TIME OF DAY SPLITS

Purpose	Morning Peak Hour	Average Inter Peak Hour	Afternoon Peak Hour	Rest of Day
	0800-0900	1000-1600	1700-1800	
HB Commute	17.7%	2.5%	15.5%	64.3%
HB Education	40.8%	6.3%	3.2%	49.7%
HB Shopping	1.6%	11.7%	5.6%	81.2%
HB Other	3.3%	5.8%	9.4%	81.4%
HB EB	12.3%	5.8%	15.7%	66.2%
NHB EB	14.5%	8.0%	9.5%	68.0%
NHB Other	5.6%	11.0%	4.0%	79.3%

Source: Merseyside Household Information Survey (2008)

- 5.43 Note the large proportions of all day trips that exist in the rest of the day column. This reflects the hourly nature of the three time period models that are morning peak hour, average inter-peak hour and pm-peak hour. This explains why the large trip-end numbers in previous tables are significantly reduced in the actual matrix tables presented later.

Directionality

- 5.44 Directionality factors have also been supplied to the productions and attractions to ensure that the relevant tidality is respected. The assumed tidality factors by time of day and journey purpose are presented in Table 5.11. Taking the example of home-based commuting trips it can be seen that in the morning peak hour 90% of the trips are from home to work with 10% (shift workers) in the reverse direction. The evening peak assumption is the reverse of this and in the average inter-peak hour it is assumed the balance of trips between home and work are even.

TABLE 5.11 DIRECTIONAL FACTORS BY TIME OF DAY AND JOURNEY PURPOSE

	Production	Attraction	AM	IP	PM
HB Commute	Housing	Employment	0.9	0.5	0.1
	Employment	Housing	0.1	0.5	0.9
HB Education	Housing	Ex Distribution IN	1	0	0
	Ex Distribution IN	Housing	0	1	1
HB Shopping	Housing	Ex Distribution IN	0.9	0.5	0.2
	Ex Distribution IN	Housing	0.1	0.5	0.8
HB Other	Housing	Ex Distribution IN	0.8	0.5	0.3
	Ex Distribution IN	Housing	0.2	0.5	0.7
HB EB	Housing	Employment	0.9	0.5	0.2
	Employment	Housing	0.1	0.5	0.8
NHB EB	Employment	Employment	0.5	0.5	0.5
	Employment	Ex Distribution IN	0.25	0.25	0.25
	Ex Distribution IN	Employment	0.25	0.25	0.25
NHB Other	Employment	Employment	0.25	0.25	0.25
	Ex Distribution IN	Ex Distribution IN	0.25	0.25	0.25
	Employment	Ex Distribution IN	0.25	0.25	0.25
	Ex Distribution IN	Employment	0.25	0.25	0.25

Cross Bradford Boundary Commuting Trips

- 5.45 The values presented in the worked examples above represent those commute trips representing new Bradford based employees who find employment in Bradford. In these examples, we exclude employees who will have to originate from outside Bradford.
- 5.46 It has been demonstrated how 28,618 dwellings within Bradford generate 28,771 home-based commute trips to employment within Bradford (Table 5.8).
- 5.47 Table 5.6 indicates that 31,703 jobs can be created from employment land identified in the ELR and, as such, an element of inward commuting is assumed. These home-based commuting trips from outside Bradford are also assumed to have the same directionality assumptions applied.

Cross Bradford Boundary Other Journey Purpose Trips

- 5.48 We have not made the simple assumption that all other journey purposes have an origin and a destination within Bradford. We have applied the following assumptions that are tabulated in Table 5.12.

TABLE 5.12 CROSS BRADFORD BOUNDARY TRIP ASSUMPTIONS

	Within Bradford	Outside Bradford
HB Education	100%	0%
HB Shopping	90%	10%
HB Other	80%	20%
HB EB	90%	10%
NHB EB	90%	10%
NHB Other	90%	10%

- 5.49 Table 5.12 shows that we have assumed:
- All HB education trips will have a destination within Bradford;
 - A 10% proportion of HB shopping trips will have a destination outside of Bradford (e.g. Leeds, the ASDA in Pudsey);
 - 20% of HB Other trips will have a destination outside Bradford;
 - HB EB and all NHB trips will have a destination outside of Bradford.

Mode Split

- 5.50 The final step in the process prior to generating the future year matrices is to split the trips by mode. We have adopted TEMPRO v5.4 car versus public transport mode splits.

Furnessing

- 5.51 Once the final, fully disaggregated trip ends are produced they are then ‘furnished’ against the base Public Transport and Highway matrices to produce the matrices ready for input into the model.

- 5.52 The furnishing process pairs up origin and destination trip ends based on the existing distribution of trips in the base matrices. In general the relative proportions of in- and out-commuters are therefore maintained. However, the additional origin trip ends outside the Bradford District that were forecast through the trip generation exercise are paired with destinations within the district, thus implying a net change in the commuting balance in Bradford towards in-commuting in 2026.

Trip Matrix Sector Analysis

- 5.53 The process of generating the future year matrices is a complex one as evidenced by the processes described in this section and it would be impossible to numerically follow the process of the trip matrix creation from start to finish without producing pages of numbers.
- 5.54 The best means of demonstrating the outputs of the growth forecasting is through sector matrices that compress the 430 zones to 15 sectors. The sectors we have used for this analysis are presented in Figure 5.7.
- 5.55 The base and future year matrices are presented in trip end sector form by origin and destination in Table 5.13 to 5.18.
- 5.56 The total row at the bottom of the table shows growth in overall trips relative to the base, with the volumes for the reference case being in-between the base and the options as expected. The balance of the origins and destination should also be noted that are identical in total across all options including the base and the reference case.
- 5.57 These tables also illustrate the distribution of the demand across the four options, the reference case and the base. It is worthwhile comparing the distribution in these tables with the dwelling settlement in Table 5.1 but note that the distributions in the output matrices will not match the distribution of the dwellings for the following reasons:
- The local service centres have been subsumed within other sectors for clarity therefore there will not be a like-for-like match between the sectors presented here and the geography of the input tables in Table 5.1;
 - Additional Non-Home Based trips distributions will not correspond to the dwelling distributions;
 - The employment attractions will influence the distribution of trips as much as dwellings;
 - Journey purposes that used the existing distribution of trips (that is, either the production or the origin of the journey purpose are not linked to dwellings or employment) will also differ from the distribution of the dwellings settlement.
- 5.58 In spite of the differences bulleted above the pattern of trip origins and destinations map onto each other well with isolated examples that are distorted for the reasons highlighted above.

FIGURE 5.7 SECTOR MAP

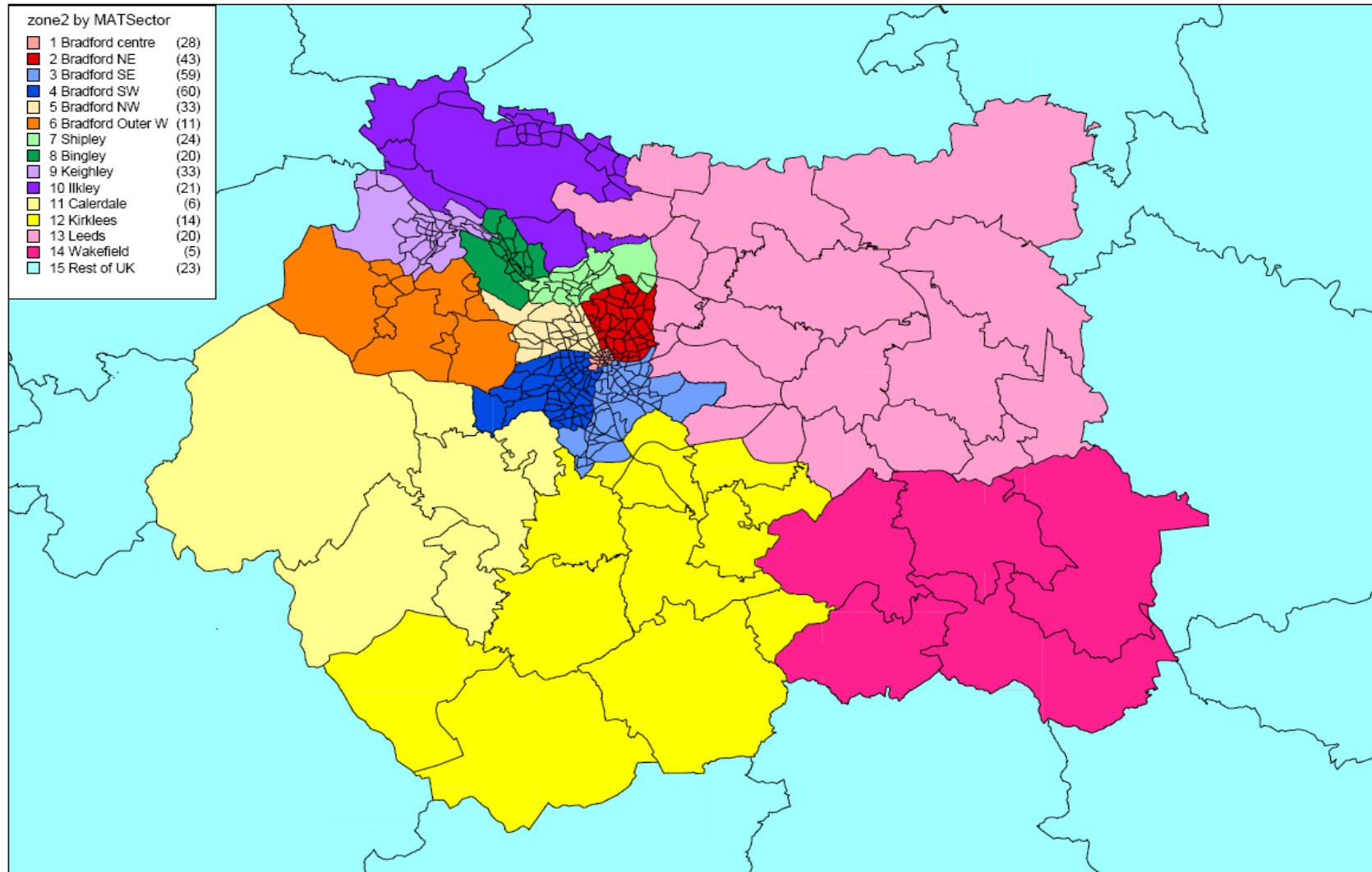


TABLE 5.13 ALL MORNING PEAK ORIGIN TRIP ENDS

Origin	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	1,466	4,128	8,521	10,327	10,474	10,414	8,854
Bradford NE	10,216	13,519	22,559	19,340	18,719	18,743	20,522
Bradford SE	8,564	11,476	19,297	16,268	21,051	21,104	17,607
Bradford SW	10,861	13,759	17,843	17,101	16,435	16,447	19,158
Bradford NW	6,132	8,532	11,799	11,004	10,343	10,353	13,406
Bradford outer W	3,974	5,906	6,729	8,049	7,177	8,046	8,785
Shipley	5,631	6,844	9,760	9,889	14,832	12,855	11,749
Bingley	3,133	5,591	6,593	10,072	6,761	8,261	7,063
Keighley	7,910	10,662	20,126	18,237	16,585	15,086	15,947
Ilkley	4,224	5,537	10,651	13,328	11,259	12,320	10,832
Calderdale	3,394	3,480	3,655	3,655	3,654	3,654	3,655
Kirklees	17,644	18,173	19,235	19,235	19,230	19,232	19,236
Leeds	42,013	43,127	45,368	45,369	45,359	45,362	45,371
Wakefield	2,815	2,897	3,061	3,061	3,060	3,060	3,061
Rest of UK	13,704	14,020	14,655	14,656	14,653	14,654	14,656
Total	141,681	167,652	219,852	219,592	219,592	219,592	219,904

TABLE 5.14 ALL AM PEAK DESTINATION TRIP ENDS

Destination	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	8,910	9,542	10,782	10,888	10,900	10,895	10,802
Bradford NE	5,858	7,753	11,769	11,561	11,538	11,536	11,659
Bradford SE	11,334	15,098	23,154	22,928	23,205	23,208	23,072
Bradford SW	8,383	10,789	15,508	15,432	15,401	15,400	15,589
Bradford NW	5,877	6,796	8,492	8,436	8,401	8,401	8,584
Bradford outer W	2,691	3,880	6,235	6,298	6,241	6,294	6,350
Shipley	5,953	7,010	9,268	9,264	9,539	9,429	9,381
Bingley	2,634	3,963	6,104	6,302	6,143	6,214	6,136
Keighley	6,858	9,452	14,265	14,160	14,019	13,951	14,023
Ilkley	2,847	3,952	6,459	6,611	6,472	6,539	6,466
Calderdale	2,779	3,120	3,812	3,809	3,808	3,808	3,813
Kirklees	15,374	17,611	22,137	22,116	22,108	22,111	22,144
Leeds	48,042	52,644	61,969	61,908	61,936	61,925	61,981
Wakefield	2,581	3,028	3,931	3,925	3,926	3,926	3,932
Rest of UK	11,561	13,015	15,968	15,955	15,956	15,954	15,972
Total	141,681	167,652	219,852	219,592	219,592	219,592	219,904

TABLE 5.15 ALL INTER PEAK ORIGIN TRIP ENDS

Origin	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	4,773	5,472	6,683	7,057	7,071	7,066	6,751
Bradford NE	6,475	7,565	10,223	9,579	9,471	9,472	9,828
Bradford SE	8,555	9,899	13,034	12,433	13,380	13,382	12,711
Bradford SW	7,251	8,354	10,218	10,069	9,945	9,946	10,483
Bradford NW	4,851	5,578	6,711	6,551	6,427	6,428	7,030
Bradford outer W	2,092	2,695	3,321	3,583	3,412	3,583	3,728
Shipley	3,893	4,386	5,483	5,509	6,479	6,089	5,877
Bingley	1,729	2,429	3,023	3,713	3,058	3,355	3,118
Keighley	6,032	7,103	9,932	9,570	9,245	8,950	9,119
Ilkley	2,389	2,866	4,330	4,870	4,457	4,670	4,370
Calderdale	2,710	2,864	3,172	3,173	3,172	3,173	3,173
Kirklees	17,680	18,618	20,494	20,500	20,497	20,498	20,501
Leeds	35,589	37,567	41,526	41,539	41,533	41,536	41,542
Wakefield	3,051	3,196	3,486	3,487	3,487	3,487	3,488
Rest of UK	10,408	10,969	12,091	12,095	12,093	12,094	12,095
Total	117,477	129,560	153,729	153,728	153,728	153,728	153,815

TABLE 5.16 ALL INTER PEAK DESTINATION TRIP ENDS

Destination	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	3,652	4,518	5,977	6,502	6,533	6,520	6,070
Bradford NE	6,665	7,906	11,074	10,151	9,988	9,991	10,501
Bradford SE	8,454	9,855	13,270	12,407	13,772	13,779	12,798
Bradford SW	8,235	9,450	11,385	11,173	10,990	10,991	11,764
Bradford NW	5,302	6,154	7,403	7,175	6,992	6,994	7,863
Bradford outer W	2,266	2,989	3,586	3,962	3,716	3,963	4,171
Shipley	3,496	4,013	5,198	5,238	6,641	6,078	5,767
Bingley	1,633	2,506	3,109	4,106	3,160	3,588	3,245
Keighley	5,740	6,894	10,234	9,717	9,251	8,826	9,066
Ilkley	2,441	2,977	4,771	5,543	4,955	5,258	4,828
Calderdale	2,535	2,637	2,841	2,843	2,842	2,842	2,842
Kirklees	17,645	18,312	19,649	19,657	19,652	19,653	19,653
Leeds	35,821	37,191	39,938	39,955	39,943	39,947	39,948
Wakefield	3,070	3,203	3,470	3,471	3,470	3,470	3,470
Rest of UK	10,522	10,955	11,824	11,829	11,826	11,827	11,827
Total	117,477	129,560	153,729	153,728	153,728	153,728	153,815

TABLE 5.17 ALL PM PEAK ORIGIN TRIP ENDS

Origin	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	9,556	10,094	11,051	11,292	11,296	11,295	11,094
Bradford NE	7,383	8,947	12,448	12,040	11,973	11,973	12,198
Bradford SE	12,200	15,190	21,798	21,417	22,015	22,015	21,595
Bradford SW	8,921	10,787	14,311	14,216	14,139	14,139	14,478
Bradford NW	6,687	7,399	8,571	8,469	8,391	8,391	8,771
Bradford outer W	2,381	3,399	5,192	5,357	5,249	5,358	5,450
Shipley	6,134	6,949	8,733	8,750	9,362	9,117	8,981
Bingley	2,297	3,496	5,156	5,592	5,177	5,365	5,216
Keighley	7,389	9,564	13,875	13,646	13,441	13,254	13,361
Ilkley	2,852	3,761	6,016	6,359	6,097	6,232	6,042
Calderdale	4,232	4,403	4,747	4,747	4,747	4,747	4,747
Kirklees	23,959	25,004	27,095	27,099	27,098	27,098	27,098
Leeds	63,131	65,336	69,749	69,756	69,754	69,755	69,755
Wakefield	2,879	3,040	3,363	3,364	3,364	3,364	3,364
Rest of UK	13,557	14,397	15,648	15,650	15,649	15,650	15,650
Total	173,557	191,766	227,753	227,753	227,753	227,753	227,799

TABLE 5.18 ALL PM PEAK DESTINATION TRIP ENDS

Destination	Base	Reference Case	Option 1	Option 2	Option 3	Option 4	Preferred Option
Bradford Centre	3,438	5,043	7,683	8,706	8,734	8,719	7,855
Bradford NE	10,017	12,115	17,704	15,843	15,490	15,498	16,524
Bradford SE	9,526	11,517	16,663	14,920	17,716	17,730	15,683
Bradford SW	11,460	13,372	16,180	15,763	15,376	15,380	16,950
Bradford NW	6,853	8,367	10,478	10,023	9,641	9,644	11,419
Bradford outer W	4,420	5,641	6,302	7,083	6,574	7,084	7,503
Shipley	4,860	5,662	7,552	7,643	10,537	9,375	8,715
Bingley	3,815	5,335	6,076	8,129	6,188	7,071	6,351
Keighley	7,454	9,249	15,121	14,002	13,078	12,200	12,679
Ilkley	4,661	5,512	8,669	10,248	9,059	9,685	8,782
Calderdale	4,399	4,500	4,702	4,705	4,703	4,703	4,702
Kirklees	26,183	26,844	28,168	28,186	28,176	28,179	28,171
Leeds	51,408	52,767	55,488	55,524	55,505	55,508	55,495
Wakefield	6,625	6,756	7,020	7,024	7,022	7,022	7,020
Rest of UK	18,440	19,085	19,948	19,956	19,952	19,954	19,950
Total	173,557	191,766	227,753	227,753	227,753	227,753	227,799

Assignment and Mode Choice

- 5.59 The completed future year matrices for the reference case and five options were then input into the mode choice and assignment models.
- 5.60 The separate PT and Highways matrices were assigned in their respective models to generate initial future year costs.
- 5.61 These future year costs were fed into the incremental mode choice model to forecast new PT and Highways mode splits matrices. In addition to the mode choice, a trip suppression effect is included which reduces the overall number of trips in origin-destination pairs where costs increase too much in the future year. The matrices are then iteratively reassigned to generate new costs and mode splits until satisfactory convergence is reached.
- 5.62 The outputs of the model operation are reported in Chapter 6.

Accession Analysis

- 5.63 CBMDC has undertaken a number of Accession runs to broadly assess accessibility by sustainable modes (public transport, walking, and cycling) across the district to:
- Hospitals;
 - Secondary schools;
 - Main employment areas;
 - Retail.
- 5.64 The analysis was performed for the three modelled time periods and the resulting isochrone maps, discussed in more detail later, can be found in Appendices A8.1 - A8.10. The maps show the time taken (up to 60 minutes) to reach the four services above by sustainable transport modes. The use of the Accession analysis for appraisal of the Core Strategy Options is detailed in Chapter 6.

6 Option Appraisal

General Approach

- 6.1 The Appraisal Framework used to test each option was based on the objectives outlined in the Guidance on Transport Assessments and the New Approach to Appraisal:
- Environment;
 - Safety;
 - Economy;
 - Accessibility; and
 - Integration.
- 6.2 Within each category quantitative measures which could be extracted from the multi-modal model and used to test the performance of each Core Strategy Option were developed. The information obtained from the stakeholder consultees was used to widen the scope of the measures to reflect the wider potential impacts of Bradford's Core Strategy.
- 6.3 In this study, CBMDC asked for an independent piece of research to assess the differences between the options and help them to inform the Preferred Option and develop the Core Strategy.
- 6.4 However, each category contains multiple measures, both global (measured for Bradford district as a whole), and local (measurements in specific corridors and local areas). Assessing the performance of each option can therefore become difficult; particularly if, for example, options score well on some measures within a category but badly in others.
- 6.5 We have therefore presented the results without commentary as to the relative merit of good or bad performance in particular measures, or indeed categories of measures. However, we have identified within each of the five categories, one global and one local measure that can be considered a proxy measure for overall global and local performance.

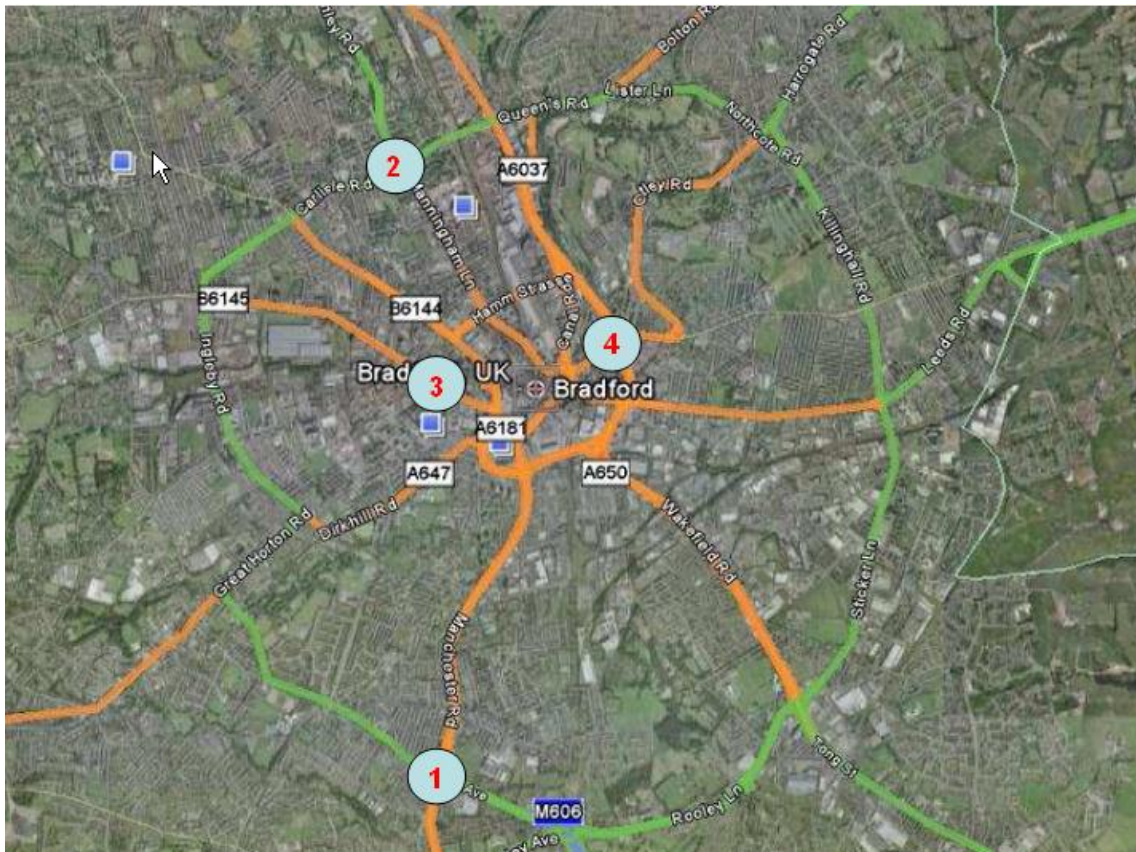
Appraisal Framework

Environment

- 6.6 Six measures were assessed within the environment category:
- Energy Use (litres of fuel);
 - Total Carbon Monoxide (CO kg);
 - Total Carbon Dioxide (CO₂ kg);
 - Total Oxides of Nitrogen (NO_x kg);
 - Total Hydrocarbons (HCs kg);
 - Air Quality Management Areas Impact (AQMAs).

- 6.7 The first five measures are global and refer to the performance of each Core Strategy Option across the transport network for the entire district, and are standard model outputs. Appendices A2.1, A3.1 and A4.1 tabulate the results for each measure and modelled time period.
- 6.8 Within this chapter of the report we report only the Energy Use statistic, because it is a good proxy for overall environmental performance across the network. Similarly, we report the overall impact on the four AQMAs in this chapter, but provide the detailed breakdown in Appendix A6.1-A6.3.
- 6.9 In Bradford there are four areas designated as AQMAs (see Figure 6.1):
- 1: Manchester Road/Mayo Avenue;
 - 2: Manningham Lane/Queens Road;
 - 3: Thornton Road;
 - 4: Shipley Airedale Road/Inner Ring Road.

FIGURE 6.1 LOCATION OF AIR QUALITY MANAGEMENT AREAS IN BRADFORD



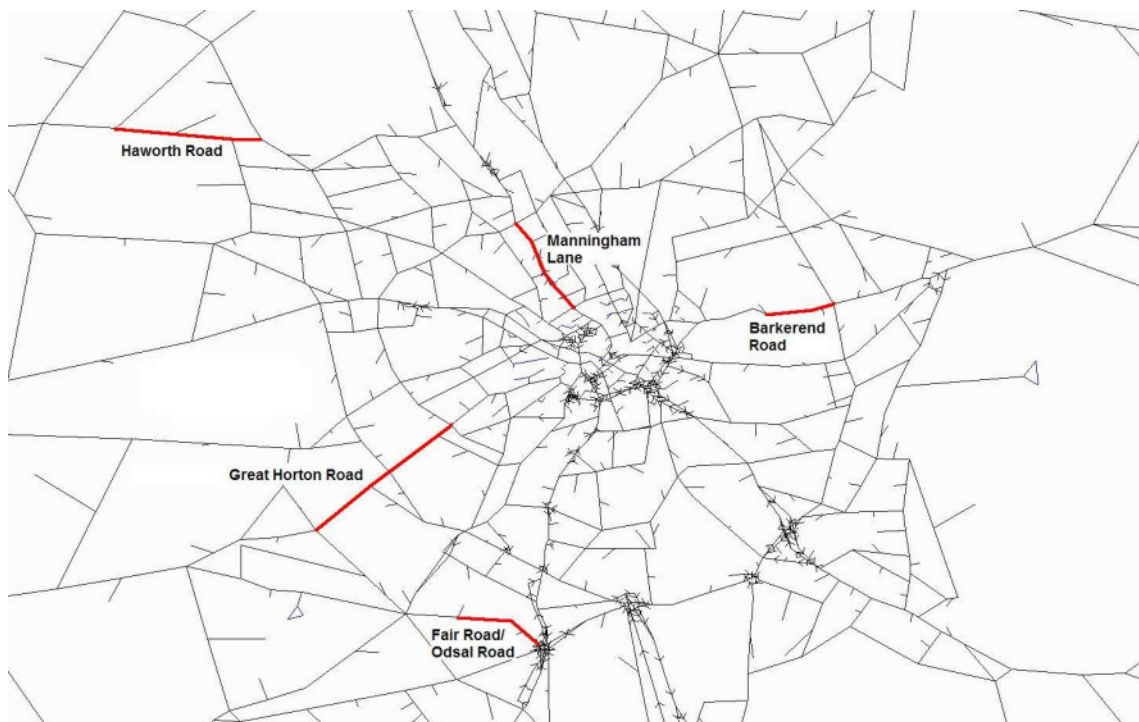
- 6.10 The links within each AQMA were identified within the highways model, and then the total vehicle demand flow in each modelled hour was extracted. The overall measure 'AQMA Impact' is the sum of vehicle demand across the four AQMAs.

Safety

- 6.11 Two measures were assessed within the safety category:

- Total Distance Travelled (highways km);
 - Accident Reduction Areas Impact (ARAs).
- 6.12 The first measure is global and refers to the performance of each Core Strategy Option across the transport network for the entire district, and is a standard model output.
- 6.13 The Total Distance Travelled statistic is a good proxy for overall safety performance across the network; traditionally, it has been assumed in methodologies such as COBA that distance travelled has a relationship with number of accidents. Appendices A2.2, A3.2 and A4.2 tabulate the results for this measure in each modelled time period.
- 6.14 We also report the overall impact on the five ARAs in this chapter, but provide the detailed breakdown in Appendix A7.1 - A7.3.
- 6.15 In consultation with CBMDC officers, five sections of road were identified as having high accident rates and designated ARAs for the purposes of this study, with the goal of reducing road traffic related injuries, particularly for children. The five sections are shown in Figure 6.2 and are as follows:
- 1: Great Horton Road;
 - 2: Manningham Lane;
 - 3: Haworth Road;
 - 4: Barkerend Road;
 - 5: Fair Road/Odsal Road.

FIGURE 6.2 ACCIDENT REDUCTION AREAS IN BRADFORD



- 6.16 The impact is measured as total vehicle demand within each ARA area and, similarly to AQMAs, the overall measure ‘ARA Impact’ is the sum of vehicle demand across the five ARAs.

Economy

- 6.17 Eight measures were assessed within the economy category:

- Total Time Travelled (hr);
- Car Time Travelled (hr);
- Average Speed (kph);
- Queues (hr);
- Public Transport Crowding;
- Public Transport Passenger Time (hr)
- Public Transport Passenger Distance (km)
- All Radials Impact.

- 6.18 The first seven measures are global and refer to the performance of each Core Strategy Option across the transport network for the entire district, and are standard model outputs. Appendices A2.3, A3.3 and A4.3 tabulate the results for each measure and modelled time period.

- 6.19 Within this chapter of the report we report only the Total Time Travelled statistic, because it is a good proxy for overall economic performance across the network. This measure is the sum of both total Public Transport Passenger Time and Car Time Travelled.

- 6.20 Similarly, we report the overall impact on the All Radials measure in this chapter, but provide the detailed breakdown in Appendix A5.1 - A5.6.

- 6.21 Eight major radial routes to and from central Bradford were identified as being the most important transport corridors within the district.

- 6.22 The radial routes within the Bradford district are:

- 1: A647 Leeds Road;
- 2: A650 Wakefield Road;
- 3: A641 Manchester Road;
- 4: A647 Great Horton Road;
- 5: B6145 Thornton Road;
- 6: A650 Aire Valley Road;
- 7: A6037 Canal Road;
- 8: A658 Harrogate Road.

- 6.23 The impact is measured as journey time on each radial, both inbound and outbound. The overall measure ‘All Radials Impact’ is the sum of the relevant journey times.

Accessibility

- 6.24 Four measures were assessed within the accessibility category which are convergent with the requirements for individual site accessibility in the Regional Spatial Strategy:
- Access to Healthcare;
 - Access to Education;
 - Access to Employment;
 - Access to Retail
- 6.25 Accessibility maps showing the time taken (up to 60 minutes) to reach the four services above by sustainable transport modes within each time period can be found in Appendices A8.1-A8.10.
- 6.26 At this stage in the development of the Core Strategy, it is not yet known which individual sites will be taken forward, so a detailed accessibility analysis was not possible. Instead, a qualitative assessment of accessibility has been performed for each of the settlements in which a significant amount of development is expected in any of the Core Strategy Options.
- 6.27 The minimum and maximum expected journey times by sustainable modes (public transport, walk and cycle) have been assessed for each settlement (see Appendices A8.11-A8.14). From this data, we have drawn a number of qualitative conclusions relating to the Core Strategy Options (see Appendix A8.15).

Integration

- 6.28 Two measures were assessed within the integration category:
- Influence Interaction Between Modes (% mode shift to public transport);
 - Impact on Surrounding Districts.
- 6.29 The first measure is global and refers to the performance of each Core Strategy Option across the transport network for the entire district, and is a standard model output. Appendices A2.4, A3.4 and A4.4 tabulate the results for each measure and modelled time period.
- 6.30 Although not strictly equivalent, we have used mode shift to public transport as a proxy for the 'Influence Interaction Between Modes' measure. Mode shift effectively measures the change in travel behaviour from car to a mixture of bus, rail, cycle and walk, and can therefore be seen as influencing positive and sustainable interaction, and compatible with wider local, regional and government policy to reduce car usage and encourage sustainable travel.
- 6.31 We also report the overall impact on the demand on key routes between Bradford and the surrounding districts.

Summary Results

- 6.32 Results have generally been presented as percentage differences from the average performance of all the Core Strategy Options. Generally, this means that the options perform with a spread of values of -x% (best) to +y% (worst) around the mean value of 0.

- 6.33 Where the percentage difference between the best and worst options is less than 4% we report ‘no significant difference’ between the options, as this level of difference is within a reasonable estimate of the accuracy of the forecasting exercise. Differences between 4% and 10% are reported here, but again, when forecasting 17 years into the future, caution should be attached to interpreting the numbers as anything other than indicative. Differences of 10% or more between the best and worst options are much more likely to be significant.

Morning Peak Hour

- 6.34 Taking account of the full results included in the Appendices, Table 6.1 shows the headline results for each of the five Core Strategy Options in the morning peak hour.

TABLE 6.1 HEADLINE RESULTS: MORNING PEAK HOUR

Category	Global	Local
Environment	No significant differences	No significant differences
Safety	No significant differences	Pref. Option: 4%, Worst Option 1: -3%, Best
Economy	No significant differences	No significant differences
Accessibility	Good across all settlements.	Development in outlying areas of Bradford & Keighley, Esholt, Holmewood, Menston, Silsden and the western settlements is likely to have low accessibility to key services from specific sites.
Integration	No significant differences	No significant differences

- 6.35 No significant differences in global performance between the Core Strategy Options were revealed by the modelling results for the morning peak hour.
- 6.36 The local measures revealed one key difference between the options:
- Safety: Options 5 has a larger impact on Accident Reduction Areas than the other options.
- 6.37 This occurs because four of the five accident reduction areas are on the western side of Bradford. The western corridors service the additional demand coming from the western settlements and from northwest and southwest Bradford in the Preferred Option.

Off-Peak Average Hour

- 6.38 Taking account of the full results included in the Appendices, Table 6.2 shows the headline results for each of the five Core Strategy Options in an off-peak average hour.

