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M4 Corridor around Newport

Revised Traffic Forecasting Report



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Revised Traffic Forecasting
Report

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1 The Project

1.1 Context

- 1.1.1** Since 1989 there have been various studies to identify the problems on the M4 Corridor around Newport and to propose possible solutions. The M4 Corridor around Newport WelTAG Stage 1 (Strategy Level) Appraisal concluded that a new section of 3-lane motorway to the south of Newport following a protected (TR111) route, in addition to reclassification measures to the existing M4 to the north of Newport, would best achieve the goals and address the problems of the M4 Corridor around Newport and should be progressed for further appraisal. These options have subsequently formed the basis for the development of the draft Plan, which was published in September 2013 and was the subject of public consultation from September to December 2013.
- 1.1.2** Having taken into account the responses to this participation process, as well as the assessments of the draft Plan, the Welsh Government decided to adopt a Plan for the Scheme. Alongside this Plan, the Welsh Government published updated strategy-level reports, including a Strategic Environmental Assessment Statement, to demonstrate how the participation process informed its decision making. It also announced in July 2014 a revised preferred route, which protected a corridor for planning purposes. These documents can be accessed from the website <http://m4newport.com>.
- 1.1.3** The Welsh Government has since awarded a Professional Services Contract for the next stage of Scheme development and environmental surveys for the M4 Corridor around Newport Project (“the Scheme”) up to publication of draft Orders and an Environmental Statement. The contract has been awarded to a Joint Venture of Costain, Vinci and Taylor Woodrow with consultants Arup and Atkins, supported by sub-consultant RPS. Draft Orders, an Environmental Statement and associated reporting has been published in 2016, in advance of a Public Local Inquiry. The Inquiry process will then inform the next stage of Ministerial decision making.

1.2 Reasons for Publishing Revised Reports

- 1.2.1** The decision to publish Draft Orders for the Scheme in March 2016 was informed by the Environmental and a number of other associated reports. A number of these reports relate to, or are informed by, forecasts for the future level of traffic on the M4 around Newport. The production of traffic forecasts is governed by guidance published by the UK Department for Transport (DfT), namely WebTAG (Web-based Transport Appraisal Guidance)
- 1.2.2** Following the publication of the March 2016 Forecasting Report, a number of changes to the guidance governing traffic forecasting have been introduced which are material to the future year traffic forecast. In view of this, the forecasting of the effects of the Scheme has been updated and the reports which rely on these forecasts have consequently been revised.
- 1.2.3** These changes are summarised here:

Changes in Guidance Relating to Traffic Forecasts

- 1.2.4** The M4 Corridor around Newport transport model (to be subsequently referred to as M4CaN) is used to understand and predict current and future traffic conditions in a situation with and without the proposed M4CaN Scheme. The outputs of the transport model are used to inform the design of the Scheme and are applied in various aspects of the economic, social and environmental assessment of the Scheme.
- 1.2.5** In accordance with WebTAG, future year traffic forecasts are derived from a set of growth factors taken from the National Trip End Model (NTEM) which is published by DfT through an interface called the Trip End Model Presentation Program (TEMPO). At the time of the publication of Draft Orders, the M4CaN transport model and the various assessments of the Scheme were based on the current version of NTEM at that time, namely NTEM6.2 (as published in TEMPRO 6.2).
- 1.2.6** In July 2016, DfT published an updated version of TEMPRO (TEMPRO 7.0) which is in turn based on NTEM 7.0. NTEM 7.0 replaces and supersedes NTEM 6.2 and the Welsh Government took the view that it needed to update the M4CaN transport model such that it is based on the up to date forecasts.
- 1.2.7** The published NTEM 7.0 was reviewed by the Welsh Government. As part of this review, a number of discrepancies were identified between the forecast numbers of dwellings in Wales contained within the latest available Local Development Plans (LDPs) which are produced by the various local authorities in Wales. These discrepancies were brought to the attention of the DfT who accepted that the Local Development Plans held by the Welsh Government provide a more up to date and accurate basis upon which to base future traffic forecasts, particularly given the material differences observed for some Local Authorities. Independently, the DfT also