TABLE 6.2 HEADLINE RESULTS: OFF-PEAK AVERAGE HOUR

Category	Global	Local
Environment	No significant differences	No significant differences
Safety	No significant differences	No significant differences
Economy	No significant differences	No significant differences
Accessibility	Good across all settlements.	Development in outlying areas of Bradford & Keighley, Esholt, Holmewood, Menston, Silsden and the western settlements is likely to have low accessibility to key services from specific sites.
Integration	No significant differences	No significant differences

6.39 No significant differences in global or overall local performance between the Core Strategy Options were revealed by the modelling results for the off-peak average hour.

Evening Peak Hour

6.40 Taking account of the full results included in the Appendices, Table 6.3 shows the headline results for each of the four Core Strategy Options in the evening peak hour.

TABLE 6.3 HEADLINE RESULTS: EVENING PEAK HOUR

Category	Global	Local
Environment	No significant differences	No significant differences
Safety	No significant differences	Pref. Option: 4%, Worst Option 3&4: -3%, Best
Economy	No significant differences	No significant differences
Accessibility	Good across all settlements.	Development in outlying areas of Bradford & Keighley, Esholt, Holmewood, Menston, Silsden and the western settlements is likely to have low accessibility to key services from specific sites.
Integration	No significant differences	No significant differences

6.41 No significant differences in global performance between the Core Strategy Options were revealed by the modelling results for the evening peak hour.

6.42 The local measures revealed one key difference between the options, similar to in the morning peak:

- Safety: The Preferred Option has a larger impact on accident reduction areas than the other options.

6.43 As explained for the AM peak, this occurs because four of the five accident reduction areas are on the western side of Bradford. The western corridors service the additional demand coming from the western settlements and from northwest and southwest Bradford in the Preferred Option.

Discussion of Appraisal Results

6.44 Generally, there was very little difference between Core Strategy Options at the global level; measured across the entire district the performance of each option with regards to Environment, Safety, Economy, Accessibility and Integration was similar.

6.45 Probably the most important reason for this is because the Core Strategy Options are constrained by many factors (other than transport related), such as land availability, flood-risk, compliance with spatial strategic policy etc, which mean that all options have a significant amount of similarity in terms of key deliverable sites. CBMDC informed us that the options were approximately 70% similar in terms of land allocations.

6.46 Additionally, the lack of global differences in the transport impacts reflects that each Core Strategy Option was originally developed to make good use of the existing transport systems, and the settlement hierarchy itself generally reflects the transport connectivity across the district.

6.47 **The important result to note is that assessed across the entire district, there is no significant reason to prefer one Core Strategy Option to another on transport grounds.**

6.48 However, differences between the options do occur once locally important measures are assessed. This is to be expected, because the Core Strategy Options do each emphasise particular areas of the district for development.

6.49 There are two levels of local impacts that can be assessed within the Appraisal Framework:

- Local impacts measured across the entire district (such as the overall AQMA, ARA and Congestion Corridor Impact measures); and
- Individual local impacts.

6.50 In this report, we focus on the first of these levels of local impacts, which measure important local effects, yet consider the overall impact on the district.

6.51 Generally, the Preferred Option showed larger impacts than the other options in the morning and evening peak time periods on measures of local safety across the district, which are mostly located on the western side of central Bradford. This is due to the relative amounts of development in the Preferred Option in northwest and southwest Bradford and the western settlements, which channel traffic demand into the western radials approaching central Bradford. However, it is important to remember that the relative difference in the safety indicator between the Preferred

Option and the best performing option is only 7% - which is not a significant difference in this type of study.

- 6.52 **The key result here is that in terms of local impact on areas designated to already problematic in terms of road safety policy, the Preferred Option is slightly worse than the other options.**
- 6.53 Individual local impacts are not considered in detail in this report, though the results are provided in the Appendices. Generally, individual local impacts are seen on the corridors and within the areas that would be expected in each Core Strategy Option. For example, Options 3 and 4 show significantly worse journey times in the A650 Wakefield Road corridor (providing access to the Holmewood area, with significant development in these options). The Preferred Option shows significant impacts on the western radial corridors into Bradford - particularly Thornton Road, which services the increased development demand from the western settlements.
- 6.54 It is not surprising that the Core Strategy Options cause individual local impacts on the transport network of the district. The Regional Spatial Strategy requirements for housing development in Bradford until 2026 are challenging and will create significant additional transport demand which must be accommodated.
- 6.55 The qualitative accessibility analysis undertaken has revealed broad settlement areas which suffer relatively poor accessibility to key services such as healthcare, education, employment and retail. These include the outlying areas of Bradford and Keighley, Esholt, Holmewood, Menston, Silsden and the western settlements. Where Core Strategy Options have significant development aspirations in these areas, it is likely that future development of public transport infrastructure, or other sustainable transport modes will be necessary to increase accessibility, and encourage modal shift away from the car.
- 6.56 **Any option taken forward will cause significant localised impacts on the transport network which will require mitigation in terms of improved public transport provision and in some cases improvements to the highways network.**
- 6.57 In the final chapters of this report, we explore the impacts and possible methods of mitigation for the Preferred Option, and make our recommendations on how local transport policy and the infrastructure development plan should be influenced to accommodate the Preferred Option.

7 Preferred Option

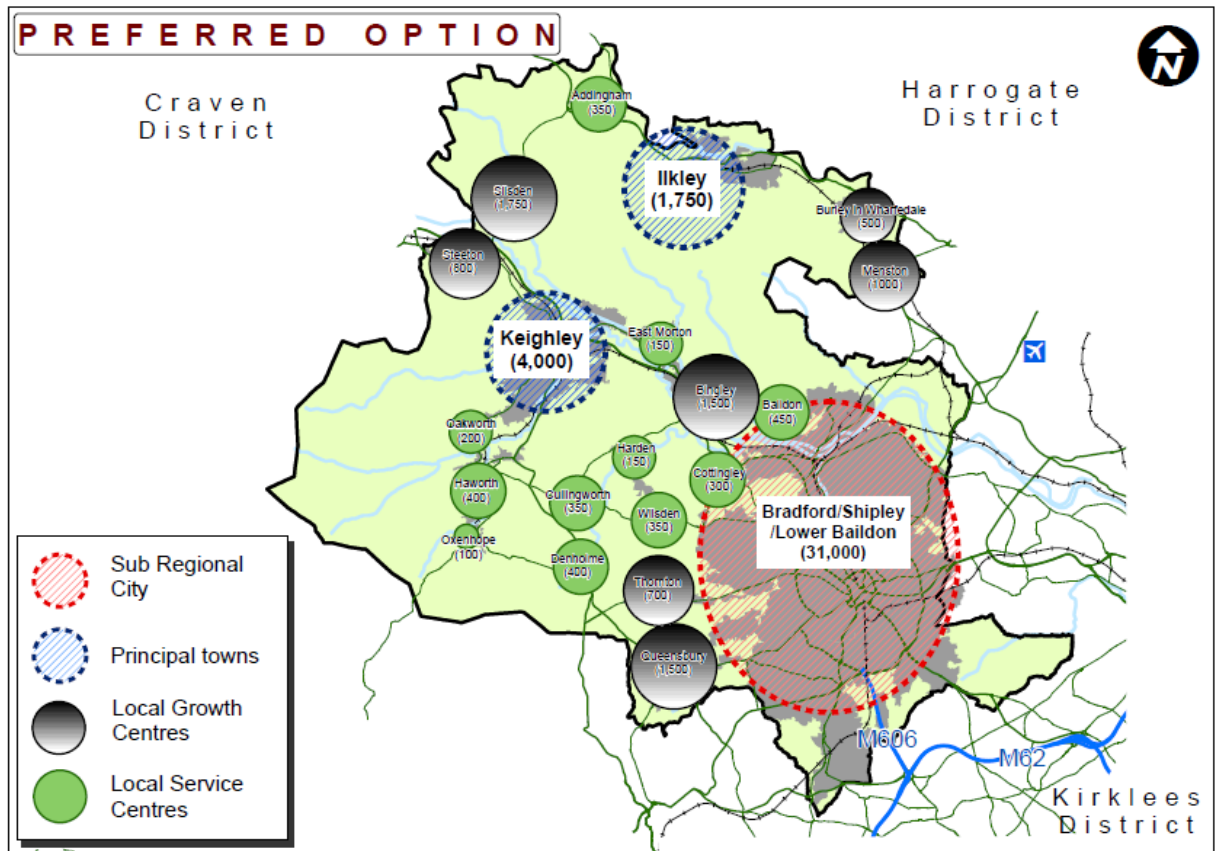
Introduction

- 7.1 The Preferred Option for spatial development in the district of Bradford has been informed by a wide range of research encompassing many issues other than just transport.
- 7.2 Our Interim Report into the transport performance of Options 1 - 4 was one such piece of evidence that fed into development of the Preferred Option by CBDMC. Our key recommendations at the Interim Stage were:
- The district-wide differences in transport performance between Options 1 -4 were very small, and no particular spatial arrangement of new development appeared to have a significant district-wide benefit;
 - In options where development was to be concentrated in specific areas, such as Keighley, Esholt, or Holmewood, then specific local indicators showed significant local impacts that may need mitigation if development were to go ahead in the future;
 - Moreover, that any option taken forward would cause significant local impacts on the transport network which will require mitigation in terms of improved public transport provision and in some cases improvements to the highways network.
- 7.3 The last of these recommendations, whilst not telling us anything particularly new or surprising, is nevertheless an important point; to accommodate almost 50,000 new dwellings, and also increase the employment balance towards in-migration to Bradford, will create significant levels of increased transport demand in the district, which will need to be accommodated through new public transport and highways infrastructure.
- 7.4 There is no realistic way to arrange new development in Bradford that reduces the transport impacts so much as to make any option a clear winner. Transport is just one factor to be considered, and whilst important, is not the most important. The most important factor has to be land availability; it is simply not realistic to consider any spatial option which is not grounded through evidence of where the land is available and realistically able to be commercially developed.
- 7.5 With this in mind, the relative transport performance of all options becomes less interesting than trying to understand how best to accommodate the Preferred Option. In the remainder of this chapter we focus on drawing from our qualitative assessment of the Preferred Option in relation to the existing transport networks, the potential for realistic improvements to those networks, and supporting quantitative evidence from the modelling results.

What are the key characteristics of the Preferred Option?

7.6 The Preferred Option dwellings allocations are detailed in Chapter 5; however, in Figure 7.1 we present the dwellings per settlement.

FIGURE 7.1 PREFERRED OPTION SETTLEMENT DWELLINGS ALLOCATIONS



7.7 The distribution of development in the Preferred Option can be characterised thus:

- New development in Bradford itself is generally spread evenly across the city, with a concentration in the Canal Road corridor, and with Bradford generally taking the biggest proportion of development in the district;
- A relatively small amount of development is spread between the numerous Local Service Centres, which are concentrated in the western part of the district;
- There is a significant concentration of development along the Aire/Wharfedale corridor from Steeton/Silsden, through Keighley, Bingley and Shipley;
- There is a lesser, but still significant, amount of development along the Wharfedale corridor from Addingham, through Ilkley, Burley and Menston.

What are the key cross-boundary issues relevant to the Preferred Option?

7.8 Five other districts have boundaries with Bradford: Craven, Leeds, Kirklees, Calderdale and North Yorkshire.

7.9 From our consultation and other districts emerging Core Strategy work, we have identified a number of cross-boundary issues that both inform this transport study, and also illuminate the need for joint working.

Craven

- 7.10 The amount of future development in Craven is likely to be relatively small, but will be concentrated in the south-eastern parts of the district.
- 7.11 This is likely to increase demand for the Airedale rail line between Craven and Bradford, and to increase traffic on the A629, and to a lesser extent the A65.

Leeds

- 7.12 Currently, we believe that most of Leeds' significant future development will be in the south-eastern areas of the city. Where residents of this area seek employment within Bradford, it is likely that they will use the M621/M606 route.
- 7.13 However, with increased dwellings and employment in Bradford and Leeds generally, we can expect the amount of cross-boundary trips to increase in both directions. In addition to increased demand on the M621/M606 route, we can expect heavy demand increases on the A647 corridor, connecting the Leeds and Bradford ring-roads. There will also be increased demand on the A65/A660 corridors, and the Airedale, Wharfedale and Calderdale rail lines.

Kirklees

- 7.14 It is likely that most growth in Kirklees will be accommodated in or near Huddersfield. This is likely to increase demand on the M62/M606 route to Bradford and on the Huddersfield branch of the Calderdale line. Similarly, any future development in the Cleckheaton area will increase demand on the M606 and the local roads in that corridor.

Calderdale

- 7.15 Future development in Calderdale is likely to be located in the eastern part of the district, with an emphasis on Halifax and Brighouse. It is possible that significant development will be concentrated in the Northowram/Shelf and north Halifax areas.
- 7.16 Although there will be increased demand on the M62/M606 route, we expect that the A647, A6036 and A641 routes will be most affected. The relative impact on each route will depend on the final placement of future growth in Calderdale.

North Yorkshire

- 7.17 Given the eastern location of existing settlements in North Yorkshire, we do not expect future growth to have a significant cross-boundary effect on Bradford, or *vice versa*.

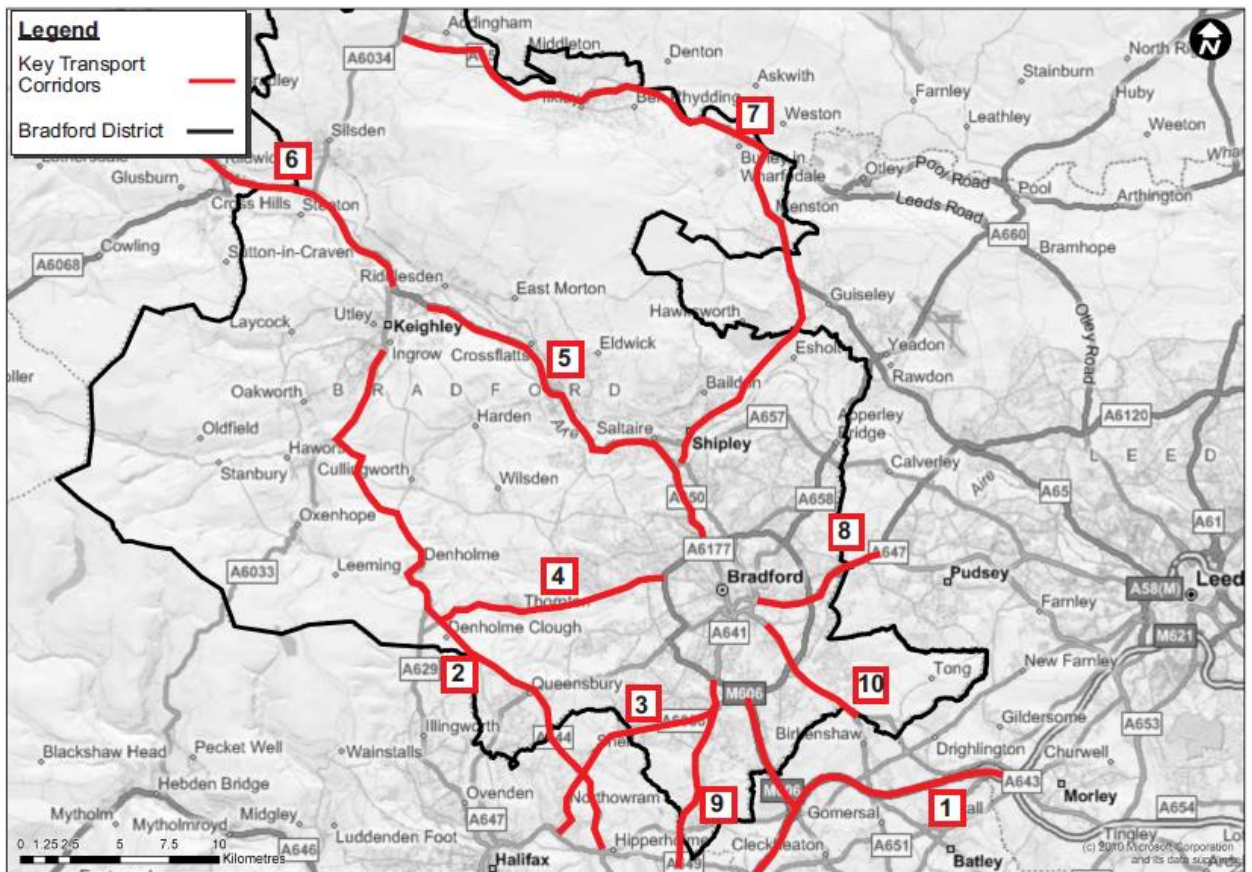
What are the likely transport impacts of the Preferred Option?

- 7.18 In this section we highlight the key transport impacts revealed both by the multi-modal modelling of the Preferred Option, and from the qualitative predictions it is possible to make from knowledge of the transport networks, the distribution of growth in Bradford district and the likely cross-boundary issues with bordering districts.
- 7.19 There are 10 key transport corridors in the district that can be expected to carry increased transport demand due to future Preferred Option development. These are shown geographically in Figure 7.2.

- 1: M606/M62

- 2: A629/A644 (Keighley to Queensbury)
- 3: A6036/Little Horton Lane (route between Calderdale and Bradford - through Northowram/Shelf)
- 4: B6145 (Thornton Road)
- 5: A650 (Airedale corridor between Keighley and Bradford)
- 6: A629 (route between Craven and Bradford - through Silsden/Steeeton area)
- 7: A65/A6038 (Wharfedale corridor between Addingham and Bradford)
- 8: A647 (route between Leeds and Bradford ring-roads)
- 9: A641 (route between Calderdale (Brighouse) and Bradford)
- 10: A650 (Tong Street)

FIGURE 7.2 TRANSPORT CORRIDORS WITH INCREASED DEMAND IN THE PREFERRED OPTION



- 7.20 Although of course transport demand, impacts and possible solutions are inextricably linked, we consider first the potential highways impacts on each of these corridors, before then considering possible realistic public transport and demand management solutions.
- 7.21 Initially, we consider each corridor in isolation. Although most of the corridors have a linkage to the City of Bradford, we have analysed the area within the outer ring-road separately because the transport issues are less easily quantifiable and identifiable from the modelling results, demanding a more qualitative analysis.
- 7.22 Towards the end of the chapter, we discuss district wide transport policies and priorities and draw together our analysis into a package of overall recommendations to support the development implied by the LDF.
- 7.23 In the following analysis, we refer generally to the morning peak, which consistently shows the highest additional demand over the base year, and the worst impacts on the network.

Corridor 1: M62/M606

Evidence

- 7.24 Appendix B1 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 1.
- 7.25 The M606 and M62 form part of important routes between Bradford, Leeds, Kirklees, Calderdale and also for trips further afield. Increased demand in this corridor is principally related to its status as a strategic route into and out of the district, although development in the corridor does also contribute.
- 7.26 As shown in Appendix B: Figure B1.2, Demand flows in the Preferred Option are significantly higher than in the base year on both the M62 and the M606.
- 7.27 The outbound flows from Bradford increase more than the inbound flows, which we consider to be an anomalous and not realistic. This is caused by the distribution of future year 'home-to-other' trips, which is based on the existing distribution of trip-ends in the model, which contains a large number of external-external trips.
- 7.28 As shown in Appendix B: Figure B1.4, Delays at the M606/M62 junction are significantly higher than in the base year.

Options

- 7.29 We have not investigated solutions or refined our forecasts in the limited section of the strategic road network covered by the model. Our consultation with the Highways Agency during the study has suggested that their own studies, specifically into the impacts of West Yorkshire LDF related development, are currently likely to provide more accurate forecasts on demand changes on the strategic road network.
- 7.30 The Highways Agency is currently working with Bradford to investigate possible options for mitigation of their predicted impacts on the strategic road network. These options are under development, but are likely to include the 'Managed Motorways' scheme on the M62 which provides additional peak capacity, and specific junction improvements along the M62.
- 7.31 There are a number of potential transport schemes planned for the M62/M606 corridor and the surrounding area:

- M62 Managed Motorways;
- M606 Staygate - final stage;
- New Rail Station at Low Moor (with Park & Ride) (West Yorkshire Strategic Programme of Schemes);
- Additional Park and Ride and Low Moor (Investment Priority);
- Cycle routes - Low Moor and Great North Trail (Committed Development).

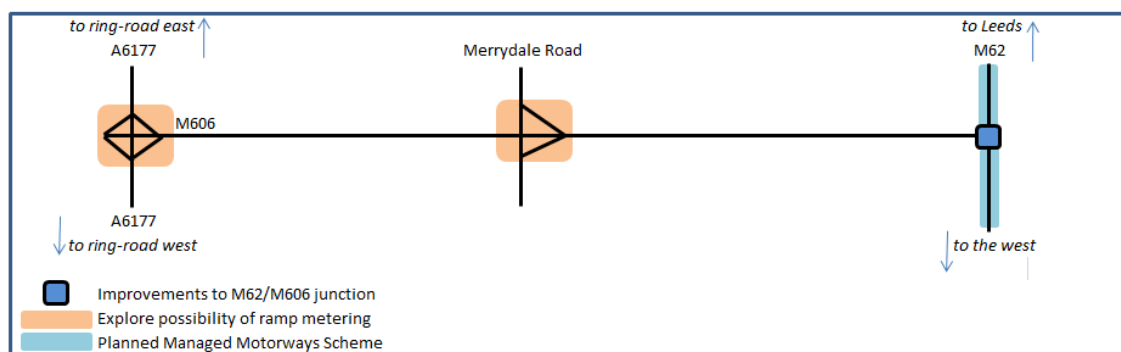
7.32 The final stage of the M606, joining the motorway to the A650, would undoubtedly increase the connectivity of the district with the rest of the region, whilst reducing pressure on the A6177 and A641. The scheme looks increasingly unlikely given both the economic climate and the reduced acceptability of major road building generally. However, in different circumstances, and with a plausible funding and deliverability plan, the scheme may be worth re-examining in the future.

7.33 In Table 7.1 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.3.

TABLE 7.1 CORRIDOR 1: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Will result in increased journey times and queueing at the local junctions leading to the M606. Capacity issues on the M62 (due to regional LDF aspirations, not just Bradford).
Low-Cost	Monitoring and control of traffic demand accessing M606 and M62 from Bradford district. May include measures such as ramp metering to throttle demand.	Would not reduce inflows to Bradford road network from M62/M606. Should be funded by developer contributions.
Highways	Managed Motorways scheme on M62. Junction improvements/upgrades on M62. Junction improvements to local road junctions to stop any potential queueing interfering with the operation of the strategic road network.	Funding arrangements likely to be arranged between multiple West Yorkshire districts and Highways Agency. District should look to fund its allocation with developer contributions.
Public Transport	Existing schemes (new station at Low Moor with Park and Ride, and cycle routes).	Being funded through West Yorkshire Strategic Programme of Schemes.

FIGURE 7.3 SCHEMATIC ILLUSTRATION OF M606 CORRIDOR IMPROVEMENTS



Recommendations

- 7.34 Assuming that the Managed Motorways scheme is completed then significant additional capacity will be provided on the M62. The amount of additional demand from Bradford and the impact on the Highways Agency junctions will be dependent on the successful delivery of the development aspirations in the LDF, and this should be monitored over time to avoid the expense of infrastructure if unnecessary.
- 7.35 If other recommendations in this report are taken up, such as shifting towards a more sustainable transport system based on public transport, then it may be possible to restrict access and thus reduce impact to the strategic road network through measures such as ramp metering.

- 7.36 The existing public and sustainable transport schemes such as the new station and Park and Ride facilities at Low Moor would potentially have benefits for the both the local area and the strategic road network. A station at Low Moor, would significantly improve accessibility to rail for south and west Bradford, increasing options for travel to central Bradford, Halifax, Huddersfield, Leeds and Manchester, potentially reducing some traffic pressure on the A6177, M606 and M62.
- 7.37 We recommend continued working with the Highways Agency to understand, plan for and mitigate impacts on the strategic road network, utilising a combination of the Highways Agency's own plans, and potential highways solutions within the local Bradford road network. It will be vital for the economic functioning of the district for the level of access to the strategic road network to be maintained/improved in the future.
- 7.38 Bradford Council is working in partnership with Leeds City Region Authorities, Metro and the Highways Agency with a view to developing a Memorandum of Agreement which will commit partners to considering how their transport strategies will help deliver the broad economic aspirations approved in regional and sub-regional plans and support the preparation of the Local Development Framework.
- 7.39 We also strongly recommend that the Council and its partners continue to prioritise the new station at Low Moor. This area of Bradford is relatively poorly served by rail currently, as is the adjoining area of north Kirklees, and would support development in both districts, in particular, increasing access to cities such as Leeds and Manchester, and to employment in the M606 corridor.

Corridor 2: A629/A644 (Keighley to Queensbury)

Evidence

- 7.40 Appendix B2 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 2.
- 7.41 The Preferred Option has around 1900 new dwellings planned in the A629/A644 corridor (at Queensbury and Denholme), and additional demand for the corridor comes from the development in Haworth, Oxenhope and Oakworth. Some traffic from the significant development in Keighley will also be using the route to travel to and from south-west Bradford and Calderdale.
- 7.42 As shown in Appendix B: Figure B2.2, demand flows in the Preferred Option are significantly higher (between 900 - 1300 vehicles southbound, and around 200 vehicles northbound) than in the base year on all sections of the A629/A644 between Keighley and Queensbury.
- 7.43 Appendix B: Figures B2.3 and B2.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor are significantly higher than in the base year. In particular, the junction of the A644 and A647 at Queensbury is impacted with severe delays which do not occur at all in the base year.

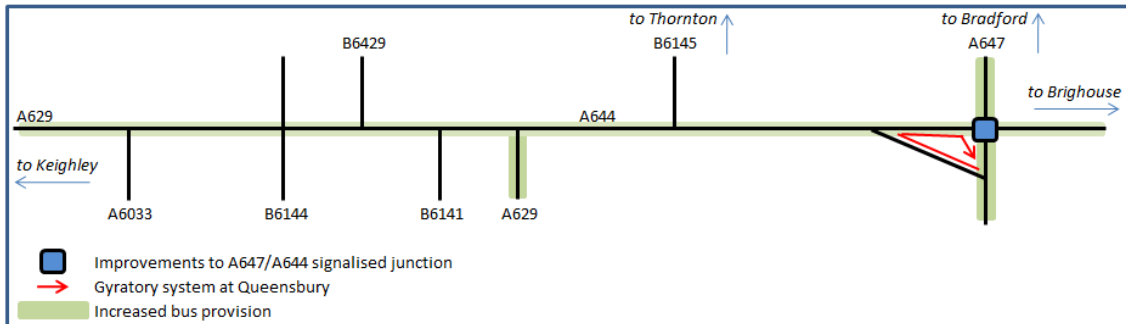
Options

- 7.44 There are currently no significant transport schemes planned for the A629/A644 corridor.
- 7.45 In Table 7.2 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.4.

TABLE 7.2 CORRIDOR 2: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Will result in increased journey times for car and bus on the A629 and A644.
Low-Cost	Increased junction capacity/improved junction operation at Queensbury.	Space at existing junction is constrained by buildings. Limited opportunity for improvement. Should be funded by developer contributions.
Highways	One-way gyratory system in Queensbury on Brighouse Road, High Street and Chapel Street.	Likely to be impractical and maybe unpopular with residents/business owners. Opportunity to build in bus lanes/bus priority. Should be funded by developer contributions.
Public Transport	Additional bus services linking Keighley, Queensbury and Bradford. Additional bus services linking Keighley, Queensbury and Halifax.	Level of demand uncertain. If subsidised then should be funded by developer contributions.

FIGURE 7.4 SCHEMATIC ILLUSTRATION OF A629/A644 CORRIDOR IMPROVEMENTS



Recommendations

- 7.46 Existing public transport service is relatively poor in this corridor. In the short-term, operators are unlikely to consider that even with the amount of development planned in the western settlements that providing additional services on the A629/A644 will be profitable. Public transport solutions will therefore require subsidy funded by developer contributions.
- 7.47 Delays at the junction of the A644 and A647 at Queensbury will increase journey times for vehicles travelling between Keighley, Brighouse, Halifax and Bradford. We recommend that the focus in this corridor should be on improving this junction so that travel times are not adversely affected for car or bus. As with many key

junctions in Bradford, it is acknowledged that physical improvements to the junction would be difficult to achieve without demolition of properties and land take.

- 7.48 As the Preferred Option is developed we recommend that options for mitigating impacts at other junctions in this corridor are explored. The future year demand flows are not so high that link capacities become a problem, so it is possible that only relatively minor works and junction re-configurations will be necessary by 2026.

Corridor 3: A6036/Fairfield Avenue/St Enoch's Road (route between Calderdale and Bradford - through Northowram/Shelf)

Evidence

- 7.49 Appendix B3 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 3.
- 7.50 The Preferred Option has around 4000 new dwellings planned in the south-western sector of Bradford. Traffic will also generally be using this route to travel between Bradford and Calderdale. Although not yet finalised, it is also likely that a significant proportion of Calderdale's LDF development will occur in Northowram and Shelf, along the A6036 corridor.
- 7.51 As shown in Appendix B: Figure B3.2, demand flows in the Preferred Option are significantly higher than in the base year on a number of sections of A6036. In particular inbound flows north of Shelf are around 800 vehicles higher.
- 7.52 Appendix B: Figures B3.3 and B3.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor are significantly higher than in the base year. In particular, the junction of the A644 and A6036 is impacted with severe delays which do not occur at all in the base year. Additionally, traffic rerouting in Fairfield Avenue appears to be causing significant junction delays on the local road network.

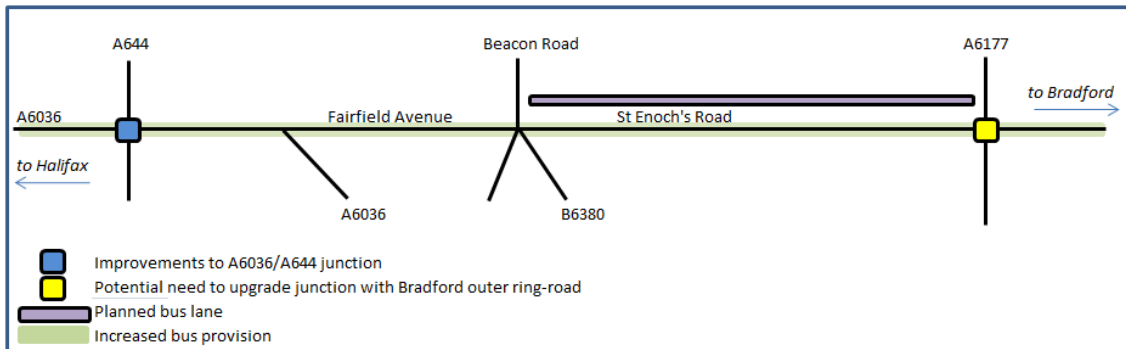
Options

- 7.53 There are two transport schemes currently planned for the A036/Little Horton Lane corridor:
- Bus Lane - St Enoch's Road (Committed Development);
 - Southfield Lane/Little Horton Lane (Committed Development).
- 7.54 In Table 7.3 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.5.

TABLE 7.3 CORRIDOR 3: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Will result in congestion within south-west Bradford and at the A644/A6036, increasing journey times for car and bus and also limiting connectivity between Calderdale and Bradford.
Low-Cost	None available	
Highways	Southfield Lane/Little Horton Lane improvements. A644/A6036 junction improvements.	It may be necessary to re-examine this junction and further upgrade in the future as the scale of realised LDF development becomes clear. Although in Calderdale, the operation of this junction will affect the connectivity between Calderdale and Bradford.
Public Transport	Committed bus lane scheme. Additional bus services linking Bradford, Shelf, Northowram and Calderdale.	Level of demand uncertain. If subsidised then should be funded by developer contributions.

FIGURE 7.5 SCHEMATIC ILLUSTRATION OF A6036 CORRIDOR IMPROVEMENTS



Recommendations

- 7.55 We recommend that as the Preferred Options of both Bradford and Calderdale are firmed up, that joint working to fully model the cross-border demands, impacts and possible mitigation solutions is implemented.
- 7.56 Generally, increased provision of bus services and improving bus journey times on this corridor should be the preferred solution to support the LDF development of both Bradford and Calderdale.

- 7.57 On the Bradford side of the corridor, particularly on Little Horton Lane up to the A6177, increasing the bus offer complements the existing plans for a bus lane on St Enoch's Road.
- 7.58 Depending on the realisation of the LDF development, it may also be necessary to re-examine and further improve the junctions with the A644 and the Bradford ring-road.

Corridor 4: B6145 (Thornton Road)

- 7.59 Appendix B4 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 4.
- 7.60 The Preferred Option has around 700 new dwellings planned in Thornton, 400 in Denholme, plus 9000 new dwellings planned in the south-western and north western sectors of Bradford. We expect most traffic using the Thornton Road route will be local traffic travelling between Thornton, Denholme and west Bradford, however, there will also be a proportion of traffic from west Bradford using this route to access Calderdale.
- 7.61 As shown in Appendix B: Figure B4.2, demand flows in the Preferred Option are significantly higher than in the base year on a number of sections of B6145. The largest increase in demand results from the new development traffic feeding in to the B6145 in Thornton and is approximately 1200 vehicles higher than the base in both directions.
- 7.62 Appendix B: Figures B4.3 and B4.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor are significantly higher than in the base year. In particular, the junctions of the A644 and B6145, the B6145 in Thornton, and the junction of the B6145 with Bell Dean Road in west Bradford, are impacted with severe delays which are minimal in the base year.

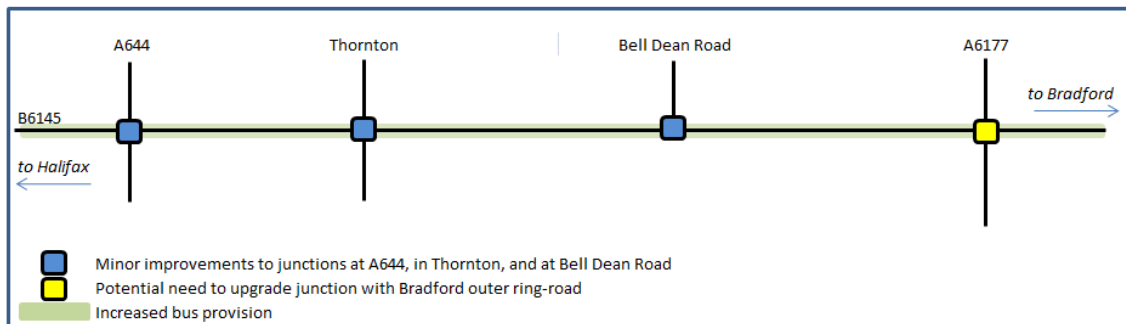
Options

- 7.63 There are currently no significant transport schemes currently planned for the B6145 corridor.
- 7.64 In Table 7.4 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.6.

TABLE 7.4 CORRIDOR 4: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Will result in congestion between Thornton and west Bradford - possibly limiting attractiveness of new development in the west of the district.
Low-Cost	Minor junction improvements at the A644, in Thornton and Bell Dean Road.	Should seek developer funding for minor capacity improvements.
Highways	Improvements to key junctions on Thornton Road corridor. Also consider HOV/Bus Lane options.	It may be necessary to re-examine these junctions and further upgrade in the future as the scale of realised LDF development becomes clear.
Public Transport	Additional bus services linking Denholme, Thornton and Bradford.	Level of demand uncertain. If subsidised then should be funded by developer contributions.

FIGURE 7.6 SCHEMATIC ILLUSTRATION OF B6145 CORRIDOR IMPROVEMENTS



Recommendations

- 7.65 As the Preferred Option is developed we recommend that options for mitigating junction impacts in this corridor are explored.
- 7.66 Link flows within Thornton towards Bradford are higher than can be carried comfortably by a single lane. However, this impact may be an artefact of the relative lack of detail about precise development locations - in the current version of the strategic model, development in Thornton is loaded onto the network at a single point.
- 7.67 Link flows on the rest of the B6145 corridor are not generally high enough to cause problems with link capacity.
- 7.68 We recommend that as the Preferred Option is firmed up - and specifically, the amount and location of development in Thornton is finalised, more detailed modelling may reveal relatively easy and low-cost mitigation options for this corridor.

- 7.69 In the longer term, we recommend that options to increase bus provision on the corridor, improving accessibility of Denholme and Thornton to Bradford are explored.
- 7.70 Depending on the realisation of the LDF development, it may also be necessary to re-examine and further improve the junction between Thornton Road and the Bradford ring-road.

Corridor 5: A650 (Airedale corridor between Keighley and Bradford)

Evidence

- 7.71 Appendix B5 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 5.
- 7.72 The Preferred Option has around 8000 new dwellings planned in the Airedale corridor, which is concentrated in Keighley, Bingley and Shipley. Additionally there are 15,000 new dwellings planned for the north of Bradford, including significant development in the Canal Road corridor. Furthermore, new development in Craven is likely to be situated in the south east of the district and use the Airedale corridor to travel to Keighley, Bradford and further afield.
- 7.73 As shown in Appendix B: Figure B5.2, demand flows in the Preferred Option are significantly higher than in the base year along the length of the A650 in the Airedale corridor. Generally there is between 1000-1400 additional vehicles more than the base in each direction.
- 7.74 Appendix B: Figures B5.3 and B5.4 show respectively delays in the Preferred Option and the increase in delays over the base year. Delays in the Airedale corridor are under-represented in the base year model, so we may expect that the future year situation would actually be significantly worse than shown here.
- 7.75 However, even so, there is significant additional delay at the roundabout junction of the A650 and the A657 in Saltaire.

Options

- 7.76 There are currently a number of transport schemes planned for the A650 corridor which will generally improve the highway linkage between Keighley, Bingley, Shipley and Bradford:
- Investment on Hard Ings Road (currently an investment priority);
 - Completion of A650 (currently an investment priority);
 - Signalisation of Saltaire roundabout (included in West Yorkshire Strategic Programme of Schemes);
 - Canal Road improvement/Shipley Eastern Link Road (submitted to Regional Transport Board).
- 7.77 A number of other transport schemes in the Airedale area will have an indirect impact on the A650 corridor, generally enhancing public transport availability and accessibility:
- Keighley improvements (committed development);
 - Shipley Station integrated transport interchange;

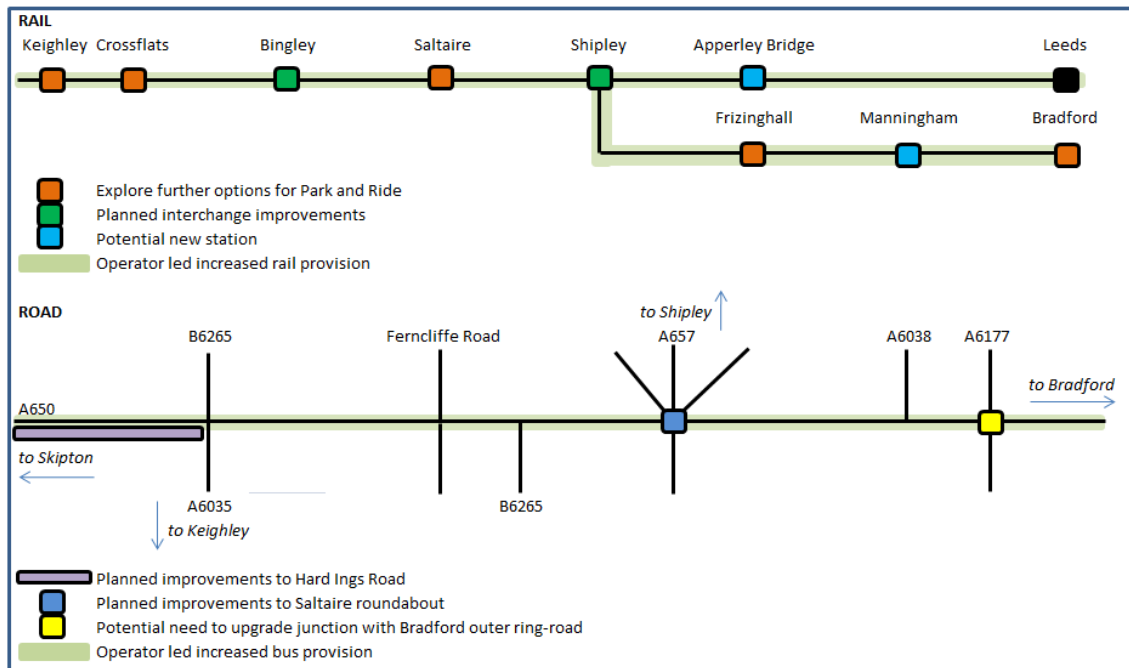
- Improvements to facilitate interchange at Shipley and Bingley;
- Improved rail connectivity and service provision between Airedale, Bradford and Leeds;
- New rail stations at Manningham (hoped to be progressed as part of the Leeds City Region Transport Strategy) and Apperley Bridge (included in Leeds Rail Growth package and awaiting DfT announcement).

7.78 In Table 7.5 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.7.

TABLE 7.5 CORRIDOR 5: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Will result in increased journey times for car and bus on the A650.
Low-Cost	None available.	
Highways	Existing A650 schemes and improvements to junction with A6177 outer ring road.	Limited opportunity for further capacity/operation improvements that are realistic. If not from other funding sources, then should be funded by developer contributions.
Public Transport	Existing schemes. Increased rail passenger capacity and services to new stations at Manningham and Apperley Bridge. Also consider extending existing bus priority measures on A650 where possible.	Demand implied by development should ensure operators supply increased bus and rail services.

FIGURE 7.7 SCHEMATIC ILLUSTRATION OF AIREDALE CORRIDOR IMPROVEMENTS



Recommendations

- 7.79 There is little scope for increasing highway capacity on the A650 corridor beyond the existing proposed highways schemes. However, with the amount of development suggested for the corridor and north Bradford, congestion and delays on the A650 are likely to be severe by 2026 resulting in increased journey times between Keighley, Bingley and Bradford. Cars will be most affected, but bus journey times will also be affected on those sections of the corridor without bus priority.
- 7.80 There are a number of bus and rail schemes planned for the Airedale corridor - yet funding provision by regional and national sources is far from guaranteed given the current political and economic climate. If other funding sources prove inadequate, as is likely, then we recommend that developer contributions are sought.
- 7.81 We consider that the planned public transport schemes will be essential to support development on the corridor in the future. To encourage travellers to switch from car to rail, adequate Park and Ride facilities will be needed at all rail stations on the Airedale line. Although the funding situation for major infrastructure such as the potential new stations at Manningham and Apperley Bridge is currently unclear, we would strongly recommend that priority is given to these schemes to support development in the Aire Valley and north Bradford.
- 7.82 Above the existing planned schemes, we suggest that the focus should be on improving bus journey times on the A650 with further priority measures - even at the detriment of car journey times.

Corridor 6: A629 (route between Craven and Bradford - through Silsden/Steeton area)

Evidence

- 7.83 Appendix B6 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 6.
- 7.84 The Preferred Option has around 800 new dwellings planned in Steeton, 1750 in Silsden, and 4000 in Keighley. Furthermore, new development in Craven is likely to be situated in the south east of the district and use the A629 and then the A650 to travel to Keighley, Bradford and further afield.
- 7.85 As shown in Appendix B: Figure B6.2, demand flows in the Preferred Option are significantly higher than in the base year on the section of the A629 between Steeton and Keighley.
- 7.86 Appendix B: Figures B6.3 and B6.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor although higher than the base year, are not severe.
- 7.87 Link flows within the corridor are not generally high enough to cause problems with link capacity.

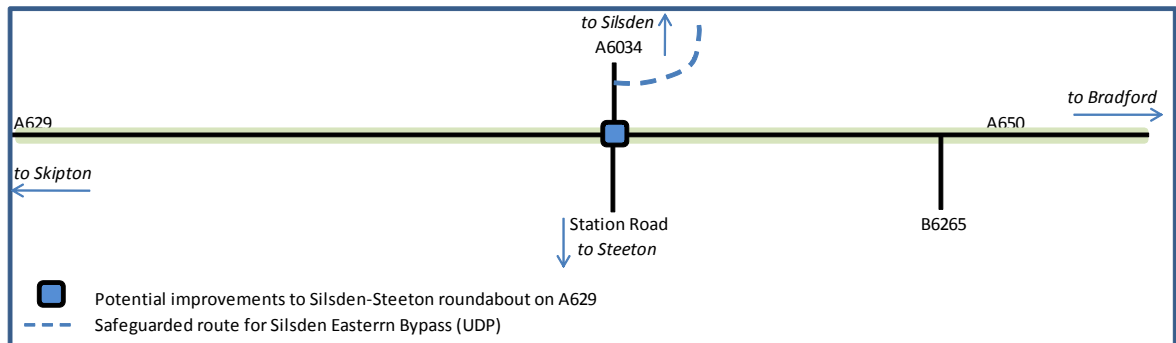
Options

- 7.88 There are currently no significant transport schemes currently planned for the A629 corridor between Craven and Keighley, although a potential route for a bypass to the east of Silsden has been safeguarded in the Replacement Unitary Development Plan.
- 7.89 In Table 7.6 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.8.

TABLE 7.6 CORRIDOR 6: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Some increases to journey times but not severe.
Low-Cost	n/a	
Highways	Improvements to junction of A6034/A629. Silsden Eastern Bypass	It may be necessary to re-examine this junction and further upgrade in the future as the scale of realised LDF development in Silsden and Steeton becomes clear. Potential to be privately funded by developer contributions as land for future development is released
Public Transport	Improved Park and Ride facilities at Steeton rail station, plus improved pedestrian and cyclist access	Potential to shift longer distance trips to rail and reduce downstream traffic pressure on A629 and A650. If subsidised then should be funded by developer contributions.

FIGURE 7.8 SCHEMATIC ILLUSTRATION OF A629 CORRIDOR IMPROVEMENTS



Recommendations

- 7.90 Based on the current evidence, we do not foresee significant problems on the A629 corridor. However, it may be that more detailed investigations of the junction of the A629 and the A6034 (carrying Silsden traffic) and junctions at the Keighley end of the corridor, reveal that some mitigation is needed depending on how much development is realised in Steeton and Silsden.
- 7.91 Extending the potential for Park and Ride at Steeton rail station should be a priority for this corridor. Switching longer distance trips (e.g. commuting to Bradford and Leeds) to rail will bring significant benefits by reducing traffic demand on both the A629 corridor itself, and further downstream on the A650.

Corridor 7: A65/A6038 (Wharfedale corridor between Addingham and Shipley)

Evidence

- 7.92 Appendix B7 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 7.
- 7.93 The Preferred Option has around 3600 new dwellings planned in the Wharfedale corridor, which is concentrated in Addingham, Ilkley, Burley and Menston. Additionally there are 5,000 new dwellings planned for the northeast of Bradford.
- 7.94 As shown in Appendix B: Figure B7.2, demand flows in the Preferred Option are significantly higher than in the base year along the length of the A65 and A6038 from Addingham to Shipley. The situation is complicated by re-assignment of traffic onto parallel local routes to avoid delays on the A65/A6038. The additional demand is highest between Burley and Shipley, with around 1000 - 1400 extra vehicles in both directions split between the A65/A6038 and parallel routes.
- 7.95 Appendix B: Figures B7.3 and B7.4 show respectively delays in the Preferred Option and the increase in delays over the base year. Significant increases in delay are apparent at junctions in Ilkley, Menston and Guiseley. Even though Guiseley is in Leeds district, delays at the junction of the A65 and A6038 will have serious effects on connectivity both within Bradford district, and between Bradford and Leeds.
- 7.96 Link flows in the corridor are not generally high enough to cause problems with link capacity.

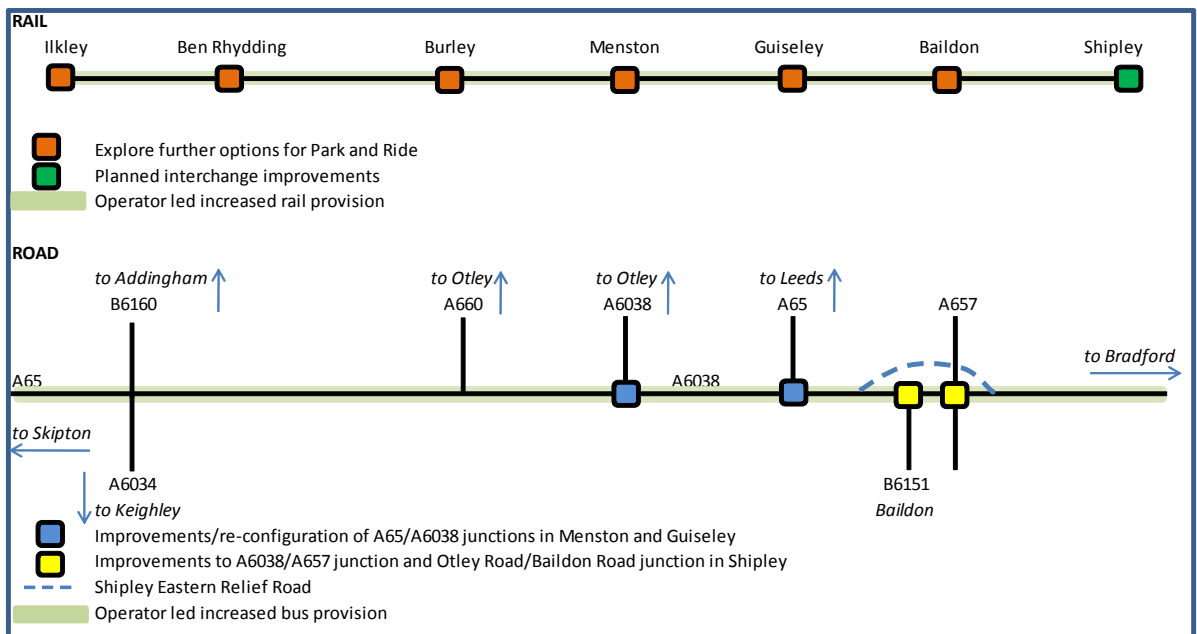
Options

- 7.97 There are currently no significant transport schemes currently planned for the A65/A6038 corridor, above those shared with the Airedale corridor (such as improved interchange at Shipley) that have already been discussed.
- 7.98 In Table 7.7 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.9.

TABLE 7.7 CORRIDOR 7: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	This route, already congested at peak times, will experience severe delays at junctions in Ilkley, Menston and Guiseley, impacting on journey times on the corridor.
Low-Cost	n/a	
Highways	Improvements/re-configuration of junctions between A65 and A6038 in Menston and Guiseley. Improvements to junctions of A6038/A657 and Otley Road/Baildon Road in Shipley. Shipley Eastern Relief Road	Cross-border working with Leeds will be necessary to mitigate traffic impacts on this corridor.
Public Transport	Improved Park and Ride facilities at stations on Wharfedale line Increased rail passenger capacity.	Demand implied by development should ensure operators supply increased bus and rail services.

FIGURE 7.9 SCHEMATIC ILLUSTRATION OF WHARFEDALE CORRIDOR IMPROVEMENTS



Recommendations

- 7.99 We recommend cross-border working with Leeds to investigate solutions on this corridor; specifically at junctions in the Menston and Guiseley area. Apart from limited improvements, constraints of space to the highways junctions on this corridor make it unlikely that significant extra highways capacity can be provided on this already congested corridor.
- 7.100 Similarly, it will be difficult to reduce bus journey time or journey time variability, because of the limited opportunities for providing bus priority.
- 7.101 We therefore recommend a focus on making best use of the existing rail services on the Wharfedale line, and specifically, encouraging modal shift to rail from car by improving the provision of Park and Ride at all outlying rail stations.
- 7.102 Depending on the realisation of the LDF development, demand may be sufficient in the future for it to be commercially viable to increase further the service provision on the Wharfedale line.

Corridor 8: A647 (route between Leeds and Bradford ring-roads)*Evidence*

- 7.103 Appendix B8 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 8.
- 7.104 The Preferred Option has around 15,000 new dwellings planned in the central and eastern parts of Bradford. However, the A647 route forms a vital strategic connection between Leeds and Bradford, and will have additional demand no matter the location of future development in the two districts.
- 7.105 As shown in Appendix B: Figure B8.2, demand flows in the Preferred Option are significantly higher than in the base year along the length of the A647 between central Bradford and the Leeds ring-road. There is also significant additional traffic on key alternative routes, such as Dick Lane.
- 7.106 The outbound flows from Bradford increase more than the inbound flows, which we consider to be an anomalous and not realistic (same issue as on the M606/M62). This is caused by the distribution of future year 'home-to-other' trips, which is based on the existing distribution of trip-ends in the model, which contains a large number of external-external trips.
- 7.107 Appendix B: Figures B8.3 and B8.4 show respectively delays in the Preferred Option and the increase in delays over the base year. Significant increases in delay are apparent at the junction with the Bradford outer ring-road (A6177), at the Thornbury gyratory, and the junction with the Leeds outer ring-road.
- 7.108 Link capacity is more of an issue on the A647 corridor between central Bradford and Thornbury, than on the section between Thornbury and the Leeds outer ring-road.

Options

- 7.109 There are currently a number of significant transport schemes currently planned for the A647 corridor:
- Leeds Road/Killinghall Road junction improvement scheme (included in LTP Programme);

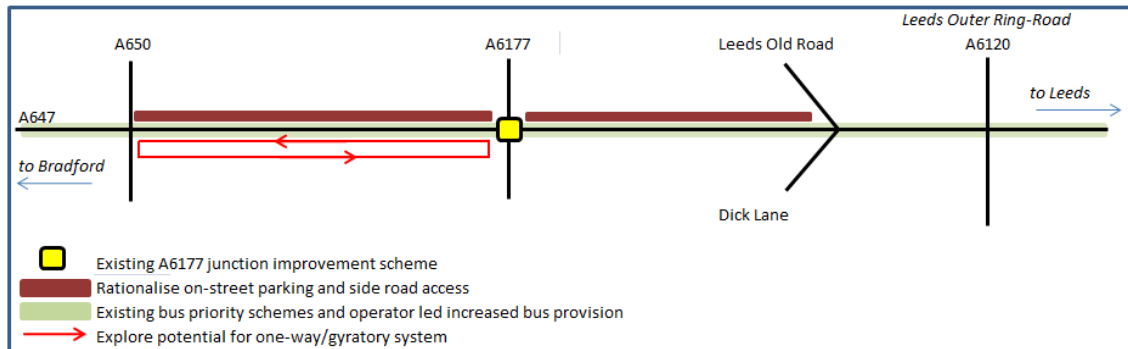
- Comprehensive bus priority measures (Proposed in Leeds City Region transport strategy).

7.110 In Table 7.8 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.10.

TABLE 7.8 CORRIDOR 8: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Increased demand along the length of the corridor with significant increases in traffic also shown along alternative routes. Specific increases in delay are predicted at the junctions with Bradford and Leeds outer ring roads and at the Thornbury gyratory.
Low-Cost	Rationalise on-street parking and side road access.	Parking movements and access/egress to side roads reduces potential capacity of this strategically important route significantly.
Highways	Existing A6177 junction improvement scheme. Explore potential for one-way gyratory system between outer and inner ring-roads using Bowling Back Lane as an alternative route.	Cross-border working with Leeds will be necessary to mitigate traffic impacts on this corridor. Demand management and public transport will probably not mitigate all impacts on this important corridor, so more radical options may be necessary.
Public Transport	Existing bus priority proposals. Increased provision of bus services between Leeds and Bradford.	Demand implied by development should ensure operators supply increased bus and rail services.

FIGURE 7.10 SCHEMATIC ILLUSTRATION OF A647 CORRIDOR IMPROVEMENTS



Recommendations

7.111 The A647 corridor is key not just to Bradford, but to the Leeds City Region in general. It is difficult to see how this corridor could be significantly improved in

terms of junction capacity although it is understood that improved connections between the city centre and Dick Lane have been considered previously, which would relieve some pressure on the A647 itself with opportunities to give the route a more local feel.

- 7.112 The existing plans to improve the junction with the A6177 and improve bus priority on the corridor should be retained.
- 7.113 Much of the existing capacity on the corridor is lost because of poor traffic management, uncontrolled parking, and access/egress to side roads. Considering the strategic importance of this corridor for the Leeds City Region, and particularly for the economy of Bradford, we recommend that traffic management is simplified and streamlined along the length of the corridor, providing the maximum capacity for principally public transport priority and secondarily other traffic movements, that the roadscape will allow.
- 7.114 In the future, it may be necessary to explore much more radical highways options for the Leeds-Bradford corridor, possibly introducing a one-way gyratory system between the outer and inner Bradford ring-roads whilst retaining two-way bus operations.
- 7.115 To maximise the benefit of the planned public transport priority on the A647, we expect that operators will provide improved services between Bradford and Leeds.
- 7.116 More detailed investigations and potential solutions should be developed jointly with Leeds.

Corridor 9: A641 (route between Calderdale (Brighouse) and Bradford)

Evidence

- 7.117 Appendix B9 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 9.
- 7.118 The Preferred Option has around 4000 new dwellings planned in the south-western sector of Bradford. Traffic will also generally be using this route to travel between Bradford and Calderdale.
- 7.119 As shown in Appendix B: Figure B9.2, demand flows in the Preferred Option are significantly higher than in the base year on a number of sections of A641.
- 7.120 Appendix B: Figures B9.3 and B9.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor are significantly higher than in the base year. However, the increased delays are mostly not on the A641 itself, but on adjoining roads at a number of junctions.
- 7.121 Link flows in the corridor are not generally high enough to cause problems with link capacity.

Options

- 7.122 There are a number of potential transport schemes planned for the A641 corridor and the surrounding area:
 - New Rail Station at Low Moor (with Park & Ride) (being funded through the West Yorkshire Strategic Programme of Schemes);
 - Additional Park and Ride and Low Moor (Investment Priority);

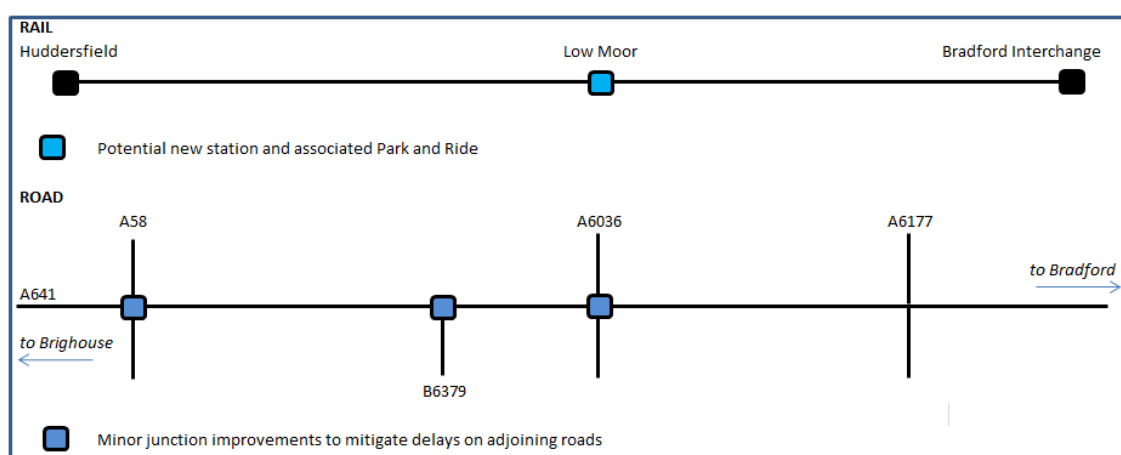
■ Cycle routes - Low Moor and Great North Trail (Committed Development).

7.123 In Table 7.9 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.11.

TABLE 7.9 CORRIDOR 9: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Some delays at adjoining junctions, and decreased connectivity between Bradford and Brighouse.
Low-Cost	Minor junction improvements to mitigate localised problems on adjoining roads.	
Highways	Cycle routes	
Public Transport	Existing schemes (new station at Low Moor, with Park and Ride).	If subsidised then should be funded by developer contributions.

FIGURE 7.11 SCHEMATIC ILLUSTRATION OF A641 CORRIDOR IMPROVEMENTS



Recommendations

7.124 Future problems on this corridor are not expected to be severe. However, the A641 route is strategically important because of the linkage it provides to Calderdale and Kirklees, so it may be necessary to make minor junction improvements along its route to ensure that the connectivity between Bradford and Brighouse is not reduced.

7.125 Furthermore, it is not yet clear where LDF development in both Calderdale and Kirklees will be situated. It is likely that in both cases a significant proportion will be on or near the borders with Bradford district. Cross-border working should continue with both authorities to ensure that mitigation solutions are found which improve overall connectivity between the districts.

7.126 Increased development in northern Calderdale and Kirklees, in addition to that planned in southern and western Bradford, significantly strengthens the case for the

new rail station at Low Moor. We recommend that this scheme is prioritised, to improve the poor rail accessibility in south and west Bradford, and divert some trips away from the city centre, to Park and Ride facilities at Low Moor.

Corridor 10: A650 (Tong Street)

Evidence

- 7.127 Appendix B10 contains SATURN plots of the Preferred Option demand flows, delays and differences from the base year in Corridor 10.
- 7.128 The Preferred Option has around 5000 new dwellings planned in the south-eastern sector of Bradford.
- 7.129 As shown in Appendix B: Figure B10.2, demand flows in the Preferred Option are significantly higher than in the base year on a number of sections of A650.
- 7.130 Appendix B: Figures B10.3 and B10.4 show respectively delays in the Preferred Option and the increase in delays over the base year. From these we can see that delays in the corridor are significantly higher than in the base year. However, the model predicts that increased delays are mostly not on the A650 itself, but on adjoining roads at a number of junctions.
- 7.131 Link flows in the corridor are not generally high enough to cause problems with link capacity.

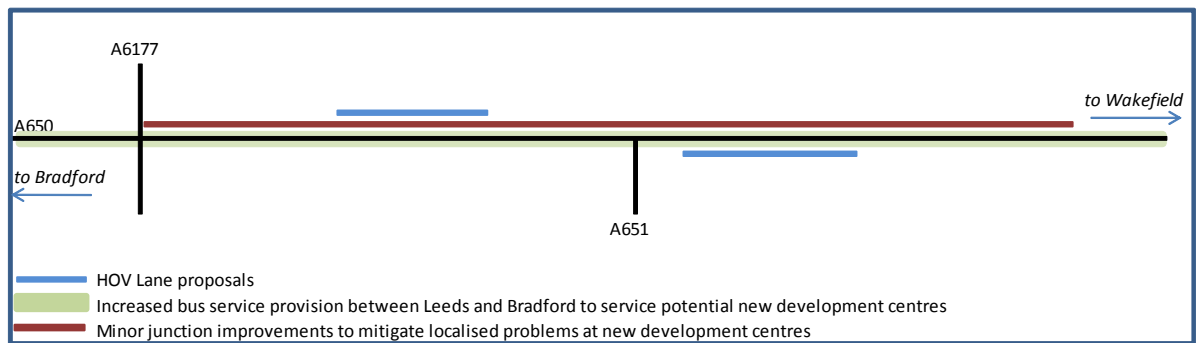
Options

- 7.132 The only significant transport schemes currently planned for the A650 corridor between Drighlington and the A6177, are for the introduction of High Occupancy Vehicle Lanes on Wakefield Road and Westgate Hill. Implementation of each scheme is planned for 2010.
- 7.133 In Table 7.10 four options for potential transport improvements in the corridor are presented, and also illustrated schematically in Figure 7.12.

TABLE 7.10 CORRIDOR 10: POTENTIAL SOLUTIONS

Solution	Details	Comment
Do-Nothing	n/a	Some delays at adjoining junctions.
Low-Cost	Minor junction improvements to mitigate localised problems on adjoining roads.	
Highways	Introduction of High Occupancy Vehicle lanes on Wakefield Road and Westgate Hill	Implementation planned for 2010
Public Transport	Increased bus services to Leeds and Bradford to support potential new development centres.	If subsidised then should be funded by developer contributions.

FIGURE 7.12 SCHEMATIC ILLUSTRATION OF A650 CORRIDOR IMPROVEMENTS



Recommendations

- 7.134 At this stage, we do not know precisely where development in south eastern Bradford may be located. As the Preferred Option is taken forward and development locations are known, it may be beneficial to model this corridor in more detail and to develop further existing proposals for the introduction of high occupancy vehicle lanes.
- 7.135 The potential location of new development centres between Leeds and Bradford in this corridor means that cross-border solutions should be sought - in particular ensuring that public transport serving both Leeds and Bradford is provided.

City of Bradford

- 7.136 The most significant amount of development in the district is planned for Bradford itself. Excluding Shipley, 31,000 new dwellings are planned, including 10,000 in the city centre and Canal Road corridor. The majority of planned employment development is also within Bradford.
- 7.137 At this stage the exact location, profile and type of developments is not known with certainty, and this, coupled with the generally high amount of future year congestion and increased delay to traffic in the City of Bradford predicted by the model mean that a detailed analysis of key junctions affected would have little use at this stage. Instead we present a more qualitative analysis, options and recommendations for mitigating transport impacts caused by future LDF development.

Canal Road Corridor

- 7.138 Within the City of Bradford the Canal Road Corridor has been identified as a key development area for the future, with the intention being to deliver a significant amount of future growth and re-generation as part of the LDF.
- 7.139 Development in the Canal Road Corridor is well placed to take advantage of existing and potential future public transport opportunities in the area. Bus accessibility is generally very good, and rail access is provided in the north at Frizinghall and in the south at Forster Square. Because of these public transport opportunities we recommend that development in the area is planned to encourage lower rates of car ownership and usage through, for instance, the introduction of restricted car parking allocations.

7.140 In addition to the intention to develop low cost junction improvements along this corridor, there are a number of potential transport schemes are planned in this area which would support development by providing better highways linkage, and improved public transport accessibility:

- Shipley Eastern Relief Road and Canal Road improvement;
- New rail station at Manningham;
- Improved interchange at Shipley;
- Extended availability of parking at rail stations.

7.141 All of these schemes support not only Canal Road development, but also development in north Bradford, and the Airedale and Wharfedale corridors.

The Outer Ring-Road

7.142 Many of the corridors identified previously provide the primary radial routes from the rest of the district into Bradford. Generally, we have considered the radial routes only up to their junctions with the A6177 outer Bradford ring-road. In almost all cases we have identified that if the full development implied by the LDF is realised, that congestion and delay will increase at the junctions between the radials and the outer ring-road, sometimes severely.

7.143 Although generally we do not advocate significant highways schemes as a sustainable way to support development and re-generation in the current economic and political climate, we do recommend that the junctions of the outer ring-road are monitored as development goes forward. Strategic access and connectivity between Bradford and the rest of the district, and between the district and the surrounding districts, is of key importance to economic activity, and major junction improvements may be necessary at some or all of these junctions in the future to provide increased capacity and better traffic management. Wherever junction improvements are proposed, there will be a critical requirement to improve conditions for buses, cyclists and pedestrians.

7.144 Within the ring-road, the radials will continue to be of key importance in providing transport capacity to the centre of Bradford.

Overall Central Area Strategy

7.145 There are relatively few realistic opportunities for significant highways infrastructure upgrades in Bradford. One major scheme that has been discussed, the completion of the M606, seems extremely unlikely, but would undoubtedly relieve pressure on the outer ring-road and the radial roads leading to Bradford centre from the south. Other highways schemes, such as improvements to outer ring-road junctions, will become necessary over time, as the location of realised LDF development becomes clear.

7.146 Public transport infrastructure plans broadly support the LDF development aspirations and are located in such a way as to maximise increased accessibility for new housing and employment development in Bradford. The three proposed rail stations are all very well situated considering the pattern of development in the LDF:

- Low Moor: significantly improves rail accessibility to south and west Bradford, and employment on the M606 corridor; improves connectivity with Calderdale

and Kirklees, and broadly supports LDF development aspirations in those districts; may reduce some traffic pressure on the strategic road network;

- Manningham: improves rail accessibility in north Bradford and the Canal Road area, and supports LDF development throughout the Airedale corridor;
- Apperley Bridge: improves rail accessibility in north-east Bradford, supports LDF development in the Wharfedale corridor, and improves connectivity to Leeds.

- 7.147 These infrastructure improvements alone will not necessarily deliver a sustainable future transport in Bradford, given the amount of development implied by the LDF.
- 7.148 In the following section, we discuss how an overall package of measures to deliver a sustainable transport system will be necessary.

District Wide Solutions

- 7.149 In the previous sections various options for transport infrastructure improvements on key transport corridors in the district and in the City of Bradford were outlined. The opportunities for significant additional transport infrastructure appear limited at this time; new highways infrastructure is generally not a sustainable option, reallocation of road space to public transport options is often difficult to achieve when corridors are already heavily congested and the provision of new highway for bus lanes is often extremely costly, and rail is limited by the location and accessibility of stations. An additional problem is the likely squeeze on government spending on transport in the next 5-10 years.
- 7.150 For Bradford to deliver an effective and sustainable transport system to support the amount of development implied by the LDF, then it will be necessary to explore more radical, and sometimes, uncomfortable solutions. We have summarised our thinking into a number of categories: land-use and transport strategy; funding and deliverability; highways; public transport; and demand management.

Land-Use and Transport Strategy

- 7.151 A sustainable transport and land-use strategy should plan development in such a way as to reduce transport demand, or to switch trips away from car to more sustainable modes such as walking, cycling and public transport.
- 7.152 This generally means locating development where there are opportunities for employment, leisure/retail and education accessible by non-car modes. If those opportunities are not currently available, then prioritising clusters of development on particular corridors or in concentrated areas can make it viable to improve the public transport offer to support the development.
- 7.153 In the context of Bradford District, our view is that development in the Airedale corridor, north Bradford and the Canal Road area, present a significant opportunity to cluster development into a package of schemes that will not only be supported by the excellent existing public transport opportunities, but will also support further development of the infrastructure.

Funding and deliverability

- 7.154 Government cutbacks, at the time of writing this report, have already started to impact on local authority budgets for transport. It is likely that in the short and medium term the focus will be on maintenance of existing transport infrastructure, rather than delivery of new schemes. It is also likely that national and regional

funding for major transport schemes will be even more difficult to obtain in the future.

- 7.155 However, mechanisms exist, such as the Community Infrastructure Levy (or its future replacement) and Section 106 agreements, by which local authorities can fund infrastructure schemes with developer contributions. This will be particularly important for LDF development, where each small development site may not have a significant impact on the transport network on its own, but the summation of all impacts from all sites will have severe impacts: increasing congestion, delays and journey times across the whole network.
- 7.156 Such levies can be politically unpopular, because of the perception that development will simply be driven elsewhere, for example, to cities without infrastructure levies. However, the economic reality is that developer funded infrastructure is likely to become more attractive to all areas wishing to have both significant amounts of development and a sustainable future transport system.
- 7.157 In the longer term, the benefits of a sustainable and effective transport system will offset any perceived barrier to development that a levy would bring.

Highways

- 7.158 There should be three emphases on managing the future highways infrastructure in Bradford:
- Maintaining good connectivity with the strategic road network; As discussed in our analysis of the M62/M606 corridor, it may be necessary to introduce traffic management schemes such as ramp metering, and modifications/improvements to junction layouts to manage in and out-flow of traffic to the M606. The completion of the final section of the M606 would improve connectivity and reduce pressure on other Bradford radials and the outer ring-road. However this scheme should not be a priority unless a realistic funding and delivery package can be put together.
 - Maintaining good connectivity with Leeds; In our analysis of the A647 corridor between Leeds and Bradford, we suggested that existing capacity could be better used through improved traffic and parking management. More radical options, such as potential for using Bowling Back Lane to create a gyratory style one-way traffic system between the inner/outer ring-road and Thornbury may be worth exploring in the future.
 - Maintaining good connectivity within the district; we have suggested a number of potential junction improvements that may be needed to reduce congestion and delay in the future. The importance of any particular improvement will be dependent on the realisation of LDF aspirations in particular areas, but generally we recommend that the outer and inner-ring roads, and their junctions with the radials are prioritised to ensure that strategic connectivity within the district is maintained.
- 7.159 Although the aim should be to reduce car trips and reduce dependence on the car generally, there will always be a residual need for a good road network to provide for trips that cannot be easily made in other ways.

Public transport

- 7.160 There should be three emphases on managing the future public transport infrastructure in Bradford:
- Improving the rail offer on the Airedale line to make it a truly high class urban rail system capable of supporting a significant proportion of the district's LDF development; this includes the new stations at Manningham and Apperley Bridge, improved Park and Ride facilities at all stations on the line, and increased passenger/train capacities in the future as indicated by levels of demand.
 - The provision of a new rail station at Low Moor, with associated Park & Ride facilities, continues to be prioritised by the Council and its partners.
 - Improving the bus offer across the district, but particularly in those areas where rail is not an option. This means the focus for bus should be on west and south Bradford, and on increasing bus priority and service levels on the western and southern radial routes. Development in the outlying western settlements may need to be supported by subsidised bus services, depending on the levels of realised development and demand.

Demand management

- 7.161 We suggest that because it is unlikely significant new highways infrastructure will be deliverable to support LDF development, a certain amount of 'natural' demand management will occur as the level of transport demand in the district increases. As roads become more congested, and journey times deteriorate, a number of responses will occur: some new trips will be suppressed, some trips will shift their time of day to less busy periods, and some trips will shift their mode.
- 7.162 For these effects to occur, and to shift transport towards more sustainable modes, the cost of using a car must increase relative to the cost of walking, cycling or using public transport.
- 7.163 Currently, for many types of trip, the cost of driving (and parking) in Bradford is either cheaper or of a similar price to using public transport. We recommend a number of policies in the district could help to shift this balance:
- Increasing parking costs across the district, but particularly in central Bradford. By increasing long-stay parking costs, and maintaining short-stay costs, this policy has real economic benefits, by shifting regular transport users, such as commuters, to more sustainable modes, and encouraging shoppers and leisure users to make use of Bradford's facilities.
 - Subsidising public transport costs on less viable routes.
- 7.164 A shift can also be made through the planning system by lowering maximum parking standards for new developments, in particular those in central areas well served by public transport.
- 7.165 In the long term, although it has become politically unpopular in recent years, the reality may well be that comprehensive road pricing is required in the UK to both manage traffic demand, and to provide the finance to maintain the road network. We do not suggest that Bradford should be an 'early-adopter' of road pricing

however - such a policy would be more viable if introduced at a regional or sub-regional level.

- 7.166 In addition to policies to change the balance of costs of travel, a number of softer policies such as Smarter Choices, travel planning, personalised journey planning, cycling education, and an emphasis on education can have real benefits in shifting users to sustainable modes. An integrated system of transport education in schools and workplaces and advertising, supporting the other measures discussed, will change attitudes in the long-term and make policies which now seem unrealistic, possible.

8 Summary and Conclusions

Comparison of the Core Strategy Spatial Options

- None of the five spatial options tested is significantly better or worse in comparison to the other options;
- The Preferred Option has local impacts on areas designated to already be problematic in terms of road safety policy;
- Any option taken forward will cause significant local impacts on the transport network which will require mitigation in terms of improved public transport provision and in some cases improvements to the highways network.

Recommendations for the Preferred Option

- Ten key multi-modal transport corridors have been identified which have significant additional transport demand, and in some cases transport impacts, in the Preferred Option:
 - 1: M606/M62
 - 2: A629/A644 (Keighley to Queensbury)
 - 3: A6036 (route between Calderdale and Bradford - through Northowram/Shelf)
 - 4: B6145 (Thornton Road)
 - 5: A650 (Airedale corridor (road and rail) between Keighley and Bradford)
 - 6: A629 (route between Craven and Bradford - through Silsden/Steeton area)
 - 7: A65/A6038 (Wharfedale corridor (road and rail) between Addingham and Bradford)
 - 8: A647 (route between Leeds and Bradford ring-roads)
 - 9: A641 (road and rail route between Calderdale (Brighouse) and Bradford)
 - 10: A650 (Tong Street)
- In addition to the specific corridor recommendations, we have outlined a district wide set of recommendations for transport policy on land-use and transport strategy; funding and deliverability; highways; public transport; and demand management, all designed to lead Bradford towards a future sustainable transport system.
- The Airedale corridor, north Bradford and Canal Road were identified as those areas for development which could be 'clustered' to both make best use of the existing public transport system, and also to provide for the possibility of using instruments such as the Community Infrastructure Levy to make improvements to that system.

Taking the Preferred Option Forward: Towards an Infrastructure Delivery Plan and Beyond

- 8.1 One of the key challenges faced by Bradford, and all the districts in the region, is unifying their development aspirations with the realities of transport planning - not only in their own district, but against a backdrop of:
- Other districts' development aspirations;
 - Other districts' transport aspirations;
 - Regional transport priorities through LTP3;
 - Emerging Leeds City Region Transport Strategy;
 - Cutbacks to transport spending following the recession;
 - Compliance with the aspirations of national transport policy (DaSTS).
- 8.2 An effective and forward-looking plan for transport in Bradford will have to take all of these into account through an integrated delivery of strategic transport schemes and solutions.
- 8.3 It is not possible nor desirable to do detailed impact assessment and mitigation work at this stage of Core Strategy development. However, this will need to be done in the future.
- 8.4 Detailed studies are underway which will support the production of supporting Development Plan Documents such as the Allocations DPD and also in key development areas:
- Shipley and Canal Road Area Action Plan. We note that new major scheme bids are unlikely in the current and medium term financial climate and so the focus in key development areas should be on developer funded interventions and making best use of existing and programmed infrastructure. Micro-simulation corridor models could be developed to help demonstrate problems, get buy in from local communities, influence design infrastructure/engineering solutions and assess the level of individual developer contributions;
 - Bradford City Centre Area Action Plan. As we have said before, more detail on the exact locations and profiles of developments in the city centre is required before a more complete understanding of the issues and potential solutions can be established. However, we believe that future proposals for car parking rationalisation, signing strategies, or even road pricing, will all play a part in keeping the city centre moving.

**APPENDIX
A
ADDITIONAL DATA AND RESULTS**

A1. STAKEHOLDER CONSULTATION NOTES

Venue	Steer Davies Gleave, Leeds		
Date	24 September 2009		
Attendees	Paul Gough/Andrew Hall - Leeds City Council, Jon Peters/Steve Oliver - SDG		
Circulation	Attendees		
Project	City of Bradford Transport Study	Project No.	221455

Subject LDF Considerations

ACTION

1. Background

JP circulated a short presentation which summarises the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

JP explained that SDG will look predominantly at strategic transport movements, but also consider specific corridor improvement that might become highlighted through the assessment.

SDG has rebased the District's multi-modal model to a 2009 base and has recently agreed the validation to complete that phase of the study. This represents a limited updated given time and data constraints. There is also a growth model that pairs up trips between new housing and employment development and which considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

The four, and emerging 5th, Core Strategy options for Bradford will be tested against a Reference Case which is similar to a Do-minimum scenario in that it includes all development proposals for which there is a degree of certainty. In reality, whatever is put forward as the Preferred Option will always include a greater level of development than in the Reference Case.

Following agreement of the growth model, the final stage will be to complete an appraisal framework, within which the relative merits of each option are assessed.

2. Leeds LDF

PG explained progress on the Leeds Core Strategy and its relationship with Area Action Plans. AAPs are specific areas identified for regeneration as part of the UDP Review (Adopted 2006). The Core Strategy work has been

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progressed alongside work on AAPs and “Towards a Core Strategy” is due for consultation in October/November this year. Leeds SHLAA is due in October.

The main challenge is how to manage delivery of 4300 new homes/year growth, whilst ensuring that the open space character that Leeds enjoys is not prejudiced. The approach will be to deliver the full RSS requirements over time, while not necessarily meeting that target year on year.

The strategy will concentrate on

- Infill
- Selected expansion (ie south east of the City, wets of Horsforth)
- Corridor development (Dewsbury Rd and rail corridor to east)
- New neighbourhoods (ie East Leeds Extension, New Pudsey)

West Leeds Gateway AAP is complementary to the Core Strategy. LCC see development of the Leeds-Bradford corridor to be more about regeneration than about growth.

3. Transport Considerations

LCC are interested in how highway infrastructure can be delivered to support the growth point in Holmewood, without impacting on the green areas around Tong Village.

Access to Leeds-Bradford airport from Bradford should be considered.

A strategic view is needed on how overall growth can be delivered, rather than progressing a series of smaller developments independently. As an example, growth in Esholt and a new station at Apperley Bridge might be a solution for new residents in that particular area, but to what extent will this have a knock on impact on existing rail users currently joining the service downstream?

4. Other Comment

When looking at the ‘environment’ element of the appraisal framework, impact on AQMAs will be evaluated. AH suggested the assessment widen to include any ‘areas for concern’.

Forecast of transport demand from new development is not an exact science. A suggested there would be merit to investigating a range of forecasts, either side of central forecasts for housing and jobs.

When moving forward from LDF to LTP3, the West Yorkshire districts really need to be coming together to define a joined up Infrastructure Plan.

Venue	Flint Street, Huddersfield		
Date	10 July 2009		
Attendees	Tony Plumbe & Simon Taylor - Kirklees, Jon Peters & Steve Oliver - SDG		
Circulation	Attendees		
Project	City of Bradford Transport Study	Project No.	221455

Subject Cross Boundary LDF Considerations

ACTION

1. Background

Prior to the meeting JP had circulated a short presentation which summarised the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

JP explained that SDG will look predominantly at strategic transport movements, but also consider specific corridor improvement that might become highlighted through the assessment.

SDG is rebasing the District's multi-modal model to a 2009 base and hopes to be option testing during August. There will also be a growth model that considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

2. Kirklees LDF

ST explained that Kirklees has undertaken consultation in relation to 4 core options. There is some evidence base underpinning the options but this is now being expanded. In reality, the bulk of the work/resource will be allocated to assessing the preferred option, which is likely to be a hybrid of the 4, similar to Bradford.

Nobody through the consultation is in favour of the scale of housing that the District is expected to deliver - the RSS requirements will lead to a 21% increase in the District's housing stock.

Delivery of the RSS in West Yorkshire should not be a competition and the Districts need to be supportive of each other. If adjacent districts can concentrate development around key infrastructure nodes, creating a critical mass of development, this might be the best way to deliver - even if this is not compatible with Highways Agency targets.

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ST briefly covered the scope of the Kirklees modelling, and explained that with minor updates their own models are good enough to identify strategic impacts of options. This is similar to the Bradford approach. With the Kirklees approach, it is likely that 'accessibility' will be better dealt with by the planning team.

In each option, the main release of land for employment is 15-20 hectares of greenbelt around Cleckheaton. This could attract traffic from Bradford.

3. Commuting

If Bradford is developing schemes close to the border, such as Low Moor station, Kirklees will be looking at how they can tie in to this with their own proposals such as for new bus services.

In terms of cross-boundary schemes, bus is really where Kirklees will focus. Both parties should help define a joint infrastructure plan. (This should apply across all boundaries, not just Kirklees-Bradford) The train is not a good option for travel between Huddersfield and Bradford - bus is a better option, with alternative services such as the X6, 363 and 662 available.

TP explained that the main commuting from Kirklees to Bradford passes through Chain Bar, with demand for Bradford Road into Oakenshaw and between Cleckheaton and Bradford centre. There is a natural affiliation between the Cleckheaton area and Bradford for service sector employment. Travel between Birstall and Tong is also significant - the border is 'imaginary' in this location.

4. Transport

The main transport considerations in Kirklees can be summarised as follows:

- The aim to deliver development along public transport corridors both to help support the extra demand for trips and to support the existing public transport networks.
- North Kirklees is where most congestion in the district occurs.
- A number of corridors into and out of Kirklees are congested. Between Kirklees and Bradford the main routes are the A638 and A651.
- More bus priority on routes between the two districts is being worked up.

5. Other

Air quality along the M62 corridor is poor, and could impose constraints on any development proposals close to the motorway. Apart from the M62 itself, there are two Air Quality Management Areas at Scale Hill and Coopers Bridge.

It is felt that Bradford's own city centre parking policy should be reviewed. The lowest long-stay parking charges in West Yorkshire are found in Bradford, and there is no shortage of availability. A possible opportunity for a demand management strategy.

Kirklees are seeking to increase cycling across the border (Route 66).

TP highlighted proposals for a new east-north connection at Chain Bar.

6. SUMMARY

Kirklees would like to see the various Districts working together to develop joint schemes; both infrastructure schemes and traffic management schemes.

There is congestion along specific corridors in Kirklees, and although traffic is busiest in North Kirklees, there is a view that the severity of the problem is relative, and not as severe as elsewhere in the region.

Bus currently competes with rail for trips between the Districts. Opening Low Moor station would improve the rail 'offer' assuming connections can be made. Capacity at Bradford Interchange is now available to support extra demand from Low Moor.

There is a need to compare cross-boundary growth predictions, both between each District and with the Highways Agency. There should be some agreement over the assumptions taken forward for assessment.

Venue	Highways Agency, Lateral, Leeds		
Date	16 July 2009		
Attendees	Toni Rios & Nicholas Whitford - HA, Helen Webster - Aecom, Chris Yapp - JMP, Jon Peters & Steve Oliver - SDG		
Circulation	Attendees		
Project	City of Bradford Transport Study	Project No.	221455

Subject LDF Considerations - Highways Agency

ACTION

1. Network Analysis Tool (NAT)

TR began by presenting a flow diagram which shows how the HA intends to work with LPAs to help promote deliverable solutions for bringing forward the LDFs. We are currently in the 'Primary Impact Assessment' stage where an understanding of those proposals with slight, moderate or severe impact on the SRN are identified.

HW then presented the NAT and explained how the model works and the data behind the forecasts. The base 2007 flows used in the model for the SRN are observed values and can be used by SDG to validate the Bradford highway model in these areas.

Future year forecasts are derived for 2016 and 2026, based on data provided by CBMDC for the 4 Core Strategy Options. Each section of the SRN is assigned a colour depending upon the level of congestion forecast for that link.

Initial results of the NAT assignments show that there is little difference in impact on the SRN between the 4 CBMDC options.

HW is close to finalising a Technical Note detailing how trips are included in the model and the interaction with TEMPRO growth. When this is agreed with HA, a copy can be made available to SDG/CBMDC.

2. Accessibility Analysis

CY briefly explained the accessibility analysis being undertaken by JMP, which helps define the distribution of trips added to the NAT. The analysis uses the Experian database for information relating to large/medium employers.

JMP are already running selective Accession models for Bradford and it could

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be that this exercise duplicates the analysis that CBMDC intend to produce.

3. Bradford Study

Prior to the meeting JP had circulated a short presentation which summarised the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

SDG is rebasing the District's multi-modal model to a 2009 base and hopes to be option testing during August. There will also be a growth model that considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

It was agreed that it makes sense to share our work on trip rates used in the growth model to aim for a level of consistency with those used in the NAT. There may be an opportunity to share the results emerging from the growth model work as they will provide a detailed assessment of cross-boundary trips resulting from each of the LDF options.

4. AOB

NW explained that HA and CBMDC have entered into a Memorandum of Agreement with respect to aspirations for major development at the northern end of the M606. The agreement aims to make the most efficient use of the SRN and the local network in this area. To that aim, an AIMSUN model is currently being developed.

HW requested that she be invited to sit in on land-use planning workshops being organised by SDG. JP will check with Wendy Fisher to confirm.

Venue	Jacob's Well, Bradford		
Date	1 July 2009		
Attendees	Sian Watson & James Ellis - Craven, Jon Peters & Steve Oliver - SDG		
Circulation	Attendees		
Project	City of Bradford Transport Study	Project No.	221455

Subject Cross Boundary LDF Considerations

ACTION

1. Background

Prior to the meeting JP had circulated a short presentation which summarised the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

JP explained that SDG will look predominantly at strategic transport movements, but also consider specific corridor improvement that might become highlighted through the assessment.

SDG is rebasing the District's multi-modal model to a 2009 base and hopes to be option testing during August. There will also be a growth model that considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

2. Craven LDF

SW explained that Craven is progressing its own Core Strategy and is currently collating the evidence base. A preferred option has been developed - a hybrid of the original options which helps provide economic growth, affordable housing and has least impact on the environment.

The principle town in Craven is Skipton, but the South Craven (Ward) villages will also be important in delivering the Core Strategy. The South Craven (Ward) villages are Cross Hills, Glusburn and Sutton.

Craven had been awarded Growth Point status but withdrew following public opposition particularly from South Craven (concern regarding Growth Point was partly based upon the fact that Craven's Strategic Housing and Employment Land Availability Assessment, which identified a number of sites for development in the South Craven Ward villages, was out to consultation at this time). Withdrawal has adversely affected the likelihood

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of funding for rail improvements in the area.

At the time when Craven District Council decided not to pursue Growth Point status, Councillors agreed to review the distribution of housing allocation across the part of the district outside the National Park, to focus more of the development on Skipton as the principal town, and less on the villages. In any case, a review was necessary following release of the RSS and completion of SHELAA. The revised strategy indicates 40% of new housing in Skipton, 17% in S. Craven, 15% and 13% in Settle and Bentham respectively and 15% in other settlements with links to existing transport provision.

3. Commuting

The main out commuting from the district is to Bradford and to Leeds, but with some into Lancashire and smaller numbers towards Harrogate. There is in-commuting also, mainly to Skipton Building Society and subsidiaries, with a new HQ building to be delivered to the north of the town.

There has been peak growth on the rail corridor, and potential rail based PnR options have been looked at. Rail demand is two way and NYCC has conducted a study into railway commuter flows. Some drive to Steeton/Silsden to get on trains within the Metro zone.

Skipton has now (recently) been included in Metro Zone 7, but since the metocard includes for bus travel also, the cost of the Zone 7 card is greater than the cost of a stand alone rail pass.

4. Transport

The main transport concerns/considerations in Craven can be summarised as follows:

- Need for new rail station at Cross Hills - bids have been submitted.
- Congestion at Kildwick level crossing - possible need for new bridge - with congestion also encountered at the only alternative crossing of the railway at Station Road
- Problems of high HGV numbers passing through Cross Hills and on to the A6068 to Lancashire

Other than localised issues, traffic is not a major issue in the district. For example, there is some local congestion at the A65/A629 roundabout, associated with the new HQ development.

5. Other

Sustrans has proposals to link Craven into Bradford's cycle network. Craven has had a successful RFA underspend bid for upgrading of canal towpath through Skipton (which it is understood forms part of the Sustrans identified route through the southern part of the district).

If Bradford develop in the Airedale corridor, then there would be a need to look at Green Transport options.

There are a number of good schools in Craven and people tend to move into

the area to get into the catchment area. Large numbers of new houses in the north-west of Bradford could put pressure on local school capacity.

Funding has now been made available to link the Embsay steam railway into Skipton.

6. SUMMARY

Craven would have concerns over any development close to the S Craven border in terms of settlements merging together as well as in terms of the impact of additional impact on the highway network in and around the South Craven Ward villages of Crosshills, Sutton and Glusburn.

Transport issues in Craven can be summarised as the desire for a new rail station at Cross Hills, improved rail based Park and Ride facilities, the need to do something about the level crossing at Kildwick and HGV pressure on the A6068 route into Lancashire.

Transport interaction with Bradford includes out-commuting to Bradford and Leeds and in-commuting to Skipton, busy trains and inadequate PnR parking to support the level of commuting. There is no economic benefit to use Metro Zone 7.

Road traffic problems in Craven are more localised than a cross border issue.

Venue	Northgate House, Halifax		
Date	19 August 2009		
Attendees	Mary Farrar/Tim Robinson/Phil Ratcliffe/Nigel Pickles - Calderdale, Jon Peters/Steve Oliver - SDG		
Circulation	Attendees		
Project	City of Bradford Transport Study	Project No.	221455

Subject LDF Considerations

ACTION

1. Background

JP circulated a short presentation which summarises the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

JP explained that SDG will look predominantly at strategic transport movements, but also consider specific corridor improvement that might become highlighted through the assessment.

SDG is rebasing the District's multi-modal model to a 2009 base and is coming to an end of that phase of the study. This represents a limited updated given time and data constraints. There will also be a growth model that pairs up trips between new housing and employment development and which considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

MF explained that various methodologies for modelling LDF scenarios are being put forward from different local authorities, and that the DfT is embarking on a study to seek some sort of compatibility through the development of a generic toolkit.

JP explained that the elements within assessment framework against which the core strategy options will be assessed will not be weighted at this stage. Any weighting will be the responsibility of CBMDC.

2. Calderdale LDF

PR summarised that Calderdale is looking to deliver some 12-15,000 new homes by 2026, along with 610 jobs per year. Most of the housing growth will be focused on the east of the district, around Halifax, Elland and

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Brighouse.

Calderdale does not operate a single transport model of the district. There are SATURN models of Halifax Town Centre and Brighouse, and an intention to connect the two models and extend the area covered to include the entire eastern half of the district. However, there is some uncertainty over whether a full scale model is necessarily required at this stage in the LDF process and a view that available funding could be better utilised elsewhere.

3. Transport

The main transport consideration in Calderdale is the highway constraint posed by the Hipperholme Crossroads junction. The junction is to the east of Halifax where the A644 and A649 meet the A58. Limits to the level of improvement available at this junction are constraining growth in the area. Any increase in traffic along this route as a result of growth in Bradford will need to be considered in the appraisal framework.

There are current bus priority measures either side of Brighouse on the Huddersfield-Bradford route. There are accusations that this lack of priority is an issue for cross-district bus users but TR explained that options have been put forward to the relevant bus operators, but they don't think it is needed. This poses the question "is there really a problem?". PR suggested that it is the peak hour congestion at the Tesco roundabout that clouds everybody's views of the route.

There is a lot of SHLAA land identified in the Northowram-Shelf corridor, and if these are brought forward there will be a need to review this link into Bradford and to investigate opportunities for public transport improvements.

There is land available for a new rail station at Hipperholme, but capacity constraints at main line stations are such that operators would not be able to amend their service times to include an additional stop.

4. SUMMARY

Calderdale is expected to deliver 12-15,000 new houses by 2026, less than required in Bradford. Most of this growth will be focused on the east of the district.

The main constraint to growth in East Calderdale is the capacity restrictions at the Hipperholme Crossroads junction. New rail station proposals have been investigated, but line capacity affects the ability of operators to introduce a new stop. Any increase in traffic along this route as a result of growth in Bradford will need to be considered in the appraisal framework.

Calderdale is considering options for model development in the east of the district.

Venue	SDG, West Riding House, Leeds	
Date	16 July 2009	
Attendees	Andy Chymera & Michael Long - Metro, Jon Peters & Steve Oliver - SDG	
Circulation	Attendees	
Project	City of Bradford Transport Study	Project No. 221455

Subject LDF Considerations - Public Transport Provision**ACTION****1. Background**

Prior to the meeting JP had circulated a short presentation which summarised the SDG role in assisting CBMDC develop a transport specific evidence base against which LDF options can be evaluated.

JP explained that SDG will look predominantly at strategic transport movements, but also consider specific corridor improvement that might become highlighted through the assessment.

SDG is rebasing the District's multi-modal model to a 2009 base and hopes to be option testing during August. There will also be a growth model that considers RSS requirements from neighbouring authorities from which changes in cross boundary trips will be forecast. The model will be the predominant source of information against which differences in options will be evaluated.

AC explained that he and ML should be thought of as Metro's planning representatives, not operations. AC also explained that his role has also changed in that he is now Metro's Project Manager for LTP3.

2. Metro Considerations

Metro's preliminary view is that development should focus on existing public transport corridors, to keep good corridors protected, but not to the extent that, without intervention, conditions on those corridors are worsened.

New rail stations at Low Moor and Apperley Bridge are proposed, although there is some concern over the delivery of longer trains that would be needed to provide the extra capacity required.

Access from Bradford district to Leeds-Bradford airport should be considered.

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Getting into and out of Bradford City Centre by public transport is relatively straight forward, but getting across Bradford is not so easy. Movement around the city centre is also confusing, particularly on the western side of the city where the ring road is not continuous. The Canal Road Corridor improvements have made things better on the eastern side.

There are uncertainties over what the bus network through the city centre will look like in the future, given slow down with development proposals and potential road closures associated with the City Park (Mirror Pool).

First Bradford has introduced significant cutbacks in Bradford, potentially losing (recent) support from Councillors. Approximately 6% of services will be affected. Cutbacks are to both number of services and frequencies.

Options for buses are being investigated in the Keighley - Worth Valley corridor.

Generally, bus reliability (lower variance in journey times) is seen as a key future deliverable in terms of improving the PT offer. This can be achieved using, eg ITS, to manage the journey, and is less expensive than achieving absolute reductions in journey times.

3. Appraisal Methodology

AC/ML identified a number of areas that could be included within the appraisal framework moving forward.

- Environment - we should consider how carbon emissions could be included within the allocation determination process.
- Congestion - to investigate the potential for using Traffic Master data (from Leeds CC) to identify indicators of congestion, particularly for the 3 routes included in the Urban Congestion Target Reduction Plan. We also need to be able to evaluate public transport congestion in terms of passenger numbers, and reliability is a big issue for public transport users. (RTI data, following a methodology derived by Tim Harvey at Leeds CC, could be used for this)
- Safety - specific consideration of accidents involving children?
- Accessibility - there are lessons we can learn from the Accession modelling undertaken in Wakefield, whereby a methodology was developed for looking at groups rather than individual sites.
- Generally, sites located near to Metro's high frequency bus network should be scored higher.

4. SUMMARY

SDG will feed back to Metro on methodologies for assessing public transport capacity in future years

SDG/CBMDC to approach Leeds CC re: real time information to assess bus reliability

Metro will provide more information with respect to the rail station

proposals and any issues arising over longer trains, and potential need for longer platforms at stations along the Airedale corridor

There are uncertainties around bus routing through the city centre, associated with new development proposals. Also, cross-city movements by public transport are difficult and Metro would look for development to be focussed on existing corridors.

Suggestions for potential additions to the appraisal methodology have been identified

Table A2.1 Core Strategy Option Appraisal: Environment AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Energy Use	-1%	0%	0%	1%	0%
Total CO	-1%	0%	0%	1%	0%
Total CO2	-1%	0%	0%	1%	0%
Total NOx	-1%	0%	0%	1%	0%
Total HCs	-1%	0%	0%	1%	0%
AQMA Impact	0%	0%	0%	-1%	1%

Table A2.2 Core Strategy Option Appraisal: Safety AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Distance Travelled (km)	-1%	0%	0%	1%	0%
Accident Areas Impact	-3%	1%	-1%	-2%	4%

Table A2.3 Core Strategy Option Appraisal: Economy AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Time Travelled (hr)	-1%	1%	0%	0%	0%
Car Time Travelled (hr)	-1%	0%	1%	0%	0%
Average Speed (kph)	1%	-1%	0%	0%	0%
Queues (hr)	-2%	1%	1%	0%	0%
All Radials Impact	2%	-1%	-1%	0%	1%
PT Crowding	2%	-5%	6%	0%	-3%
Passenger Time (PT) (hr)	1%	2%	-1%	-1%	-1%
Travel Distance (PT) (km)	1%	2%	-1%	-1%	-1%

Table A2.4 Core Strategy Option Appraisal: Integration AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Influence interaction between modes	-1%	-1%	-1%	-1%	-1%
Impact on surrounding districts	0%	-1%	1%	1%	0%

Table A3.1 Core Strategy Option Appraisal: Environment OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Energy Use	-1%	0%	0%	0%	0%
Total CO	-1%	0%	0%	0%	0%
Total CO2	-1%	0%	0%	0%	0%
Total NOx	-1%	0%	0%	0%	0%
Total HCs	-1%	0%	0%	0%	0%
AQMA Impact	0%	0%	0%	0%	1%

Table A3.2 Core Strategy Option Appraisal: Safety OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Distance Travelled (km)	-1%	0%	0%	0%	0%
Accident Areas Impact	0%	0%	-1%	-1%	2%

Table A3.3 Core Strategy Option Appraisal: Economy OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Time Travelled (hr)	-1%	0%	0%	0%	0%
Car Time Travelled (hr)	-1%	0%	0%	0%	0%
Average Speed (kph)	0%	0%	0%	0%	-1%
Queues (hr)	-2%	0%	-1%	0%	2%
All Radials Impact	-1%	0%	-1%	2%	0%
PT Crowding	1%	2%	-4%	-6%	6%
Passenger Time (PT) (hr)	0%	0%	0%	0%	0%
Travel Distance (PT) (km)	0%	1%	0%	0%	0%

Table A3.4 Core Strategy Option Appraisal: Integration OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Influence interaction between modes	-1%	-1%	-1%	-1%	-1%
Impact on surrounding districts	0%	0%	0%	1%	0%

Table A4.1 Core Strategy Option Appraisal: Environment PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Energy Use	-1%	-1%	1%	1%	1%
Total CO	-1%	-1%	1%	1%	1%
Total CO2	-1%	-1%	1%	1%	1%
Total NOx	-1%	0%	0%	0%	0%
Total HCs	-1%	-1%	1%	1%	1%
AQMA Impact	-1%	0%	-1%	0%	2%

Table A4.2 Core Strategy Option Appraisal: Safety PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Distance Travelled (km)	-1%	0%	0%	1%	0%
Accident Areas Impact	1%	1%	-3%	-3%	4%

Table A4.3 Core Strategy Option Appraisal: Economy PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Total Time Travelled (hr)	-1%	-1%	1%	1%	1%
Car Time Travelled (hr)	-2%	-1%	1%	1%	1%
Average Speed (kph)	1%	0%	0%	0%	-1%
Queues (hr)	-3%	-1%	1%	1%	2%
All Radials Impact	-1%	0%	0%	0%	1%
PT Crowding	3%	3%	-6%	-1%	1%
Passenger Time (PT) (hr)	1%	0%	0%	0%	-1%
Travel Distance (PT) (km)	0%	-1%	1%	1%	-1%

Table A4.4 Core Strategy Option Appraisal: Integration PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Influence interaction between modes	-1%	-1%	-1%	-1%	-1%
Impact on surrounding districts	-1%	-1%	1%	1%	0%

Table A5.1 Core Strategy Option Appraisal: Corridor Analysis AM - Inbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	9%	-3%	1%	-2%	-5%
2: A650 Wakefield Road	-12%	-14%	17%	16%	-7%
3: A641 Manchester Road	2%	-2%	0%	0%	-1%
4: A647 Great Horton Road	0%	1%	-3%	-3%	5%
5: B6145 Thornton Road	-4%	1%	-7%	-4%	14%
6: A650 Aire Valley Road	-8%	18%	-4%	-3%	-2%
7: A6037 Canal Road	7%	-8%	-6%	0%	7%
8: A658 Harrogate Road	16%	-3%	-2%	-6%	-5%

Table A5.2 Core Strategy Option Appraisal: Corridor Analysis AM - Outbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	12%	1%	-10%	-5%	2%
2: A650 Wakefield Road	-1%	-4%	5%	5%	-5%
3: A641 Manchester Road	2%	3%	-4%	-3%	1%
4: A647 Great Horton Road	-3%	2%	0%	0%	2%
5: B6145 Thornton Road	0%	1%	0%	1%	-1%
6: A650 Aire Valley Road	1%	-8%	0%	0%	8%
7: A6037 Canal Road	2%	-15%	9%	-1%	6%
8: A658 Harrogate Road	23%	0%	-16%	-6%	-1%

Table A5.3 Core Strategy Option Appraisal: Corridor Analysis OP - Inbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	3%	1%	-2%	-3%	1%
2: A650 Wakefield Road	-2%	-2%	2%	2%	1%
3: A641 Manchester Road	0%	0%	0%	0%	0%
4: A647 Great Horton Road	-1%	0%	-1%	0%	3%
5: B6145 Thornton Road	-1%	0%	-2%	-1%	3%
6: A650 Aire Valley Road	-1%	0%	0%	1%	0%
7: A6037 Canal Road	-8%	-7%	-6%	27%	-5%
8: A658 Harrogate Road	1%	0%	0%	0%	0%

Table A5.4 Core Strategy Option Appraisal: Corridor Analysis OP - Outbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	2%	4%	-3%	-1%	-1%
2: A650 Wakefield Road	-2%	-3%	3%	4%	-2%
3: A641 Manchester Road	1%	0%	0%	0%	0%
4: A647 Great Horton Road	-1%	0%	0%	0%	1%
5: B6145 Thornton Road	-1%	3%	-4%	-2%	4%
6: A650 Aire Valley Road	-2%	5%	-2%	1%	-1%
7: A6037 Canal Road	-1%	4%	-3%	-2%	1%
8: A658 Harrogate Road	0%	0%	0%	0%	0%

Table A5.5 Core Strategy Option Appraisal: Corridor Analysis PM - Inbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	13%	11%	-15%	-14%	5%
2: A650 Wakefield Road	0%	-1%	2%	2%	-2%
3: A641 Manchester Road	-1%	0%	1%	2%	-1%
4: A647 Great Horton Road	-1%	-1%	1%	0%	1%
5: B6145 Thornton Road	0%	0%	0%	0%	0%
6: A650 Aire Valley Road	-2%	-6%	2%	2%	4%
7: A6037 Canal Road	3%	-4%	-2%	-1%	4%
8: A658 Harrogate Road	-3%	2%	0%	0%	1%

Table A5.6 Core Strategy Option Appraisal: Corridor Analysis PM - Outbound

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: A647 Leeds Road	-6%	-3%	5%	4%	0%
2: A650 Wakefield Road	-9%	-5%	11%	7%	-5%
3: A641 Manchester Road	1%	3%	-3%	-3%	3%
4: A647 Great Horton Road	-1%	1%	-1%	-1%	2%
5: B6145 Thornton Road	-3%	1%	-2%	0%	4%
6: A650 Aire Valley Road	-2%	5%	-3%	-1%	1%
7: A6037 Canal Road	-5%	6%	-1%	2%	-2%
8: A658 Harrogate Road	-1%	-1%	1%	0%	0%

Table A6.1 Core Strategy Option Appraisal: AQMAs AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: Manchester Road/Mayo Avenue	0%	2%	-2%	-2%	2%
2: Manningham Lane/Queens Road	-3%	0%	0%	0%	2%
3: Thornton Road	-1%	-1%	-2%	-1%	4%
4: Shipley Airedale Road/IRR	1%	-2%	3%	0%	-1%

Table A6.2 Core Strategy Option Appraisal: AQMAs OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: Manchester Road/Mayo Avenue	0%	0%	0%	0%	1%
2: Manningham Lane/Queens Road	0%	1%	-2%	-1%	2%
3: Thornton Road	0%	0%	0%	0%	1%
4: Shipley Airedale Road/IRR	0%	0%	0%	0%	0%

Table A6.3 Core Strategy Option Appraisal: AQMAs PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
1: Manchester Road/Mayo Avenue	-1%	0%	0%	-1%	2%

2: Manningham Lane/Queens Road	-1%	1%	-2%	0%	2%
3: Thornton Road	1%	-1%	-2%	-1%	3%
4: Shipley Airedale Road/IRR	-1%	0%	-1%	0%	2%

Table A7.1 Core Strategy Option Appraisal: Accident Areas AM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Great Horton Road	-1%	2%	-3%	-2%	4%
Manningham Lane	-4%	1%	-2%	-2%	6%
Haworth Road	-2%	0%	0%	-2%	4%
Barkerend Road	-15%	7%	3%	0%	4%
Fair Road / Ordsal Road	2%	-1%	0%	0%	-1%

Table A7.2 Core Strategy Option Appraisal: Accident Areas OP

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Great Horton Road	1%	-2%	-1%	-1%	3%
Manningham Lane	-1%	0%	0%	0%	1%
Haworth Road	-4%	4%	-5%	0%	4%
Barkerend Road	5%	2%	-2%	-3%	-2%
Fair Road / Ordsal Road	0%	0%	-2%	-1%	3%

Table A7.3 Core Strategy Option Appraisal: Accident Areas PM

	2026 Option 1	2026 Option 2	2026 Option 3	2026 Option 4	2026 Preferred Option
Great Horton Road	1%	0%	-2%	-2%	4%
Manningham Lane	-1%	1%	-3%	-1%	3%
Haworth Road	-2%	-3%	1%	1%	3%
Barkerend Road	15%	8%	-15%	-15%	7%
Fair Road / Ordsal Road	-1%	1%	-1%	0%	1%

Figure A8.1 Accessibility to Hospitals by Sustainable Transport Modes AM

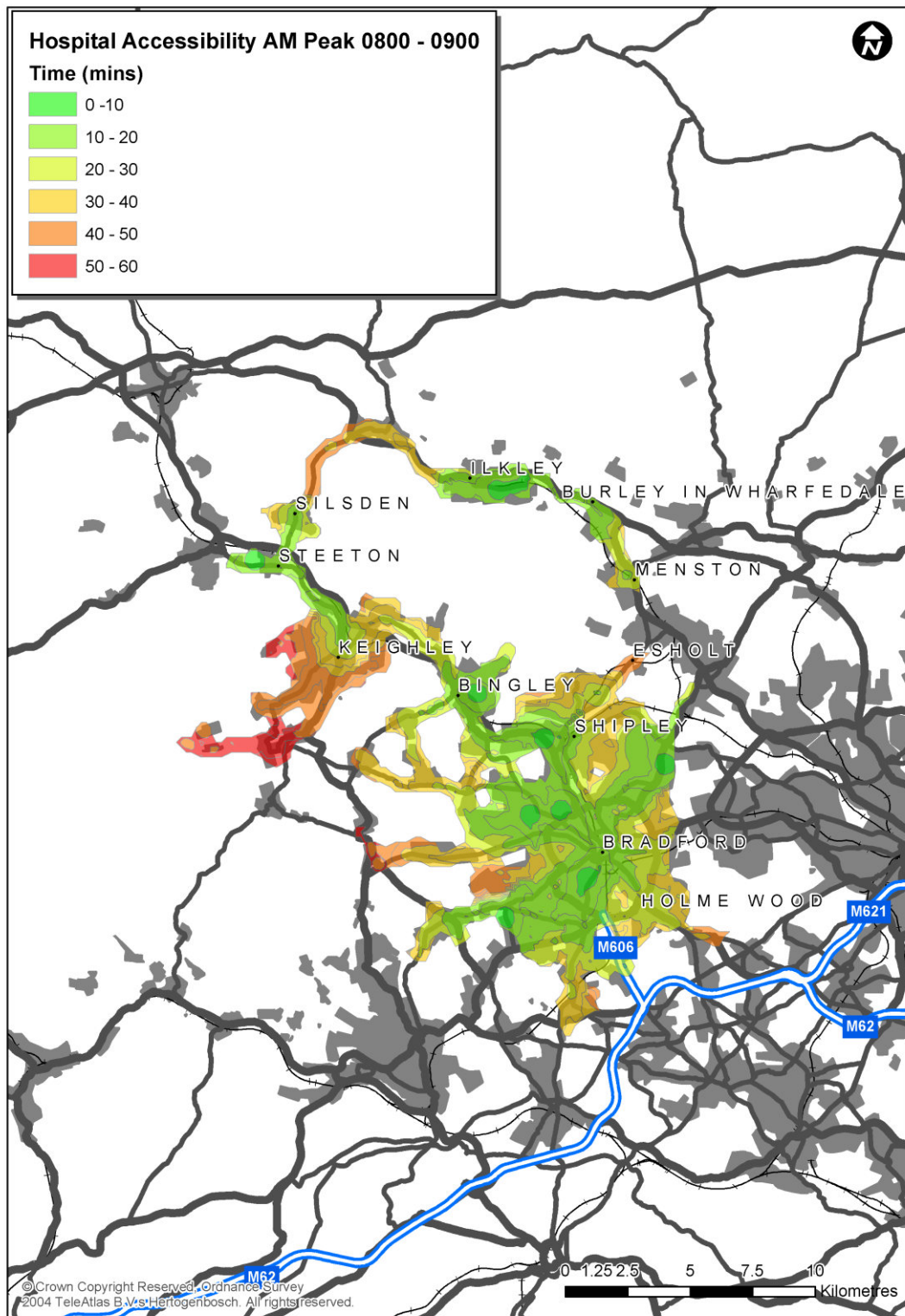


Figure A8.2 Accessibility to Hospitals by Sustainable Transport Modes OP

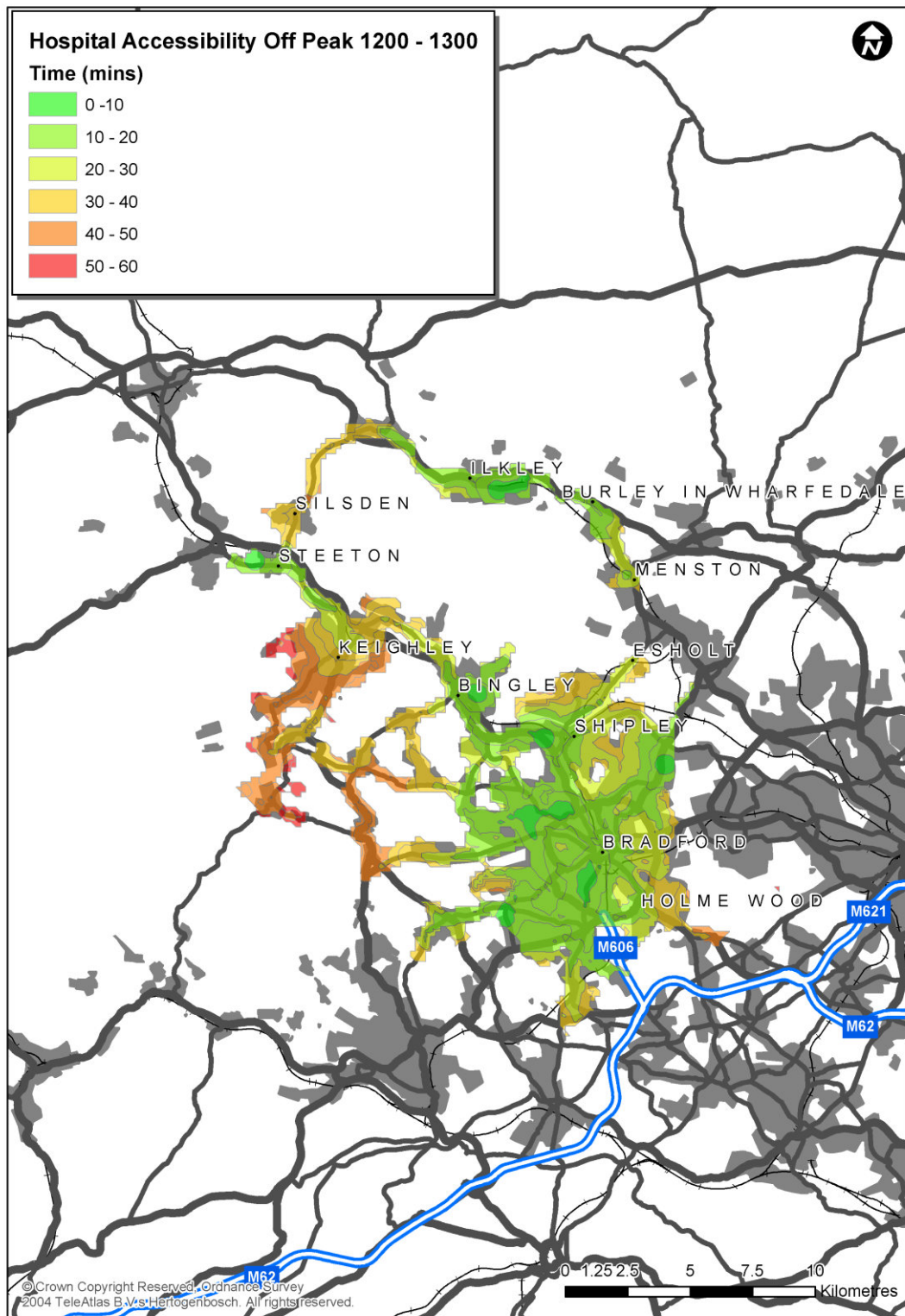


Figure A8.3 Accessibility to Hospitals by Sustainable Transport Modes PM

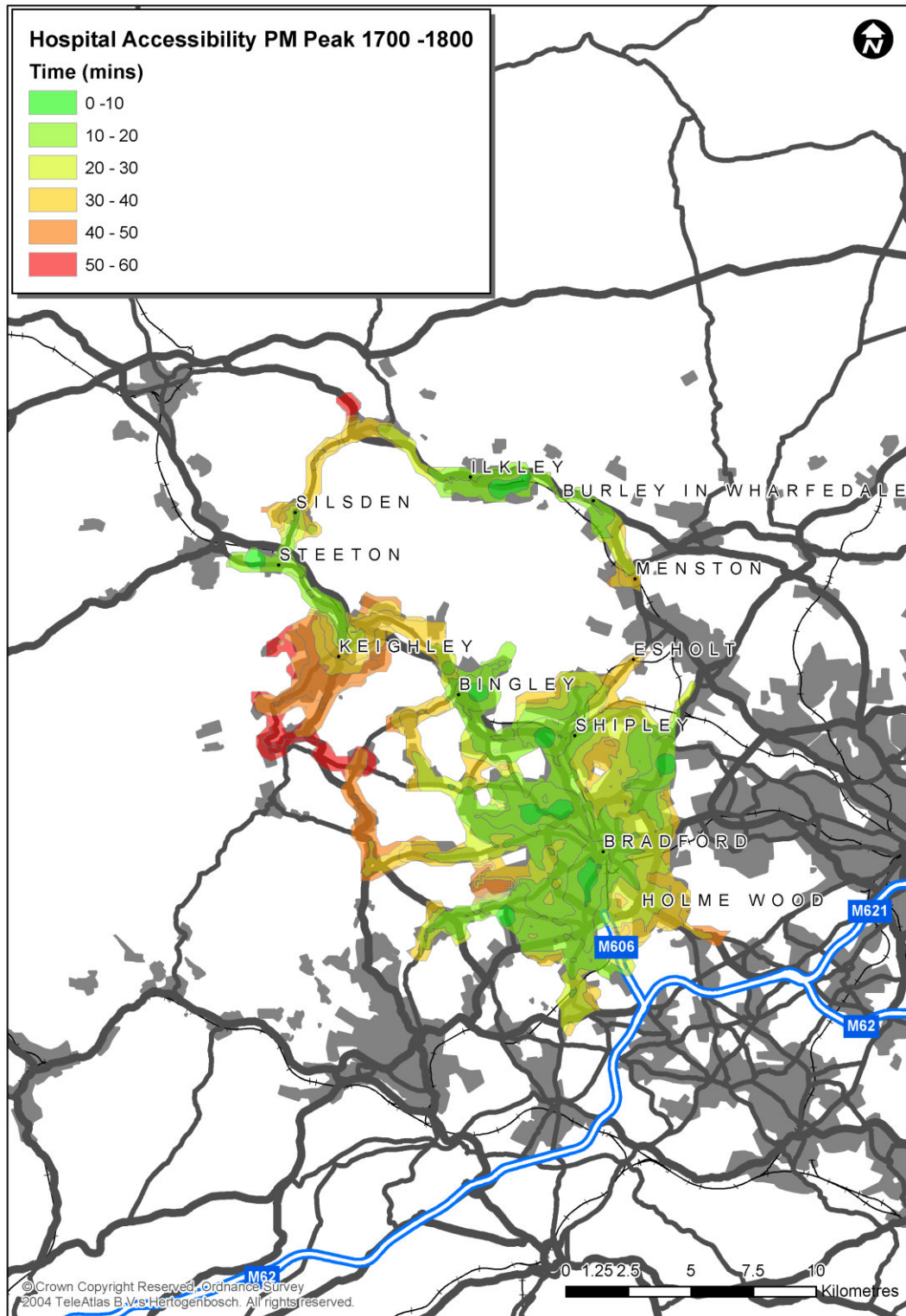


Figure A8.4 Accessibility to Education by Sustainable Transport Modes AM

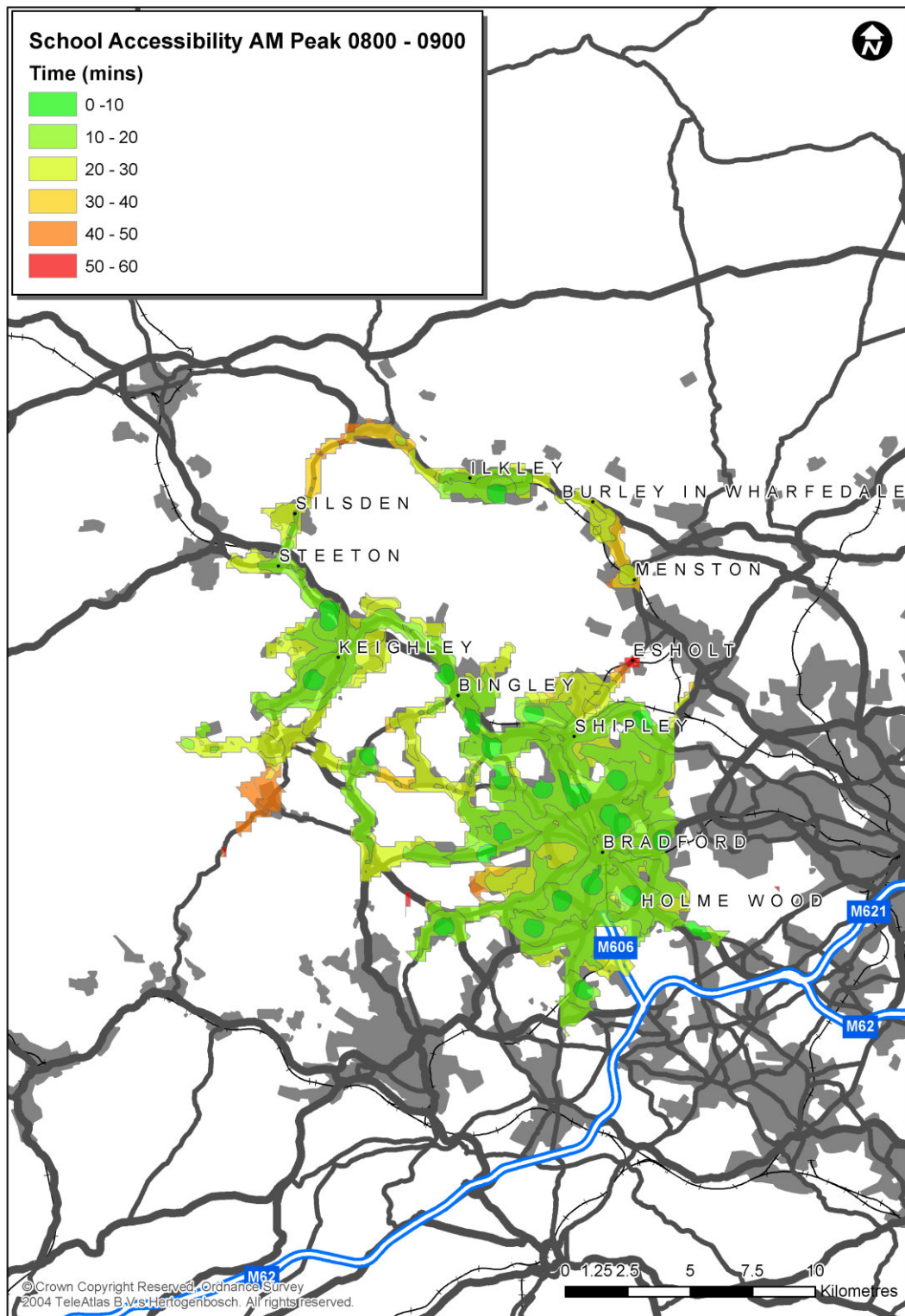


Figure A8.5 Accessibility to Education by Sustainable Transport Modes OP

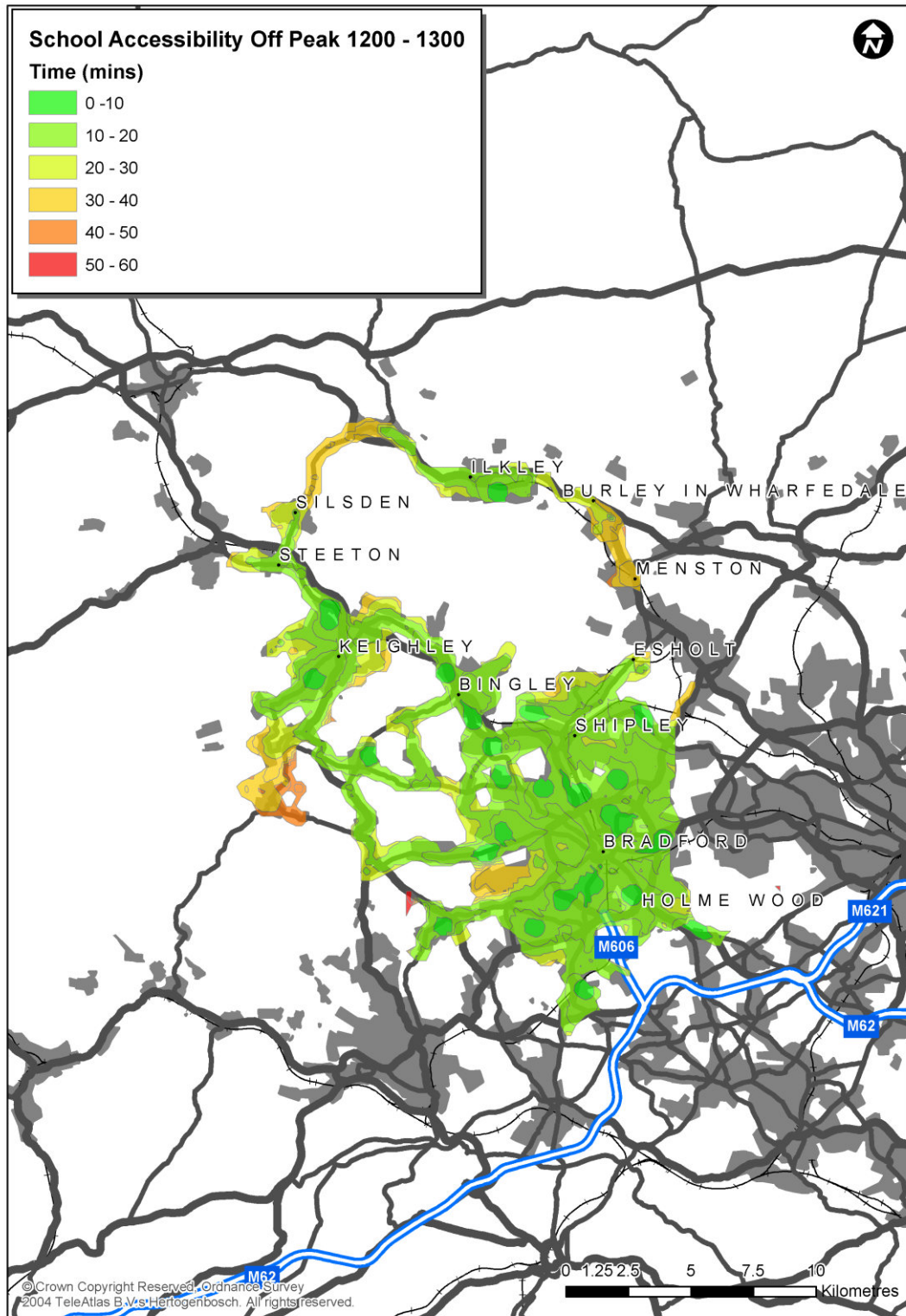


Figure A8.6 Accessibility to Employment by Sustainable Transport Modes AM

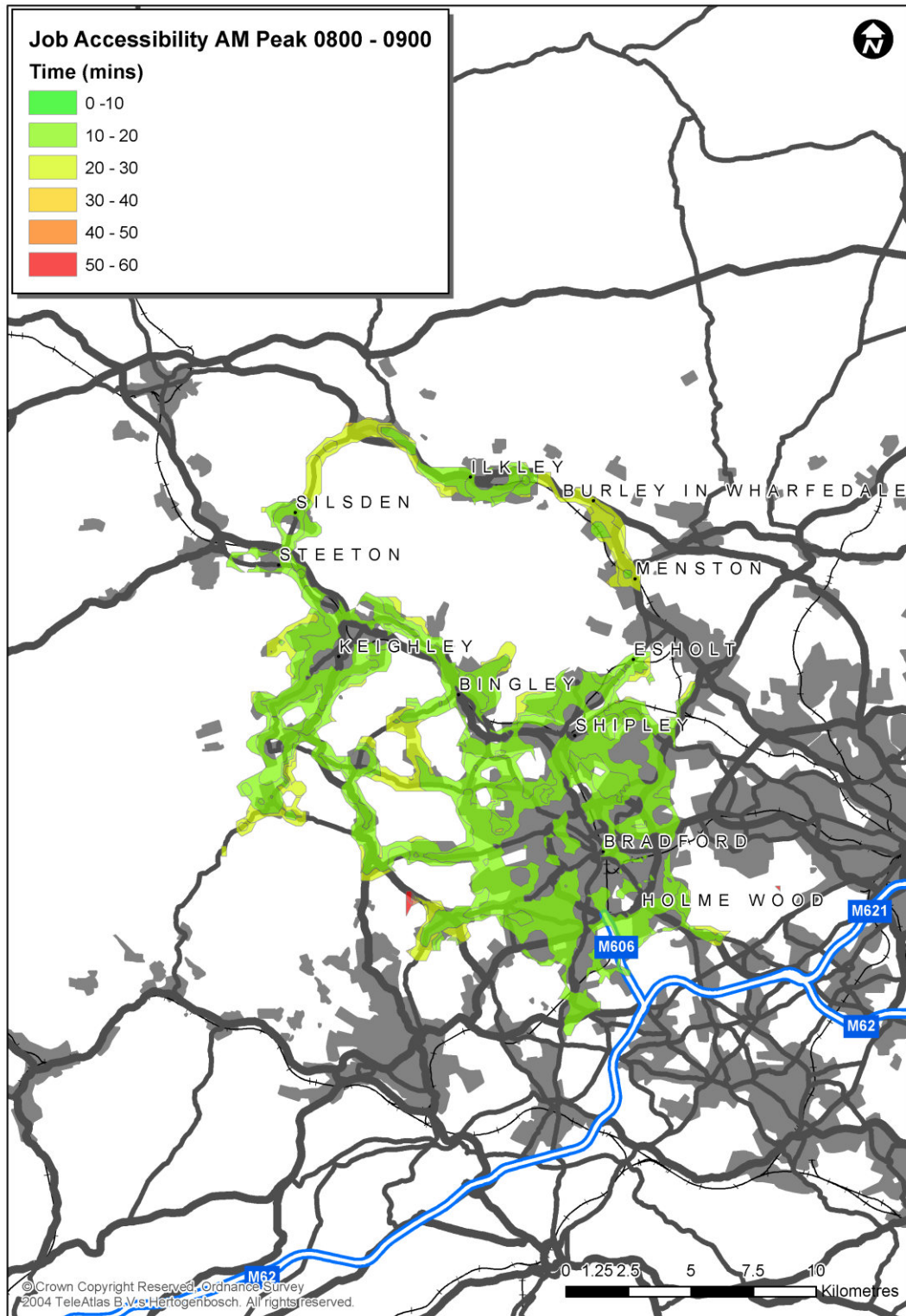


Figure A8.7 Accessibility to Employment by Sustainable Transport Modes OP

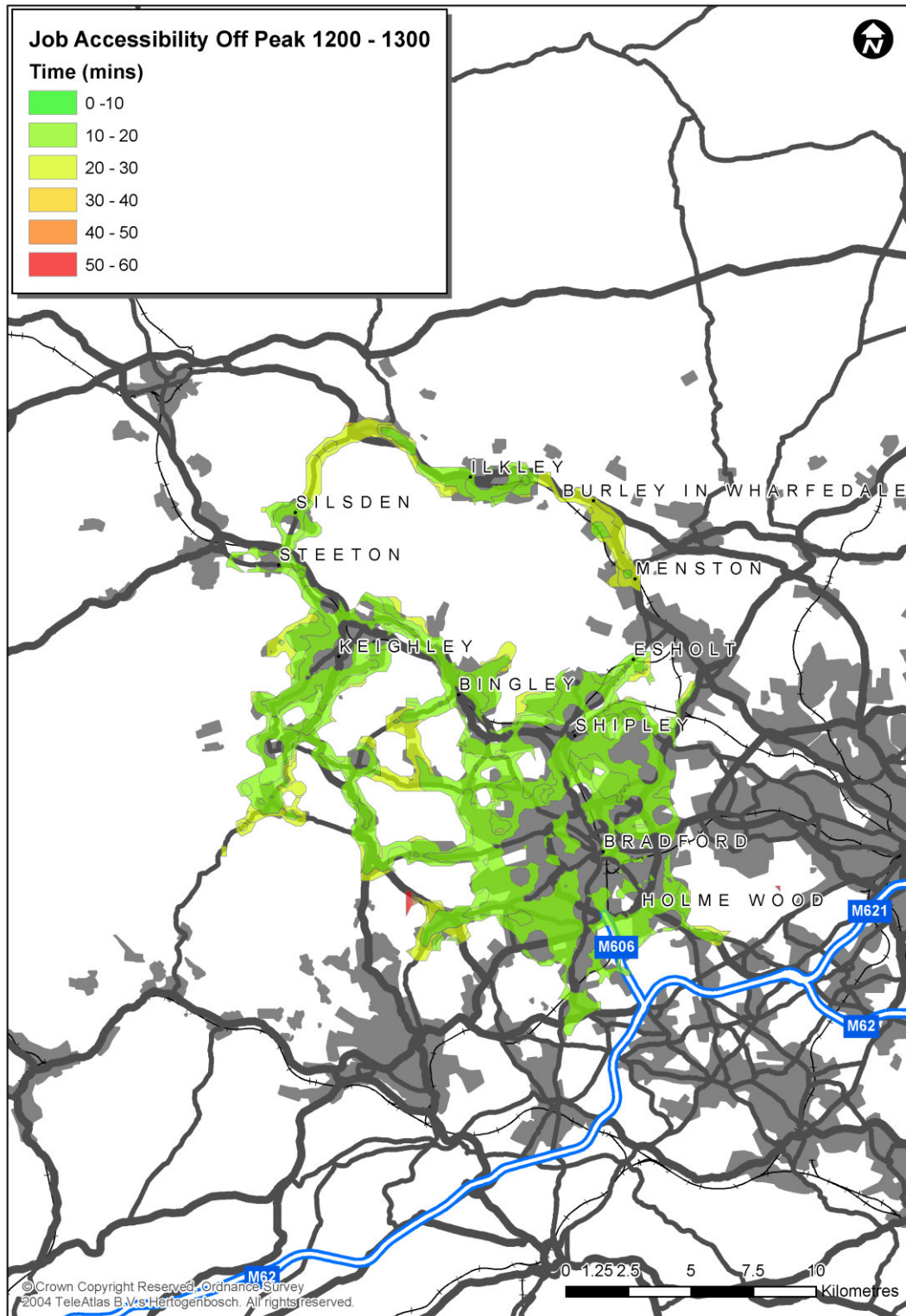


Figure A8.8 Accessibility to Employment by Sustainable Transport Modes PM

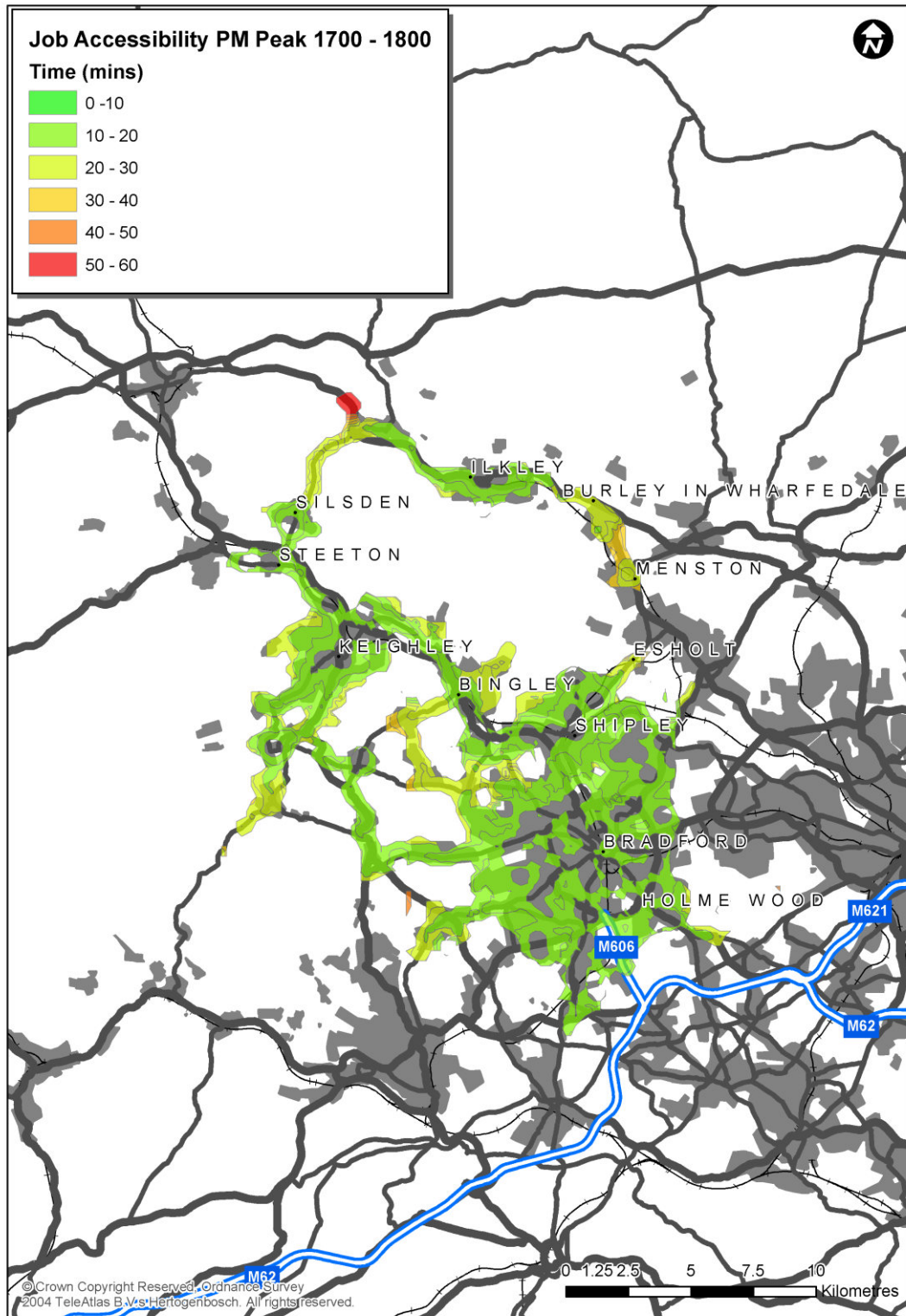


Figure A8.9 Accessibility to Retail by Sustainable Transport Modes OP

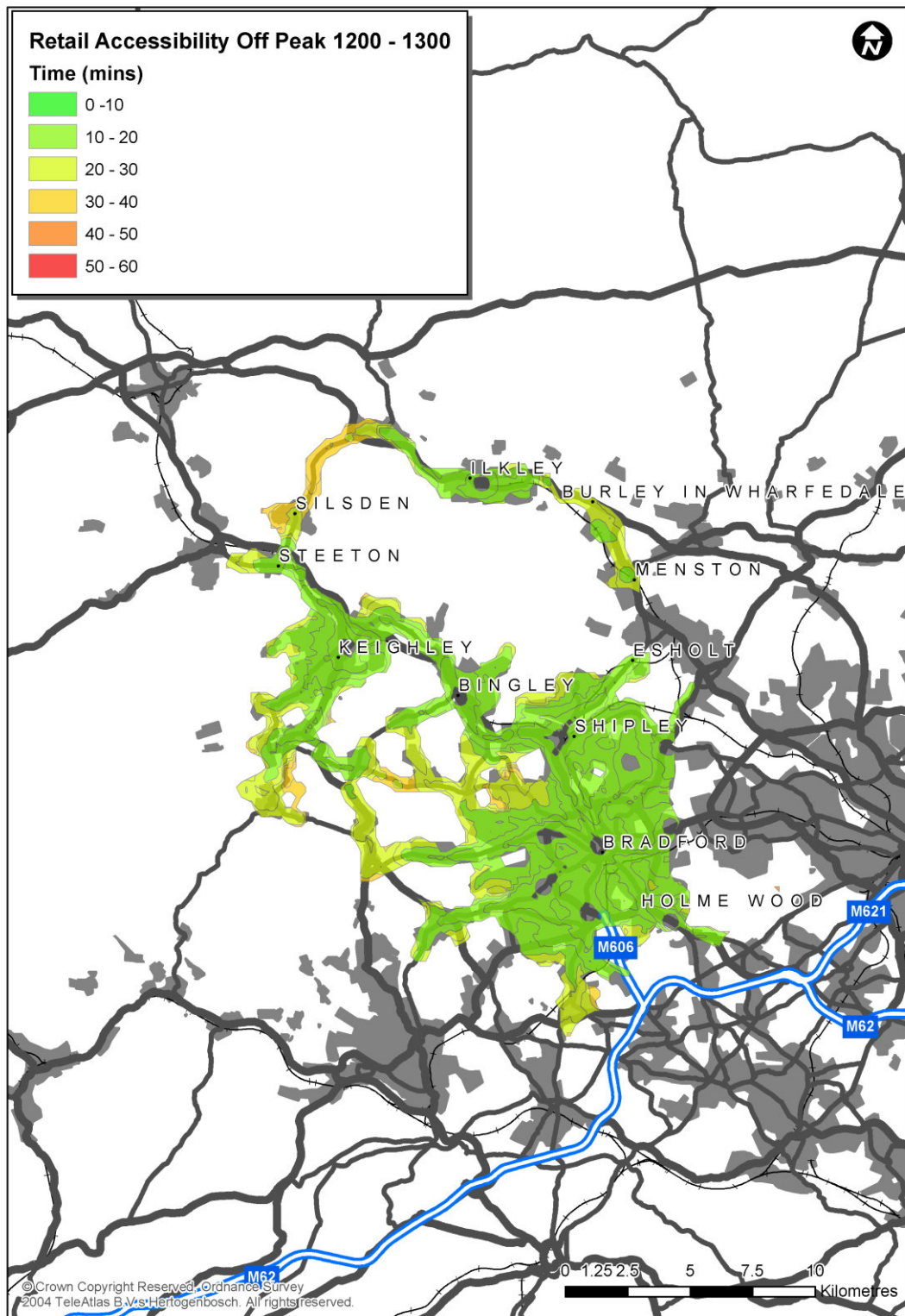


Figure A8.10 Accessibility to Retail by Sustainable Transport Modes PM

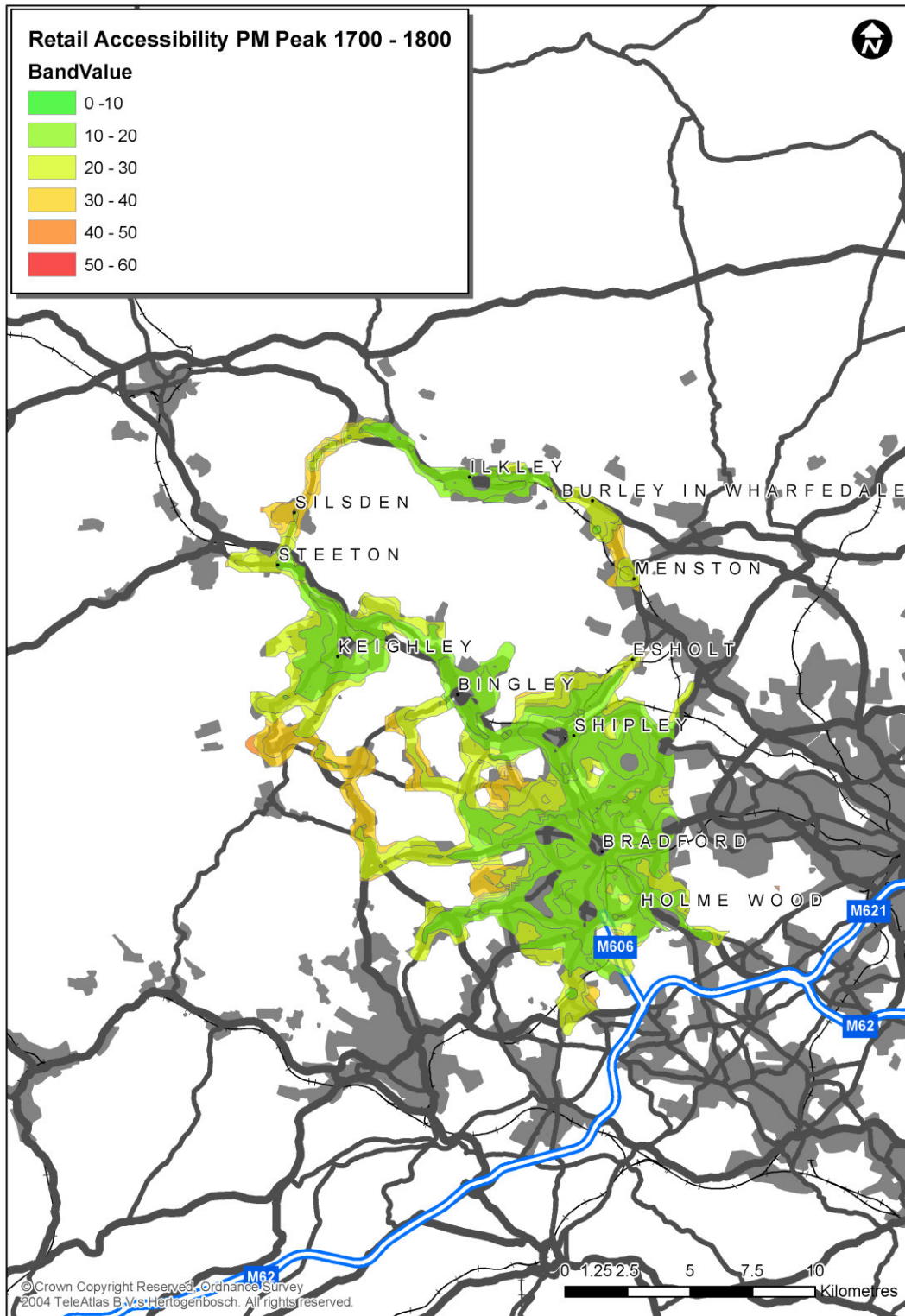


Table A8.11 Minimum and Maximum Journey Times (minutes) by Sustainable Transport Modes from potential development areas to Hospitals

Access to Hospitals	AM		OP		PM	
	MIN	MAX	MIN	MAX	MIN	MAX
Settlements						
Bradford	0	50	0	50	0	50
Shipley	0	40	0	40	0	40
Esholt	40	50	20	40	30	40
Holmewood	40	50	30	40	30	40
Keighley	0	60	20	60	0	60
Ilkley	0	20	0	20	0	20
Bingley	0	30	0	30	0	20
Burley	10	30	10	30	10	30
Menston	20	40	10	40	20	40
Steeton/Eastburn	0	20	0	20	0	20
Silsden	0	50	30	50	20	50

Table A8.12 Minimum and Maximum Journey Times (minutes) by Sustainable Transport Modes from potential development areas to Education

Access to Education	AM		OP	
	MIN	MAX	MIN	MAX
Settlements				
Bradford	0	50	0	40
Shipley	0	40	0	40
Esholt	50	60	10	30
Holmewood	20	40	10	30
Keighley	10	30	0	40
Ilkley	0	20	0	20
Bingley	0	30	0	30
Burley	20	40	20	40
Menston	20	40	30	50
Steeton/Eastburn	10	30	10	30
Silsden	10	30	10	40

Table A8.13 Minimum and Maximum Journey Times (minutes) by Sustainable Transport Modes from potential development areas to Employment

Access to Employment	AM		OP		PM	
	MIN	MAX	MIN	MAX	MIN	MAX
Bradford	0	30	0	30	0	30
Shipley	0	30	0	30	0	30
Esholt	0	30	0	30	10	30
Holmewood	10	20	10	20	0	20
Keighley	0	30	0	30	0	30
Ilkley	0	30	0	30	0	20
Bingley	0	30	0	30	0	30
Burley	10	30	0	30	10	30
Menston	10	30	10	30	20	40
Steeton/Eastburn	0	20	0	20	0	20
Silsden	0	20	0	20	0	20

Table A8.14 Minimum and Maximum Journey Times (minutes) by Sustainable Transport Modes from potential development areas to Retail

Access to Retail	OP		PM	
	MIN	MAX	MIN	MAX
Bradford	0	40	0	40
Shipley	0	30	0	30
Esholt	0	20	20	30
Holmewood	0	20	10	30
Keighley	0	30	0	30
Ilkley	0	20	0	20
Bingley	0	20	0	30
Burley	0	30	10	30
Menston	0	30	20	40
Steeton/Eastburn	0	20	0	30
Silsden	20	40	20	40

A8.15 Qualitative Assessment of Accessibility of Core Strategy Options

The results of the minimum and maximum journey time assessments have allowed us to make a number of qualitative conclusions about accessibility from settlements with the potential for housing development:

- Accessibility to hospitals is good in many settlements (less than 30 minutes for all time periods). However, in outlying areas of Bradford, Shipley, Esholt, Holmewood, Keighley, Menston and Silsden accessibility is significantly worse (up to 60 minutes in one or more time periods).
- Accessibility to education is good in many settlements (less than 30 minutes for all time periods). However, in outlying areas of Bradford, Shipley, Esholt, Holmewood, Keighley, Burley, Menston and Silsden accessibility is significantly worse (up to 60 minutes in one or more time periods).
- Accessibility to employment is very good in all settlements (less than 30 minutes for all but one settlement in all time periods). Accessibility between specific settlements and specific employment sites is likely to be less good however.
- Accessibility to retail is also very good in nearly all settlements. Most are less than 30 minutes but outlying areas of Bradford, Menston and Silsden are up to 40 minutes. Similarly to employment, accessibility between specific settlements and specific retail sites is likely to be less good.
- In the larger settlements of Bradford and Keighley, accessibility to all services is highly variable and will be dependent on the relative location of new housing. The outlying areas in the south and west of both Bradford and Keighley are less accessible than more central locations in both towns.
- Other specific settlements where accessibility may be an issue are Esholt, Holmewood, Menston and Silsden.
- If Core Strategy Options are taken forward with significant development in outlying areas of Bradford or Keighley, or in Esholt, Holmewood, Menston or Silsden, then a more detailed accessibility analysis of individual sites may be necessary to identify ways to increase accessibility to those settlements to specific services.

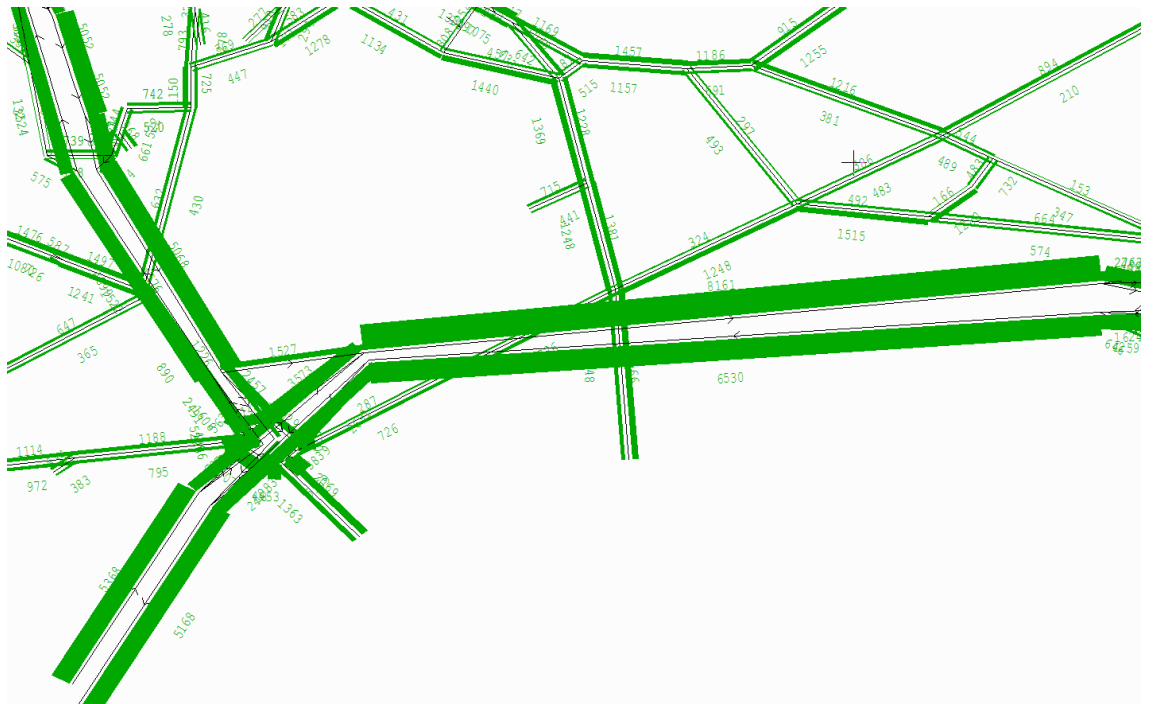
APPENDIX

B

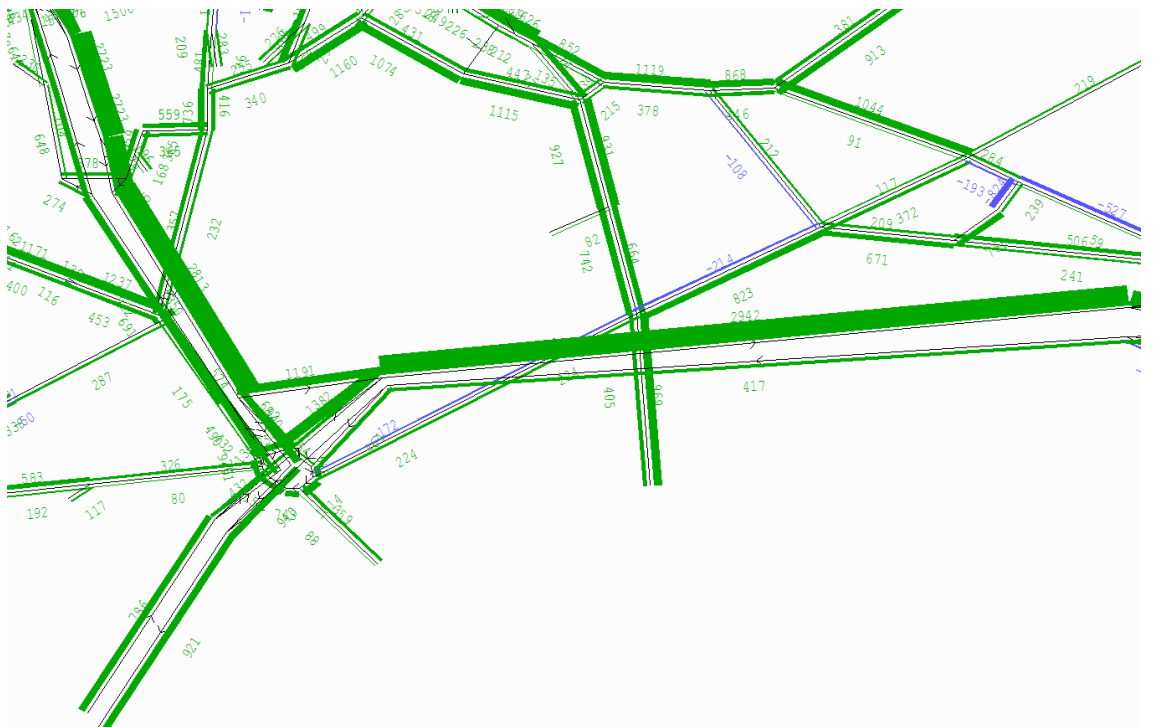
PREFERRED OPTION: SATURN OUTPUTS

B1. CORRIDOR 1

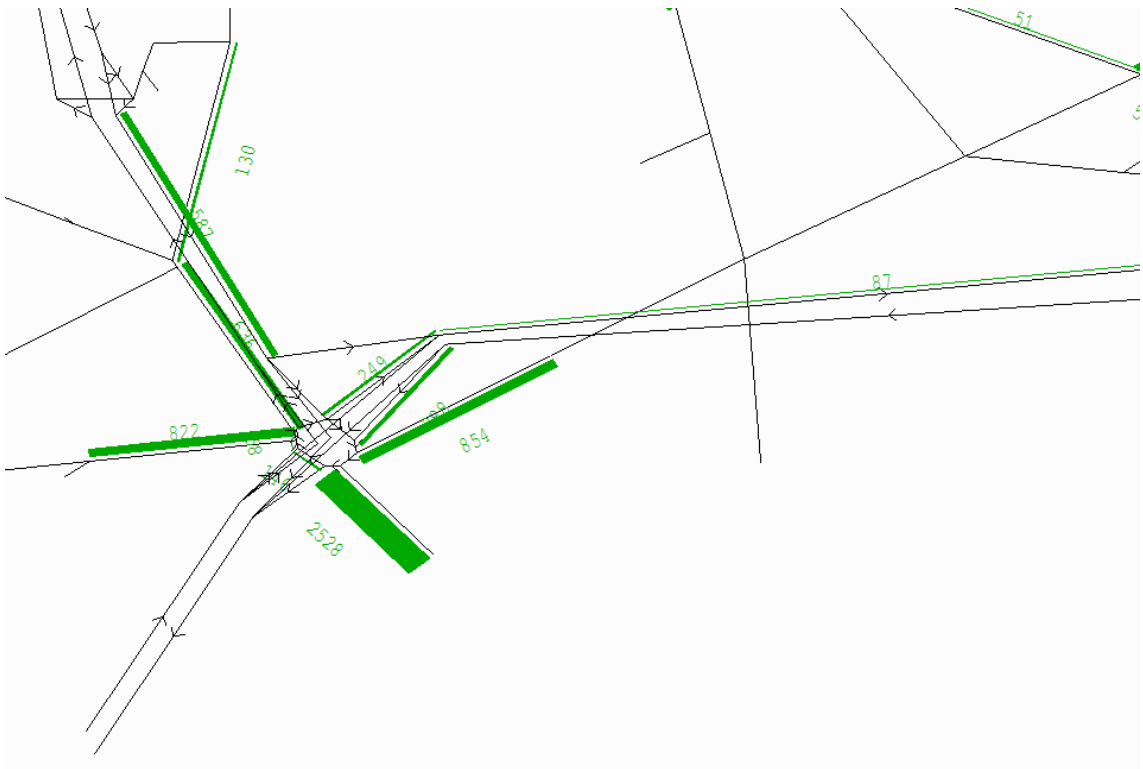
APPENDIX: FIGURE B1.1 CORRIDOR 1: PREFERRED OPTION DEMAND FLOWS (AM)



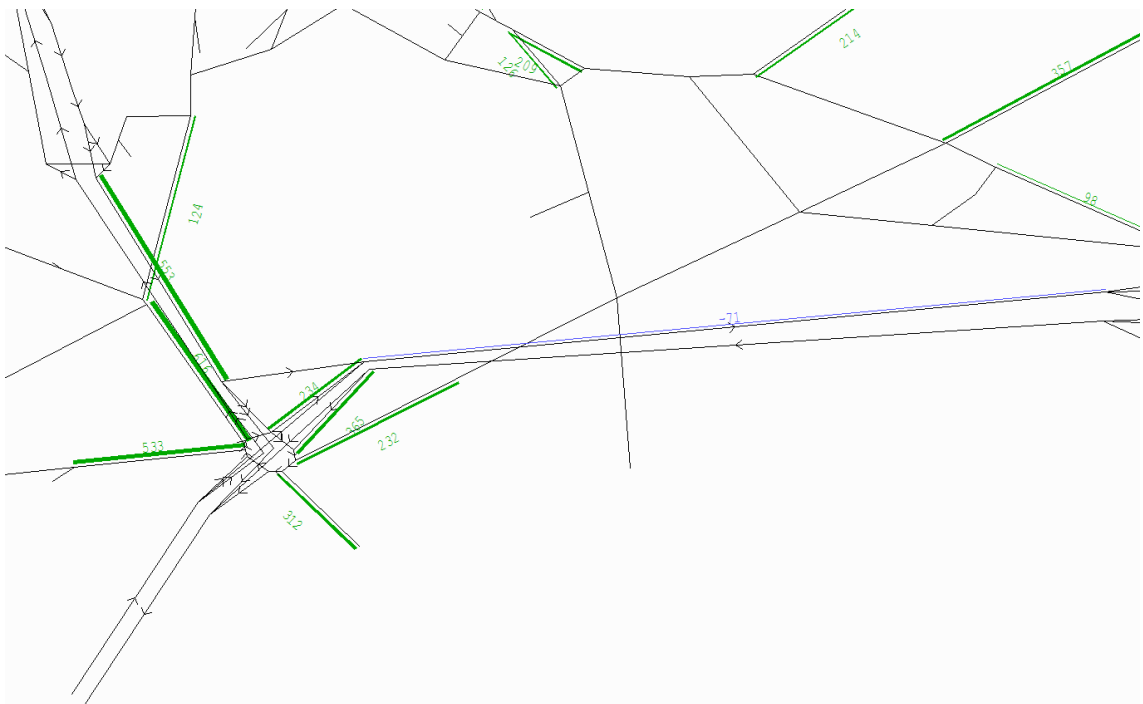
APPENDIX: FIGURE B1.2 CORRIDOR 1: PREFERRED OPTION - BASE DEMAND FLOWS (AM)



APPENDIX: FIGURE B1.3 CORRIDOR 1: PREFERRED OPTION DELAYS (AM)

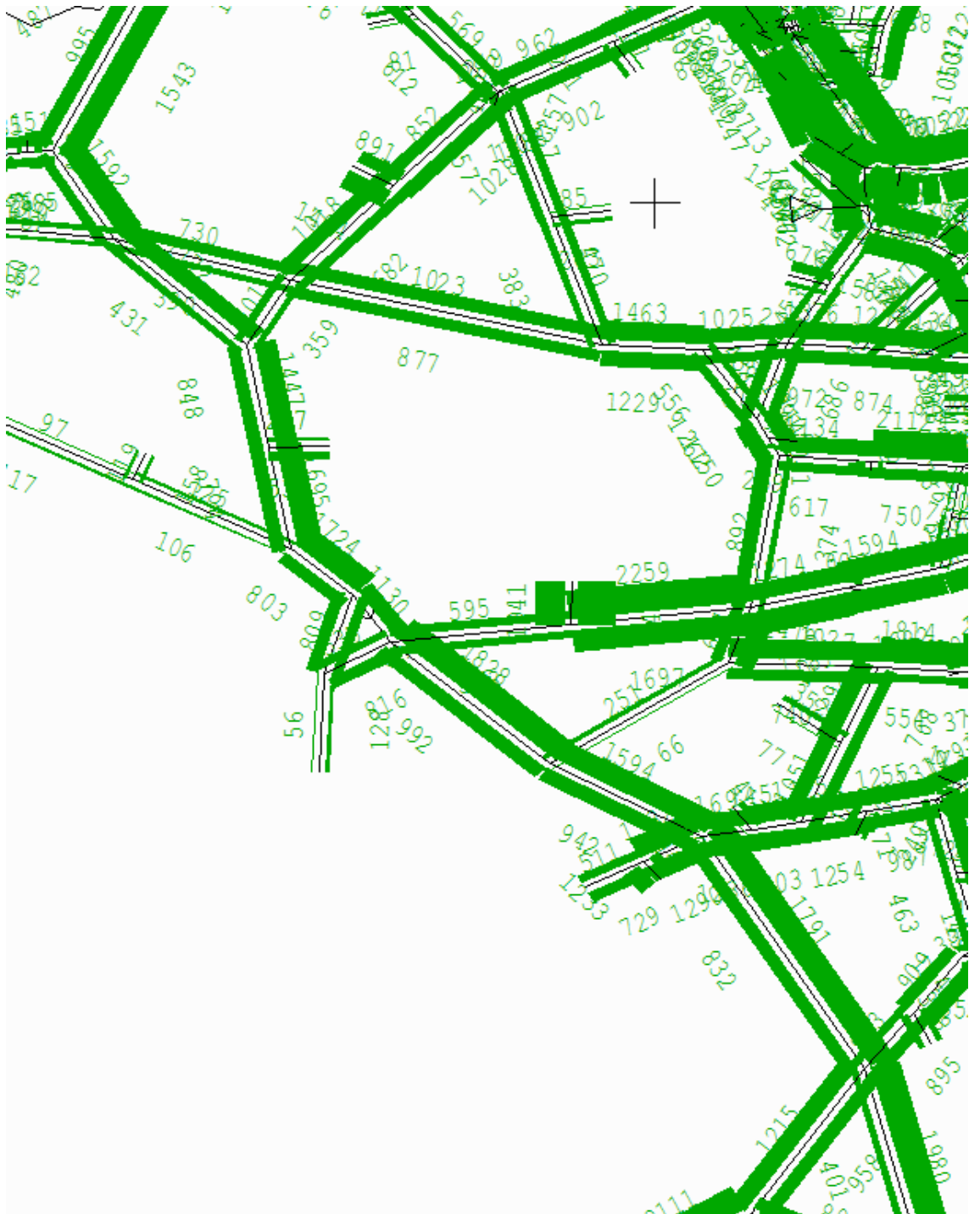


APPENDIX: FIGURE B1.4 CORRIDOR 1: PREFERRED OPTION - BASE DELAYS (AM)

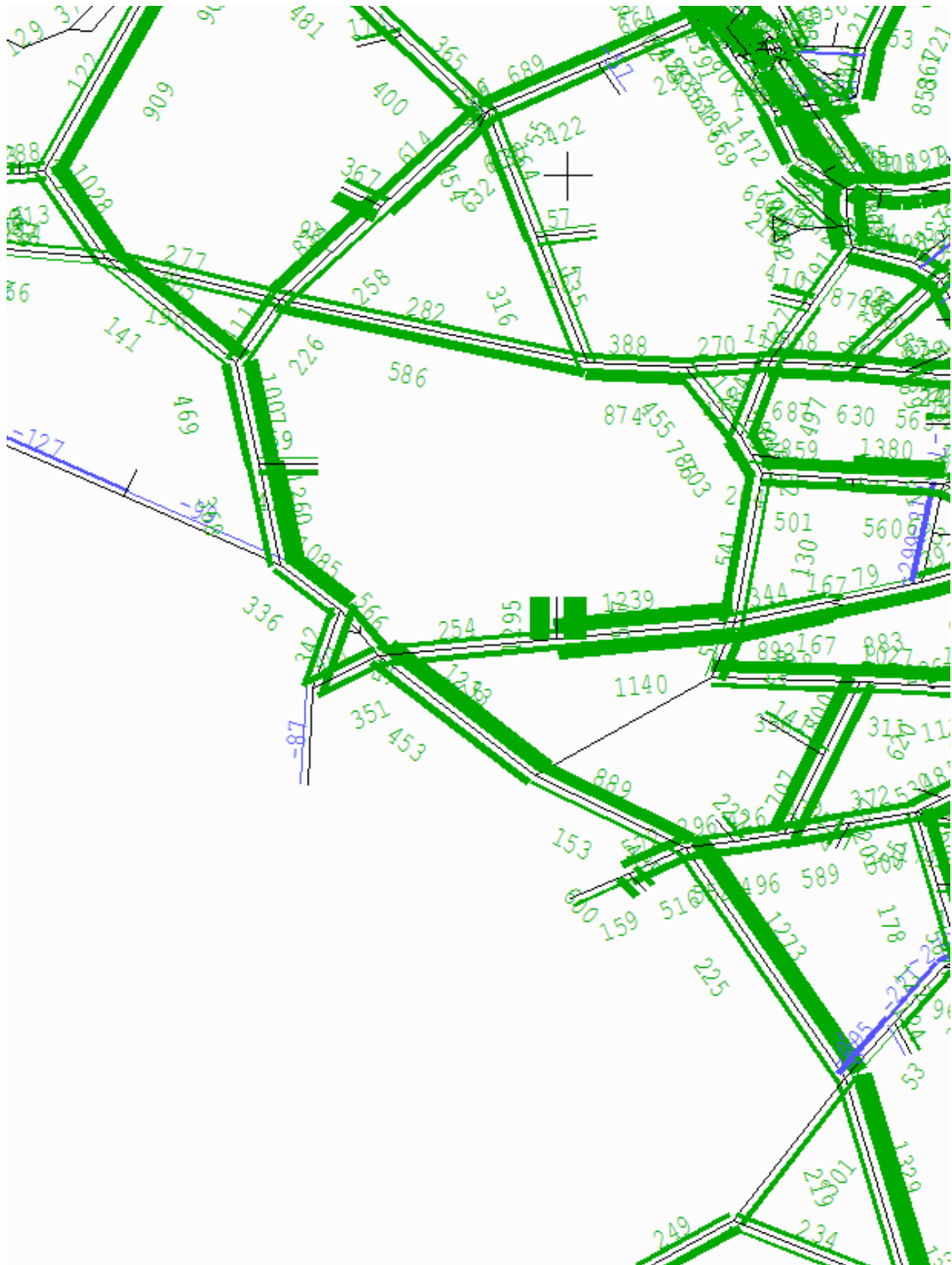


B2. CORRIDOR 2

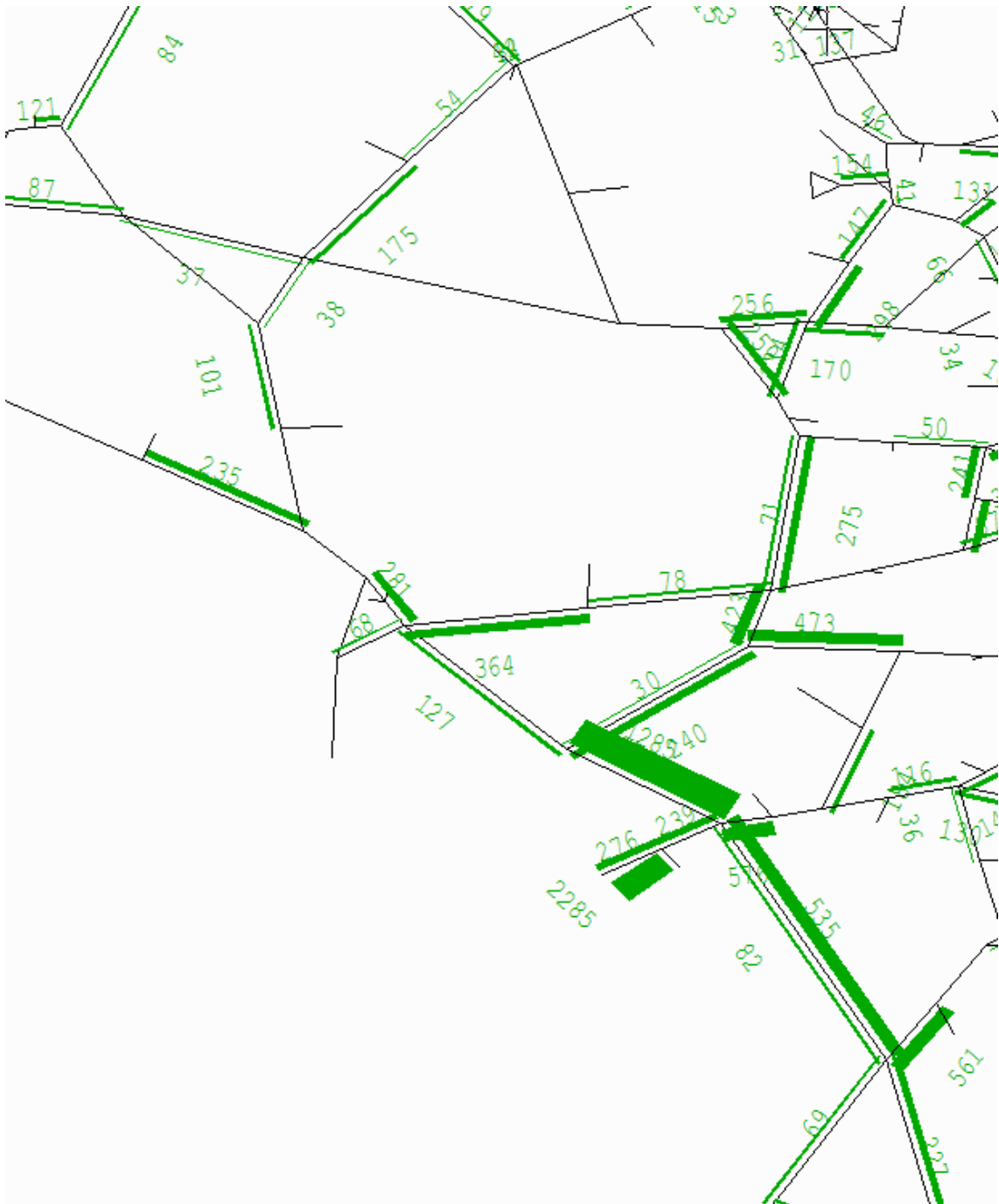
APPENDIX: FIGURE B2.1 CORRIDOR 2: PREFERRED OPTION DEMAND FLOWS (AM)



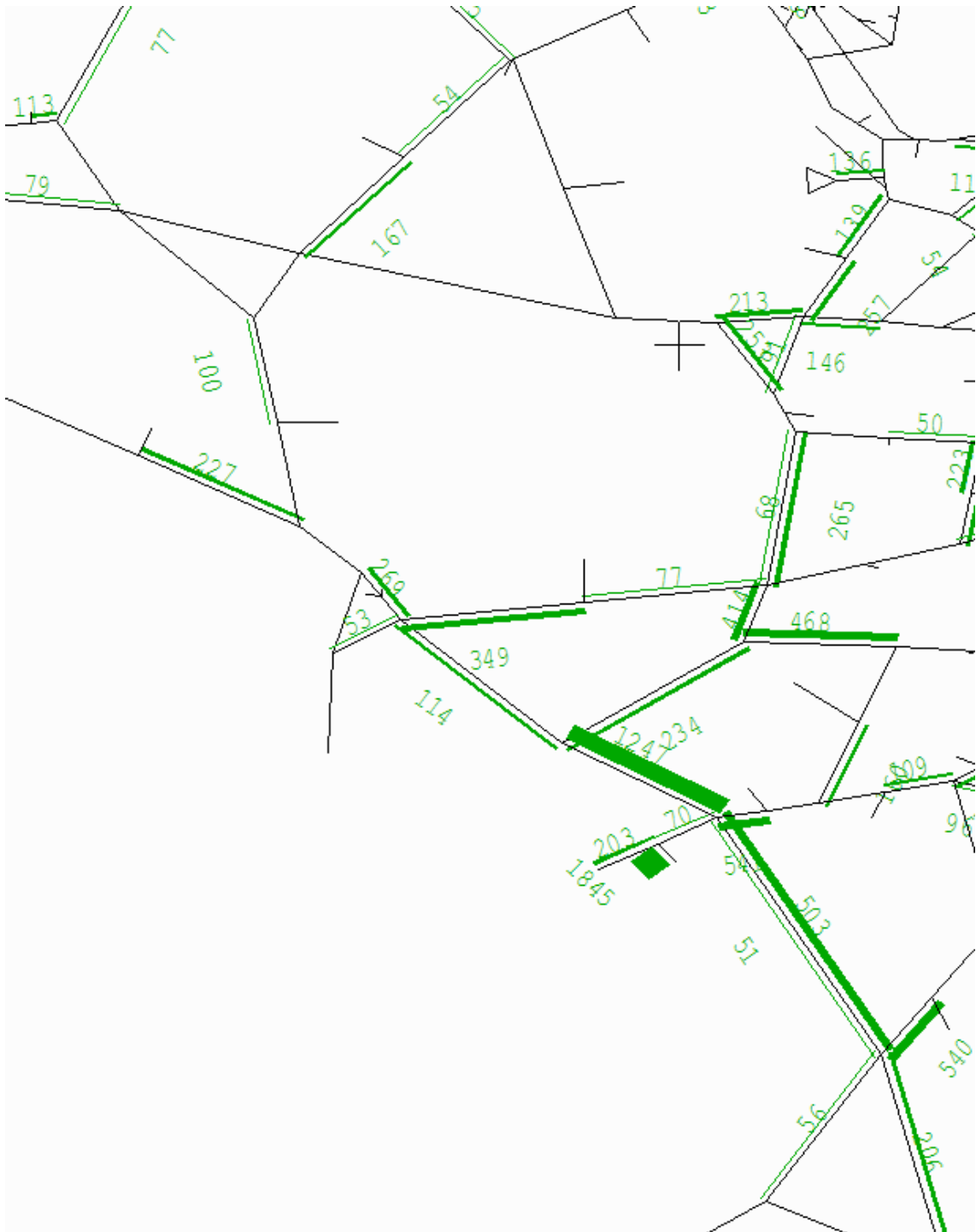
APPENDIX: FIGURE B2.2 CORRIDOR 2: PREFERRED OPTION - BASE DEMAND FLOWS (AM)



APPENDIX: FIGURE B2.3 CORRIDOR 2: PREFERRED OPTION DELAYS (AM)

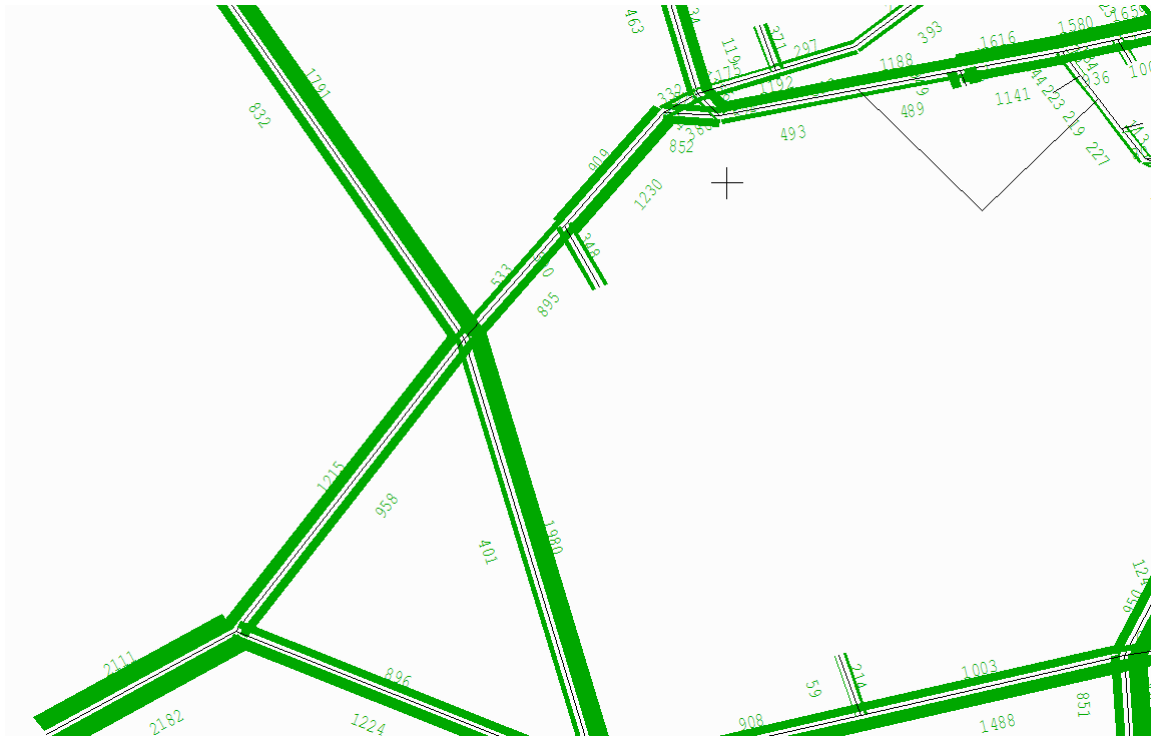


APPENDIX: FIGURE B2.4 CORRIDOR 2: PREFERRED OPTION - BASE DELAYS (AM)

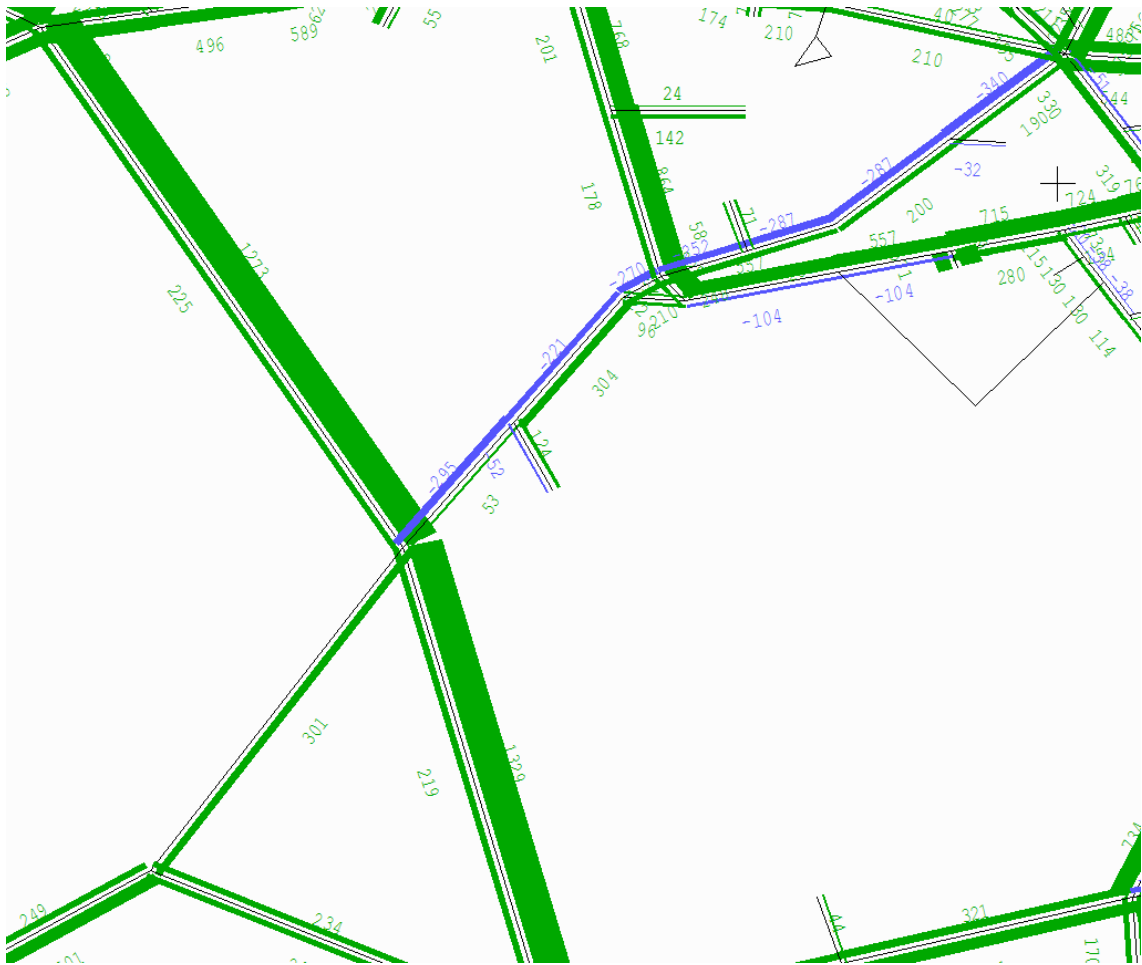


B3. CORRIDOR 3

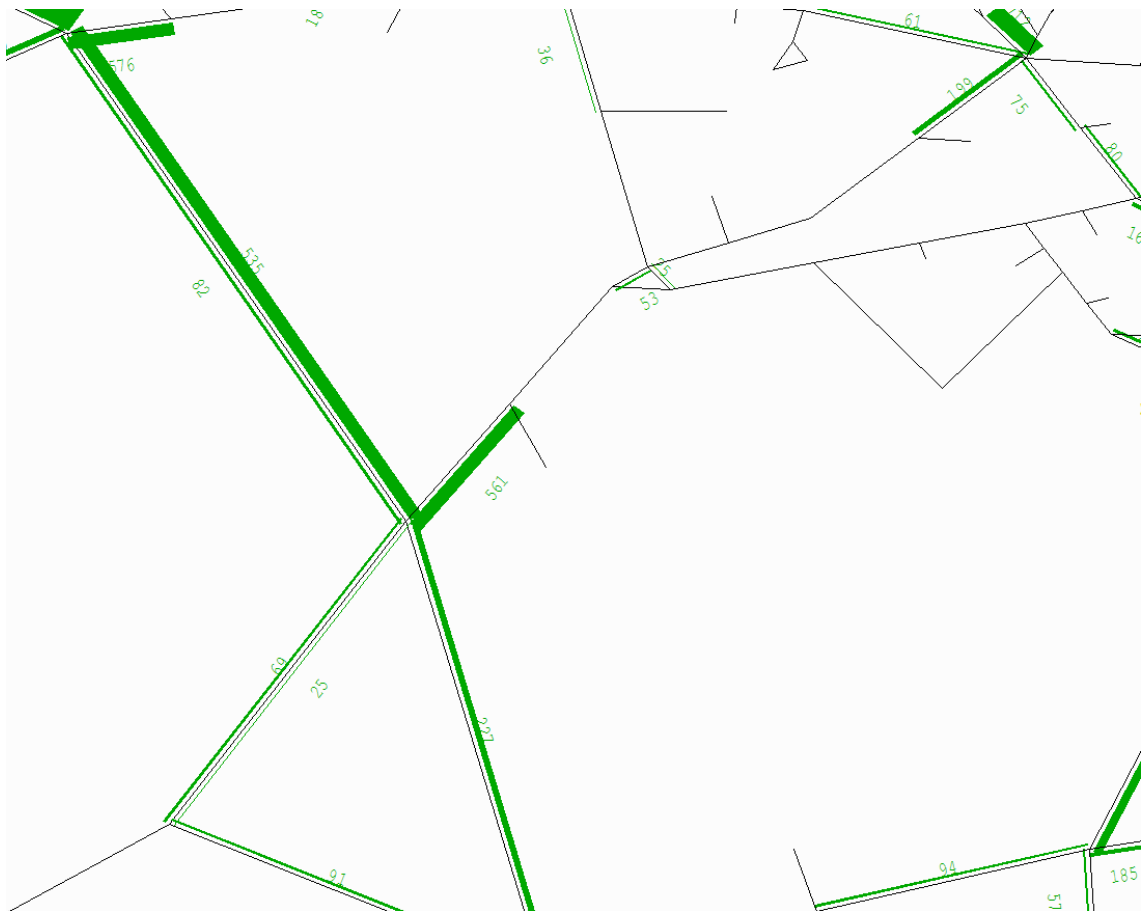
APPENDIX: FIGURE B3.1 CORRIDOR 3: PREFERRED OPTION DEMAND FLOWS (AM)



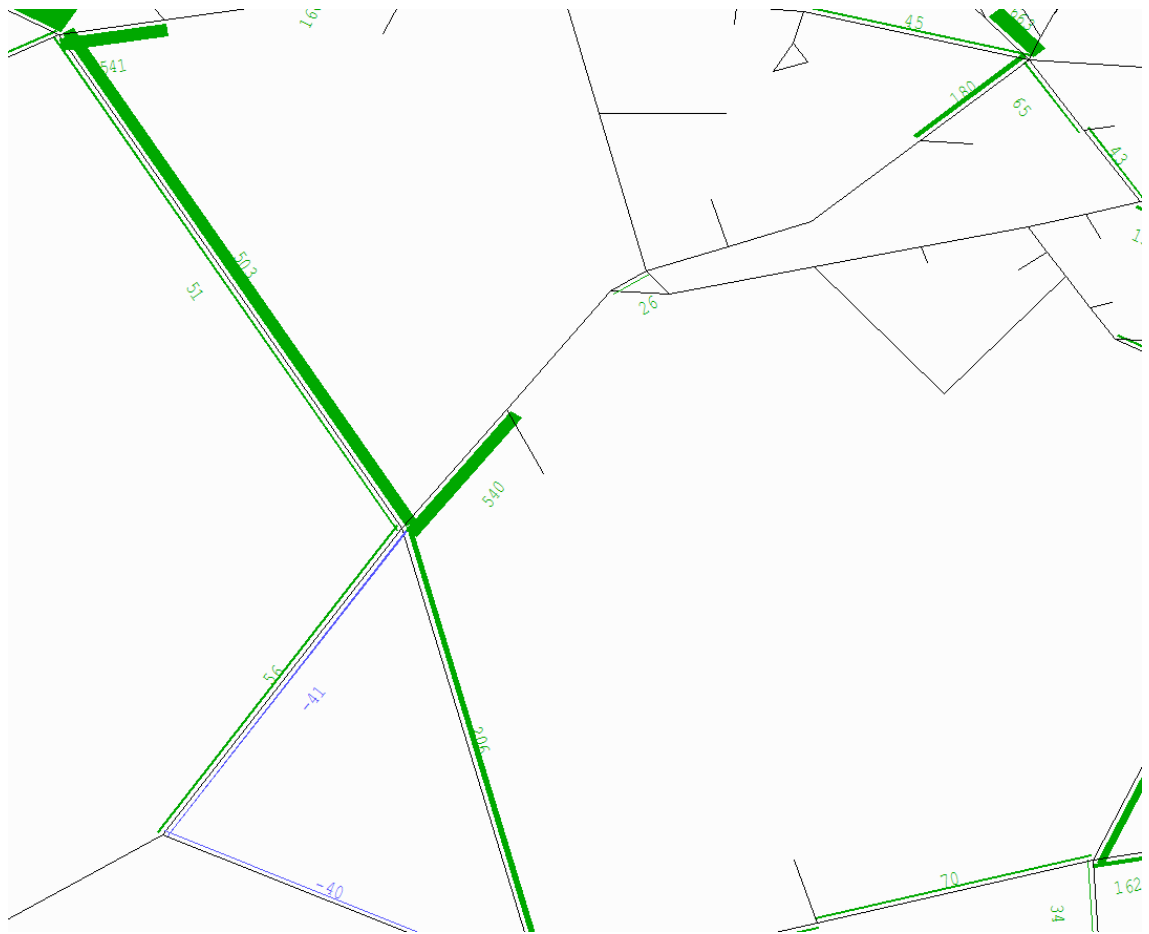
APPENDIX: FIGURE B3.2 CORRIDOR 3: PREFERRED OPTION - BASE DEMAND FLOW (AM)



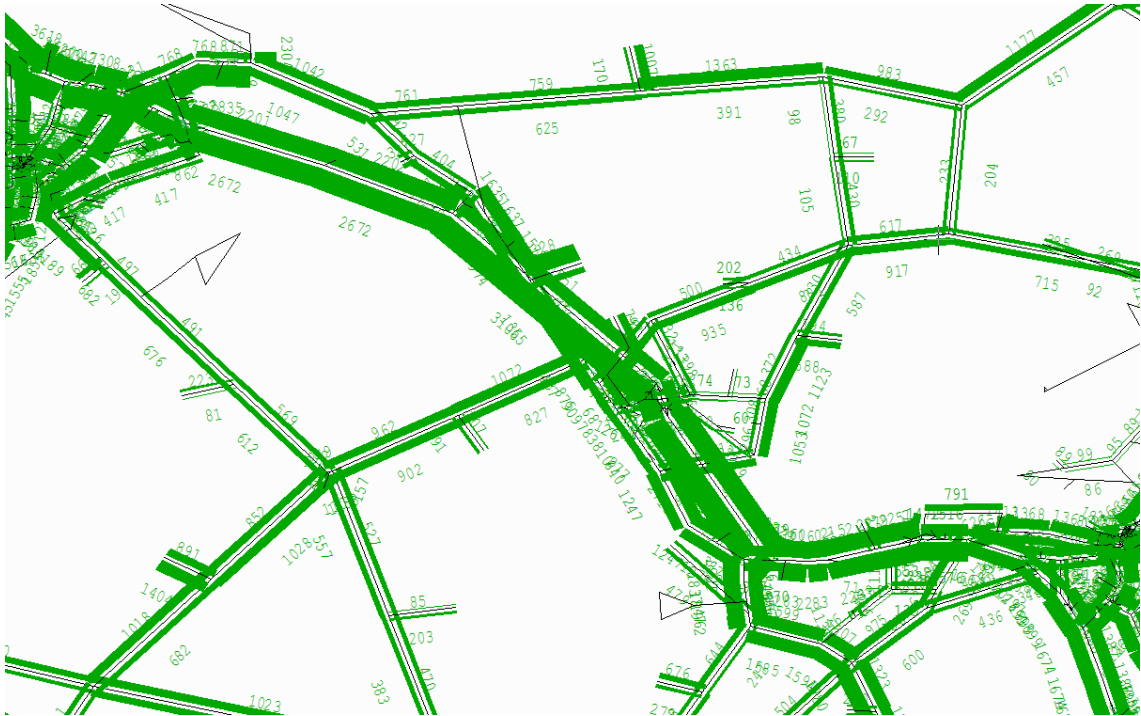
APPENDIX: FIGURE B3.3 CORRIDOR 3: PREFERRED OPTION DELAYS (AM)



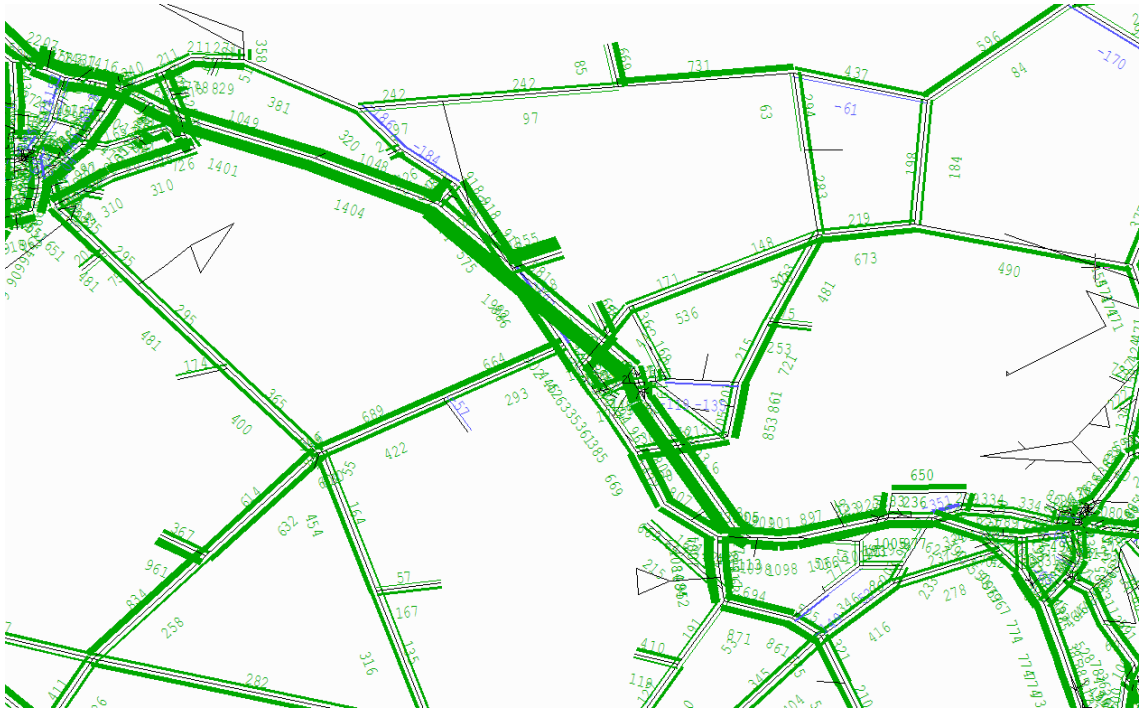
APPENDIX: FIGURE B3.4 CORRIDOR 3: PREFERRED OPTION - BASE DELAYS (AM)



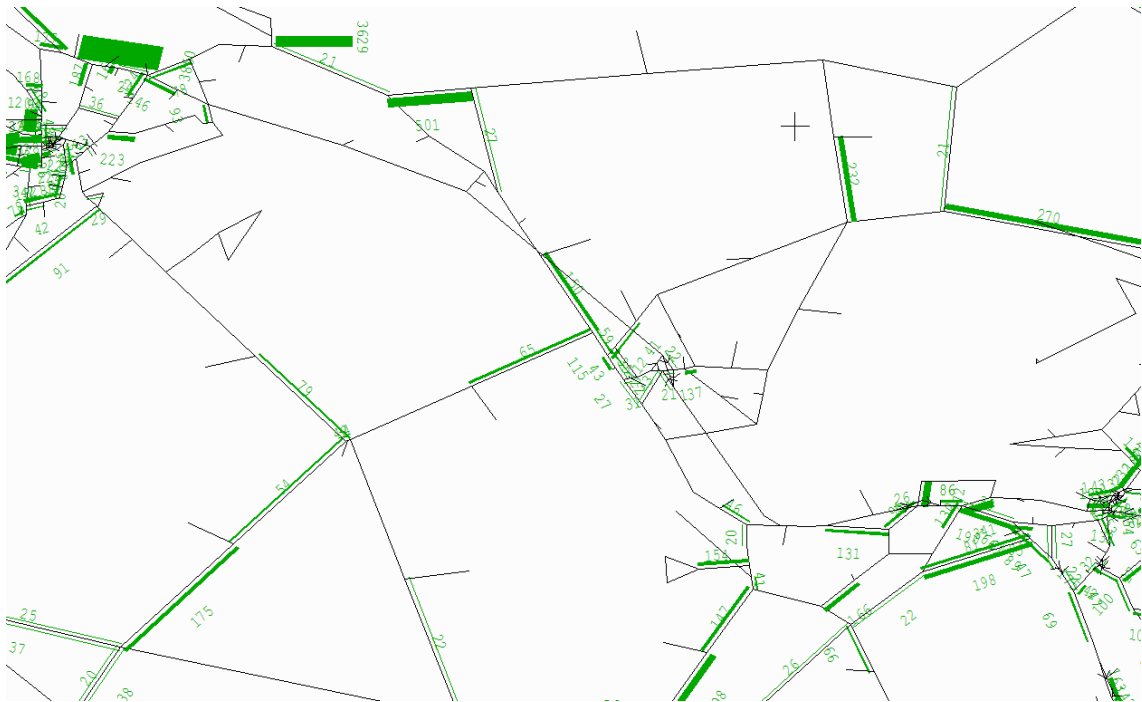
APPENDIX: FIGURE B5.1 CORRIDOR 5: PREFERRED OPTION DEMAND FLOWS (AM)



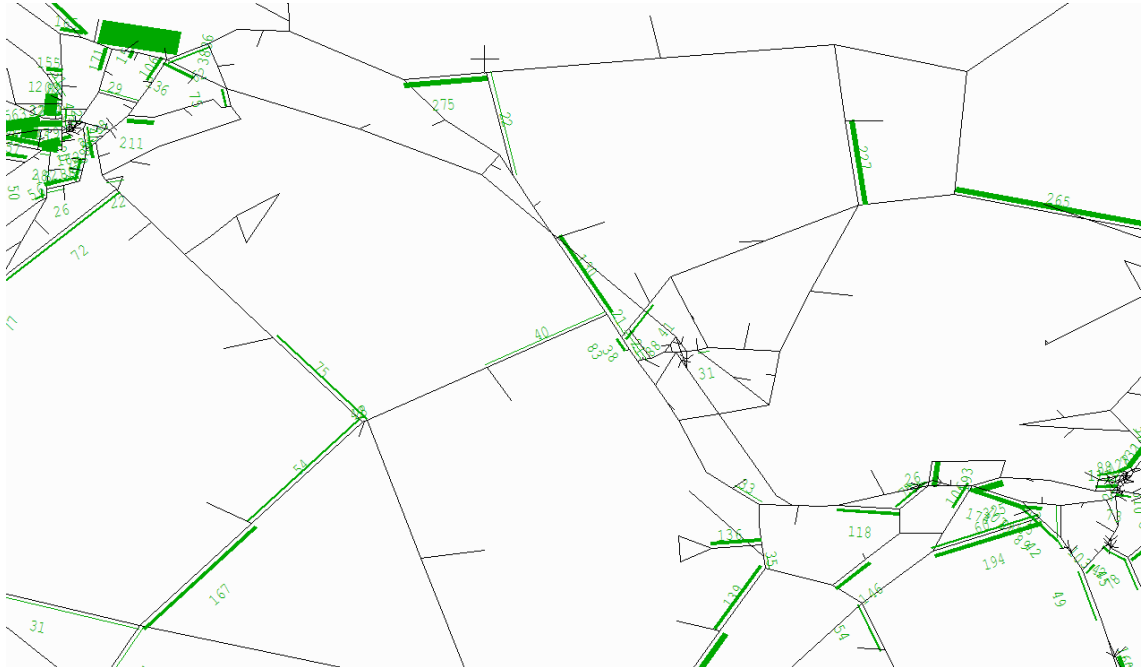
APPENDIX: FIGURE B5.2 CORRIDOR 5: PREFERRED OPTION - BASE DEMAND FLOWS (AM)



APPENDIX: FIGURE B5.3 CORRIDOR 5: PREFERRED OPTION DELAYS (AM)

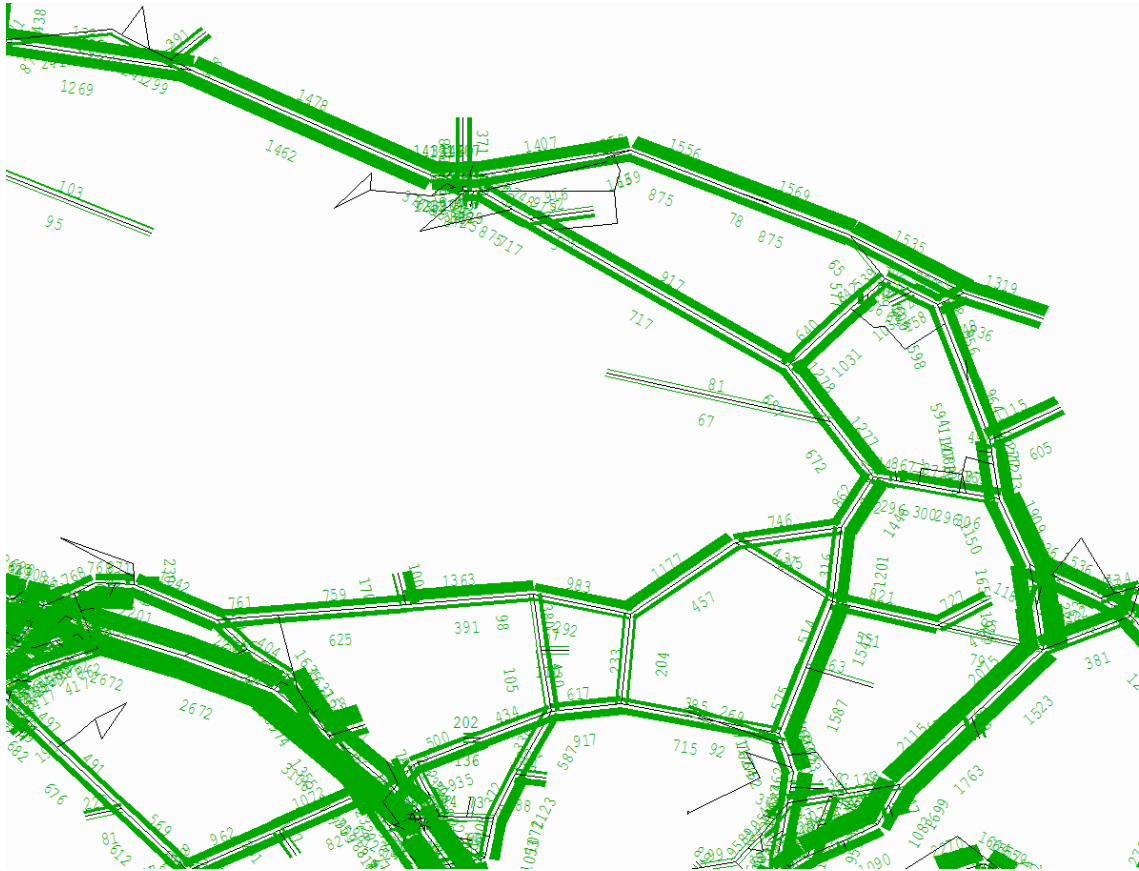


APPENDIX: FIGURE B5.4 CORRIDOR 5: PREFERRED OPTION - BASE DELAYS (AM)

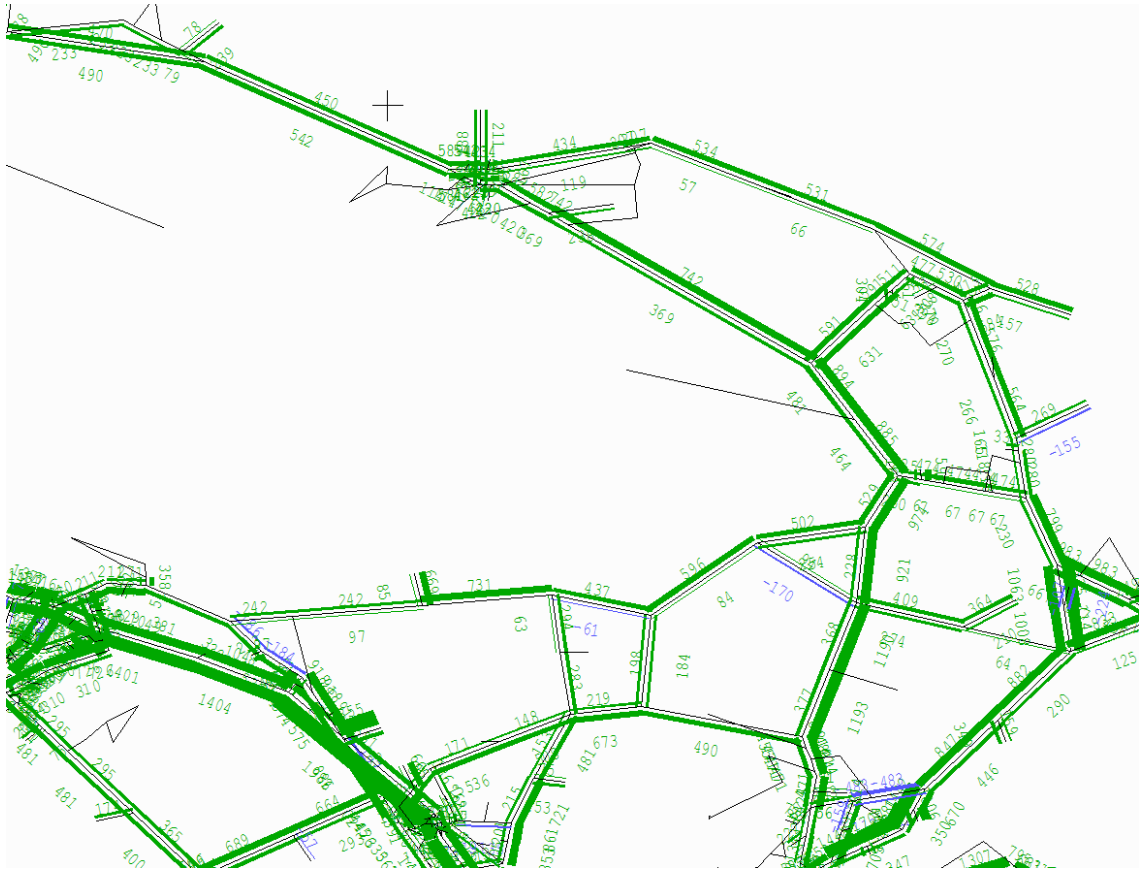


B7. CORRIDOR 7

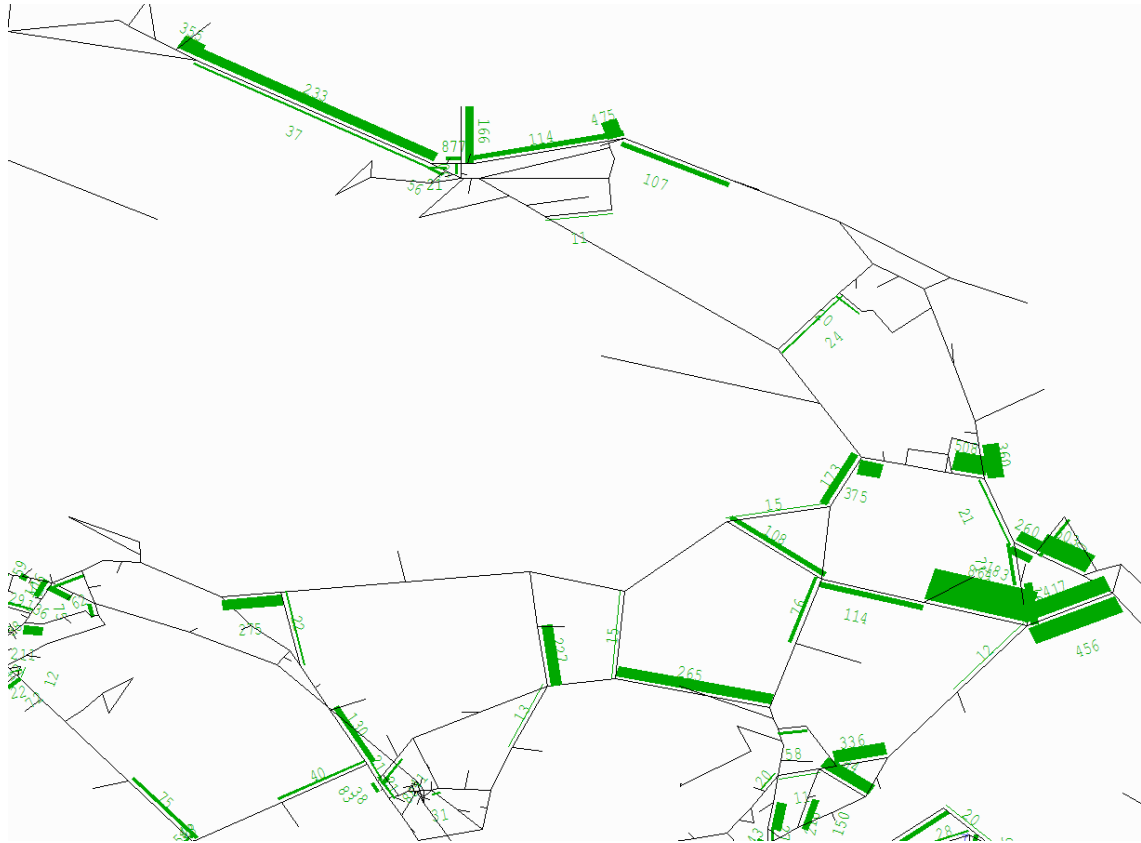
APPENDIX: FIGURE B7.1 CORRIDOR 7: PREFERRED OPTION DEMAND FLOWS (AM)



APPENDIX: FIGURE B7.2 CORRIDOR 7: PREFERRED OPTION - BASE DEMAND FLOWS (AM)

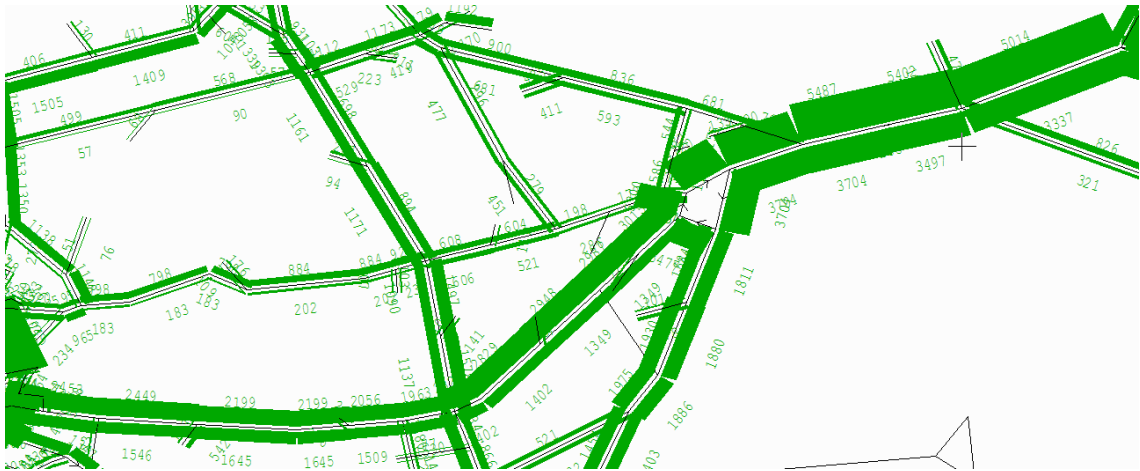


APPENDIX: FIGURE B7.4 CORRIDOR 7: PREFERRED OPTION - BASE DELAYS (AM)

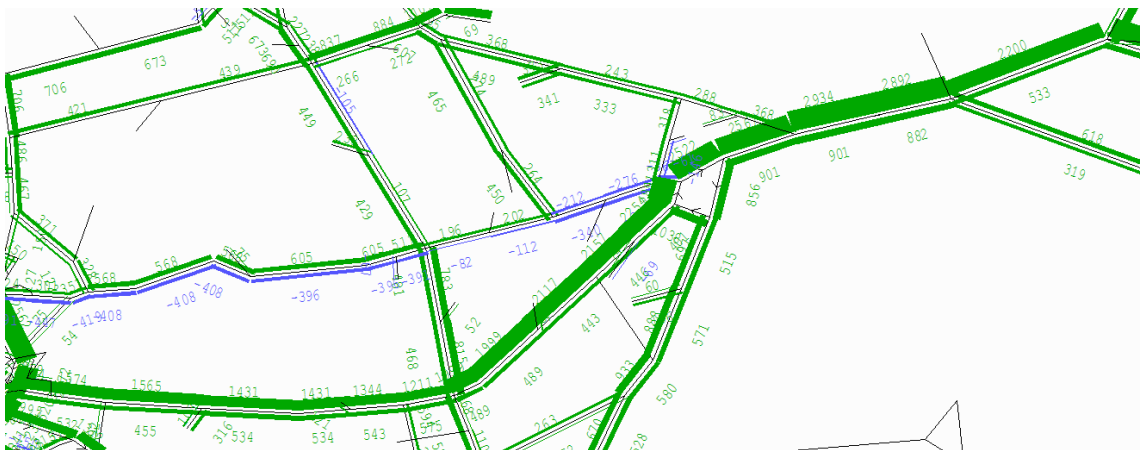


B8. CORRIDOR 8

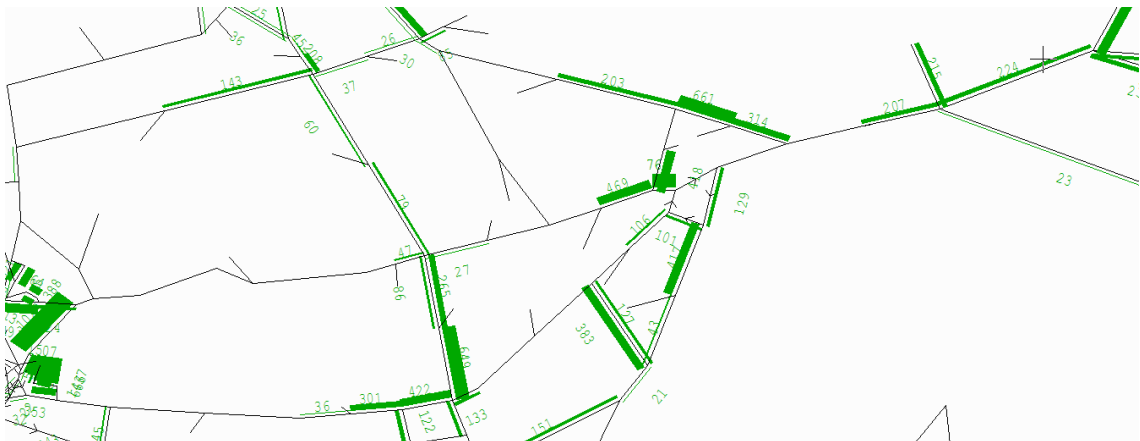
APPENDIX: FIGURE B8.1 CORRIDOR 8: PREFERRED OPTION DEMAND FLOWS (AM)



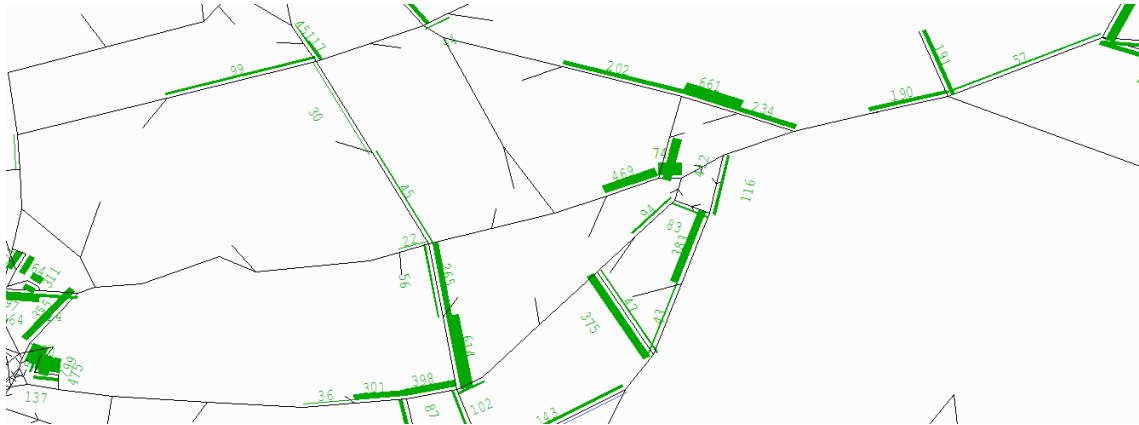
APPENDIX: FIGURE B8.2 CORRIDOR 8: PREFERRED OPTION - BASE DEMAND FLOWS (AM)



APPENDIX: FIGURE B8.3 CORRIDOR 8: PREFERRED OPTION DELAYS (AM)

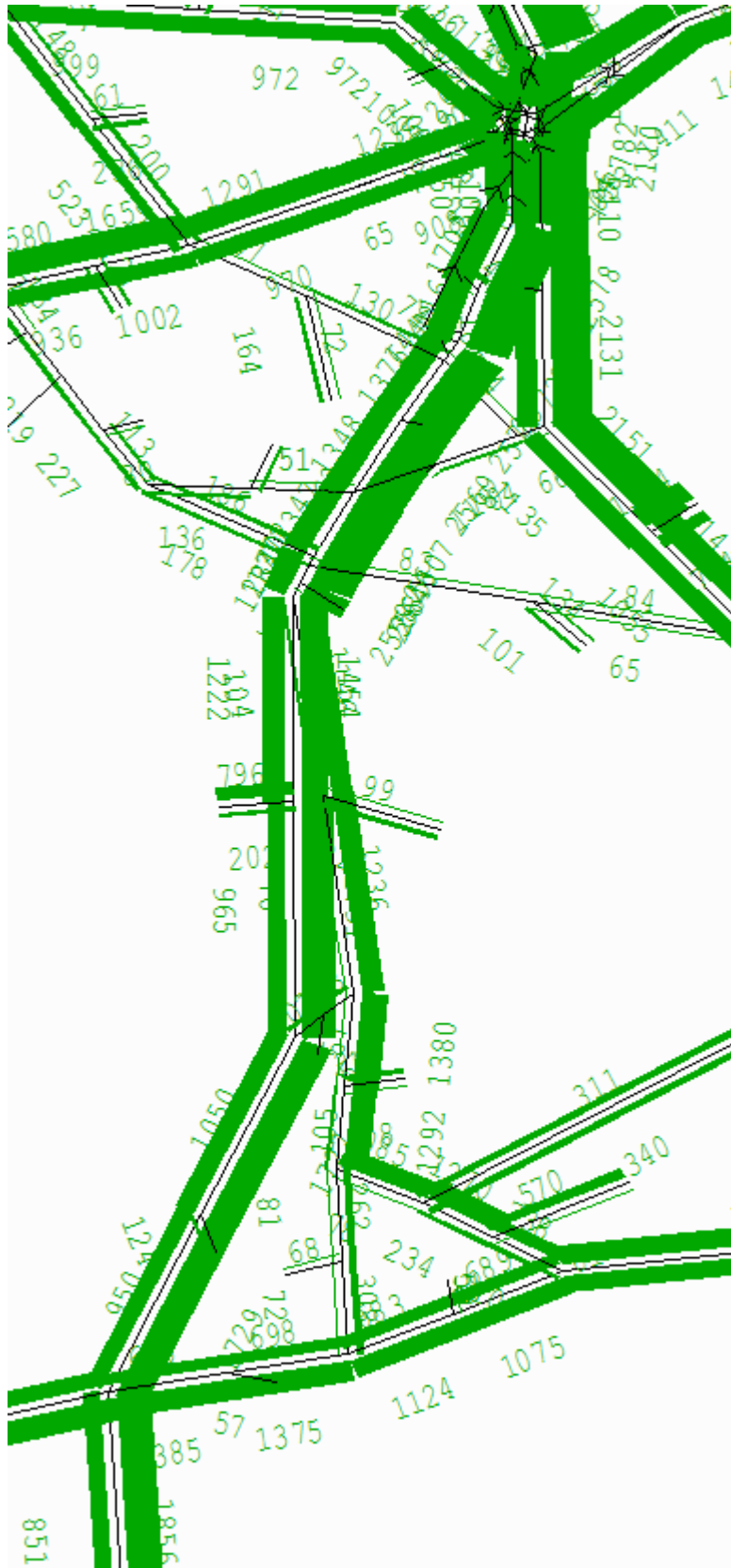


APPENDIX: FIGURE B8.4 CORRIDOR 8: PREFERRED OPTION - BASE DELAYS (AM)

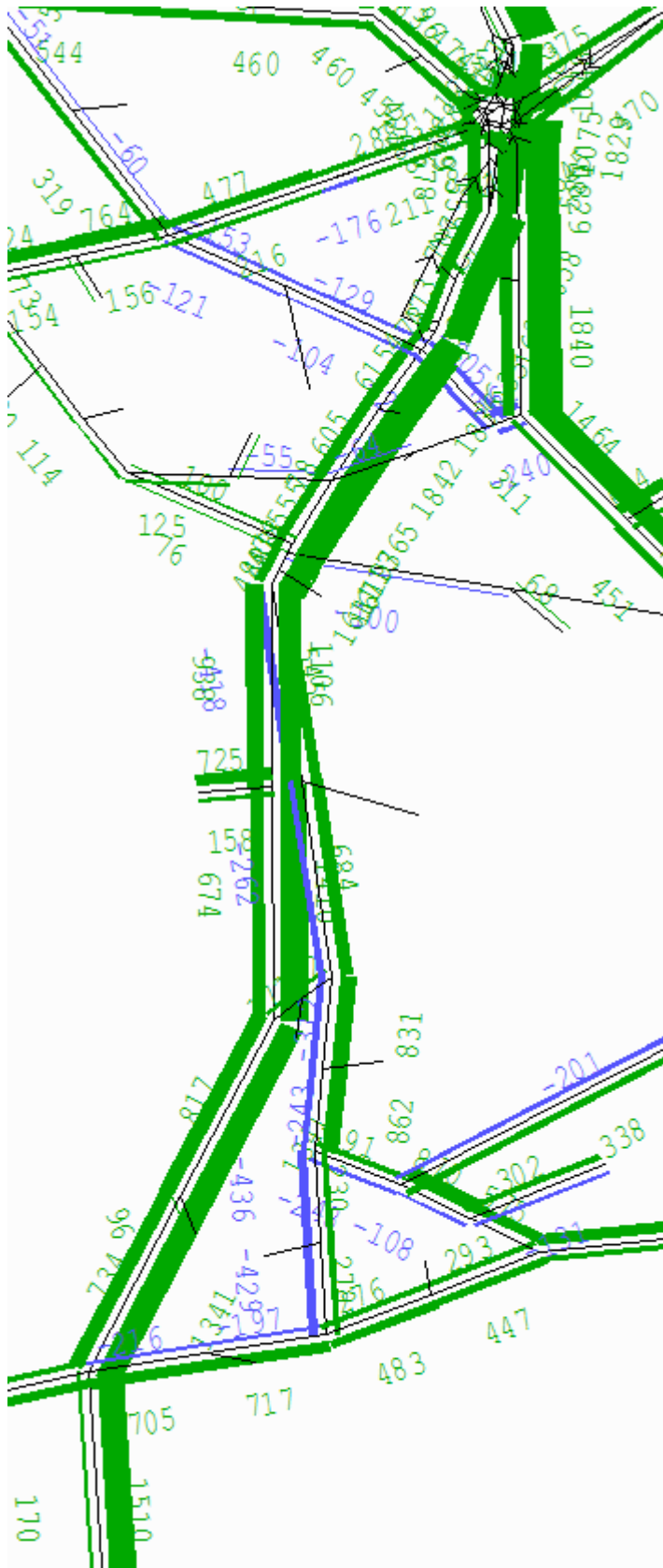


B9. CORRIDOR 9

APPENDIX: FIGURE B9.1 CORRIDOR 9: PREFERRED OPTION DEMAND FLOWS (AM)



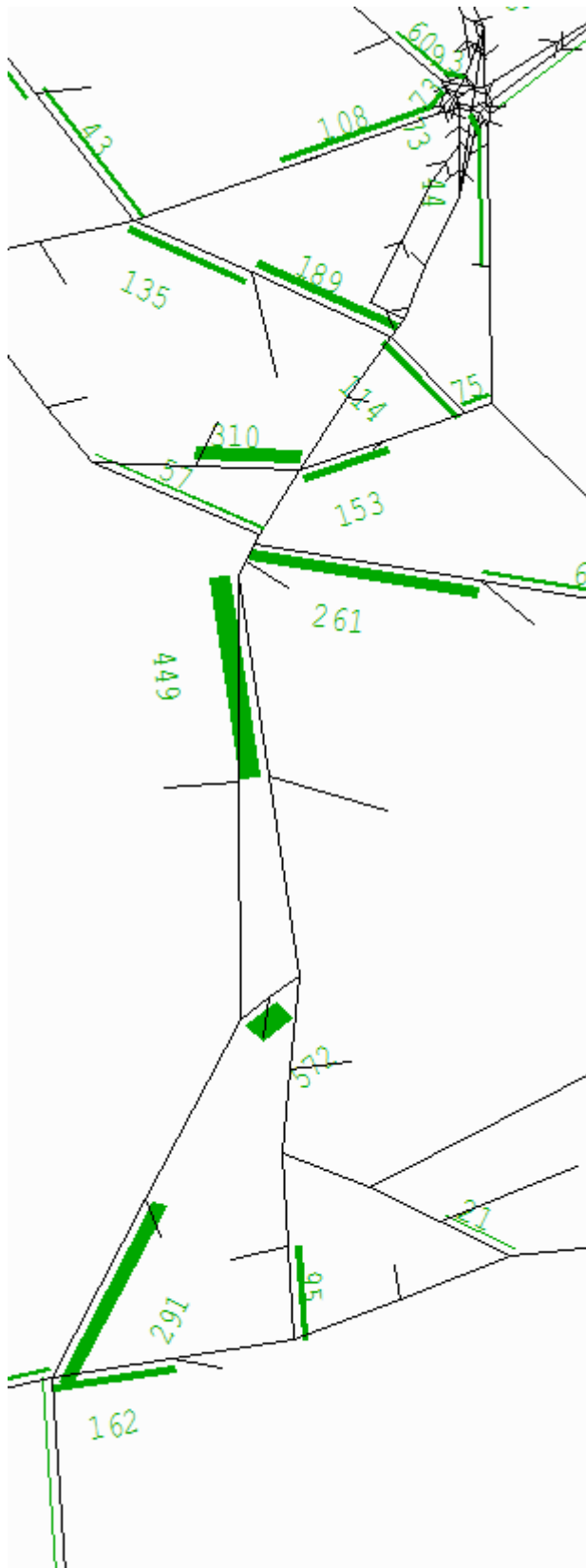
APPENDIX: FIGURE B9.2 CORRIDOR 9: PREFERRED OPTION - BASE DEMAND FLOWS (AM)



APPENDIX: FIGURE B9.3 CORRIDOR 9: PREFERRED OPTION DELAYS (AM)



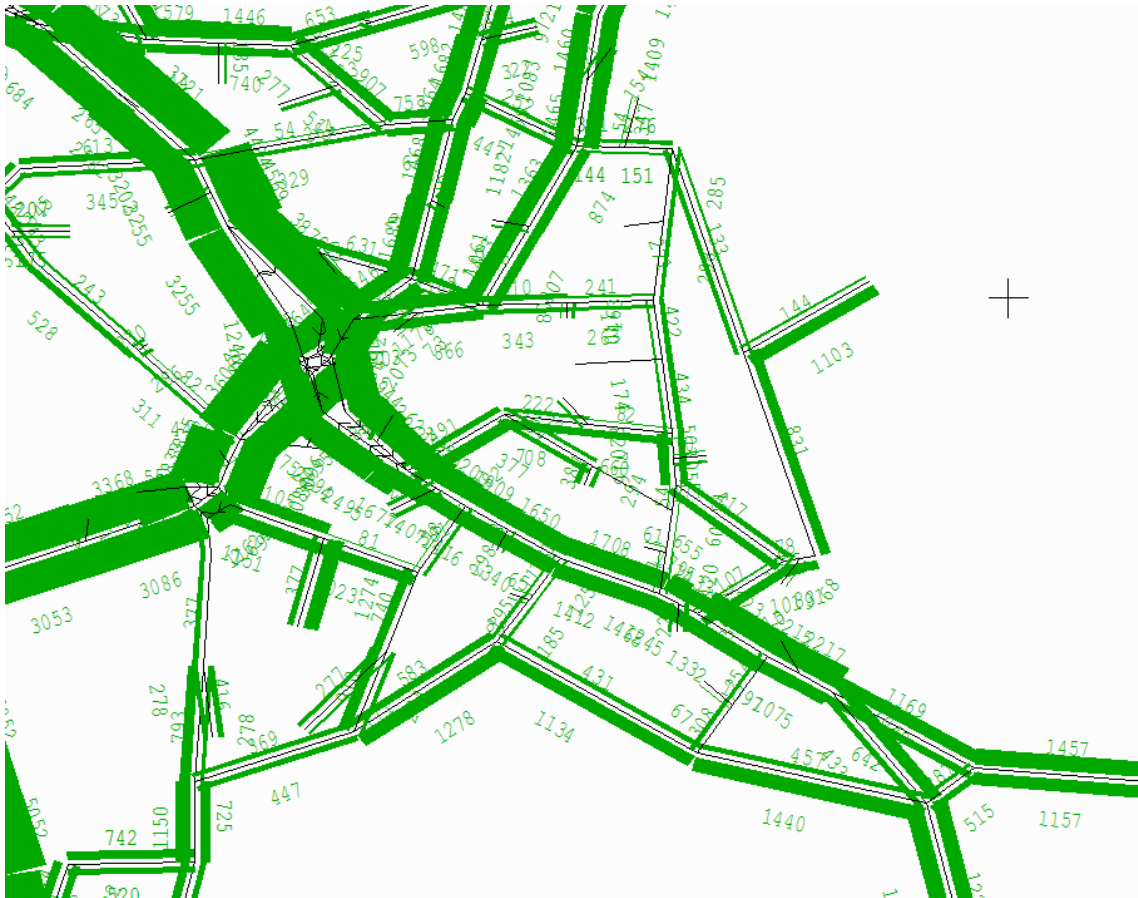
APPENDIX: FIGURE B9.4 CORRIDOR 9: PREFERRED OPTION - BASE DELAYS (AM)



B10. CORRIDOR 10

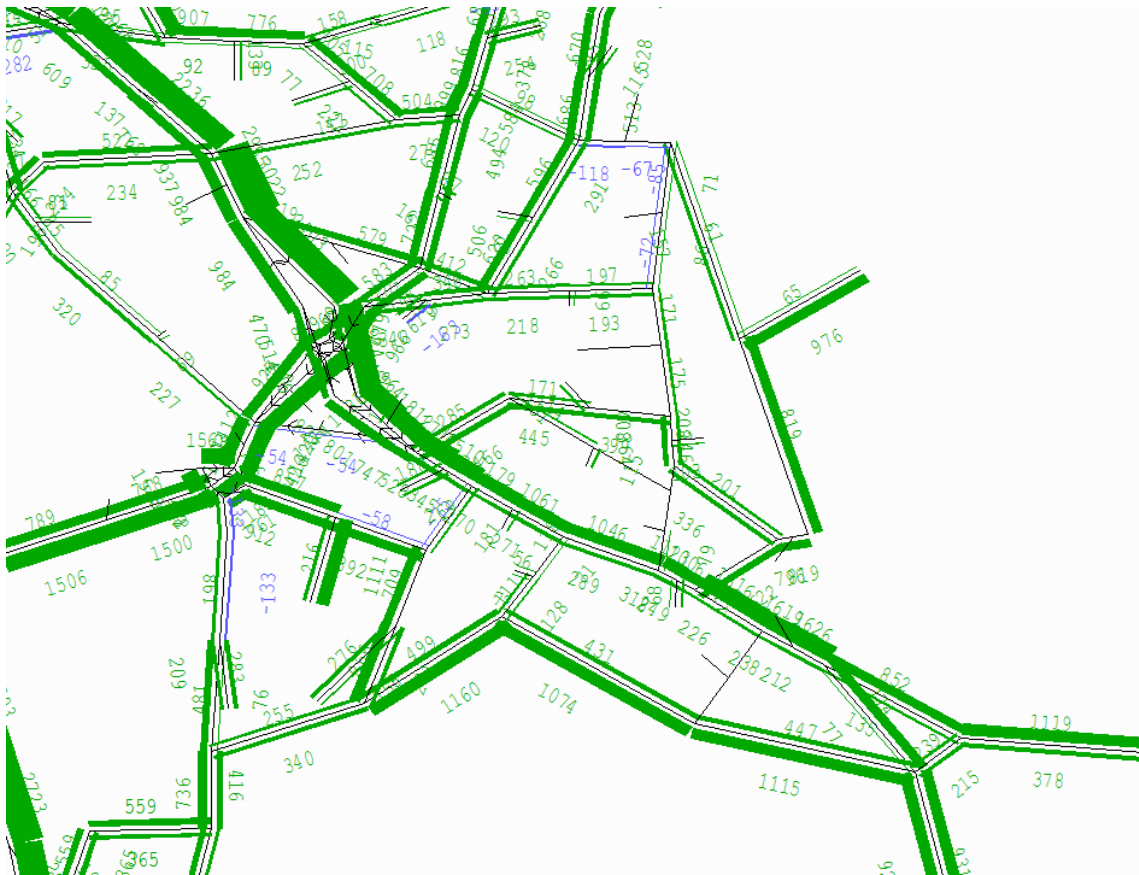
APPENDIX: FIGURE B10.1

CORRIDOR 10: PREFERRED OPTION DEMAND FLOWS (AM)



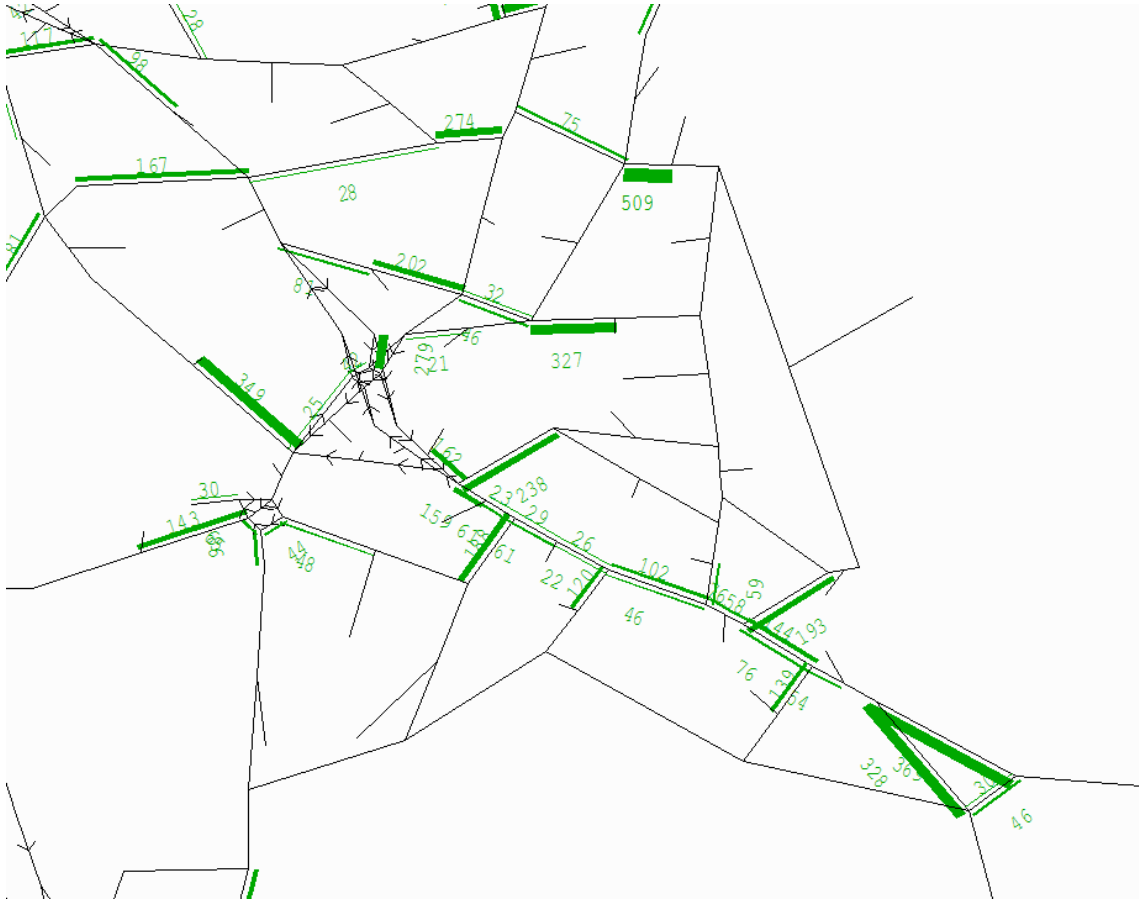
APPENDIX: FIGURE B10.2
FLOWS (AM)

CORRIDOR 10: PREFERRED OPTION - BASE DEMAND



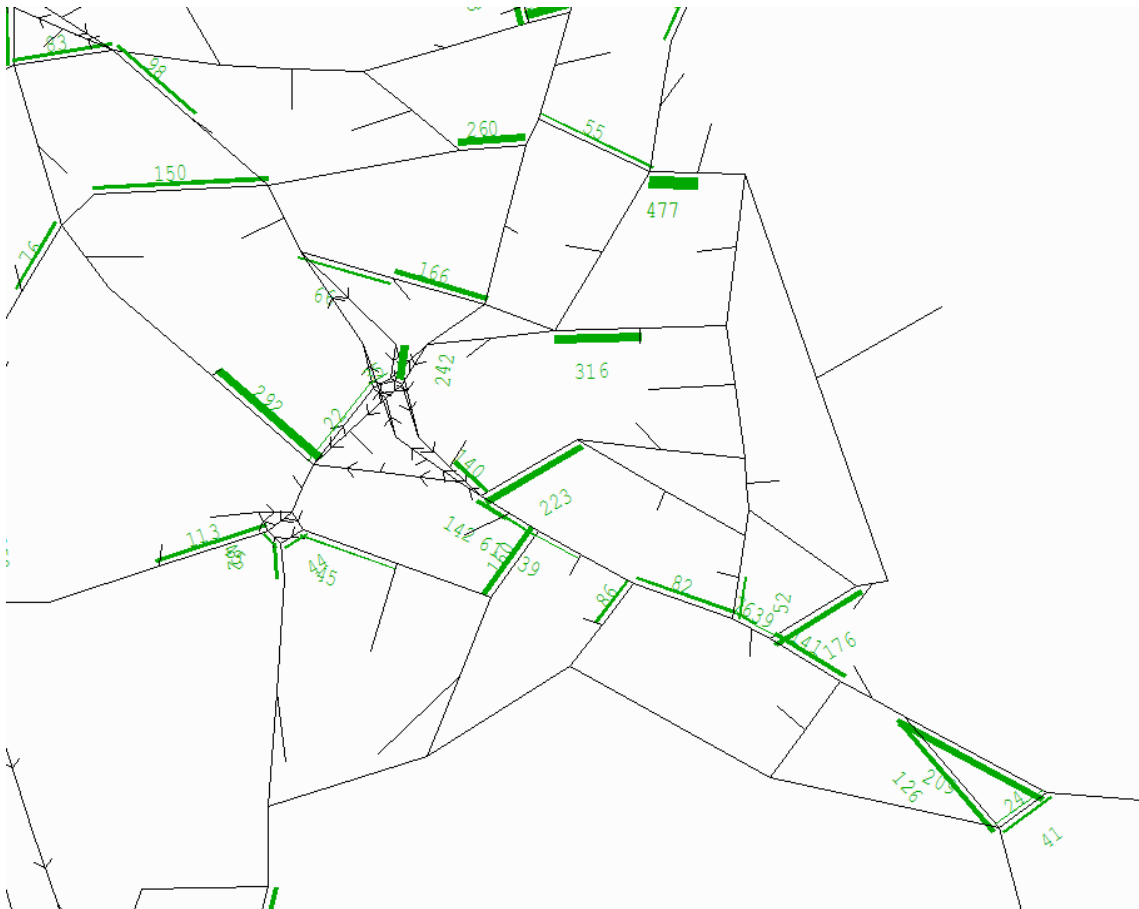
APPENDIX: FIGURE B10.3

CORRIDOR 10: PREFERRED OPTION DELAYS (AM)



APPENDIX: FIGURE B10.4

CORRIDOR 10: PREFERRED OPTION - BASE DELAYS (AM)



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SDG Project/Proposal No.

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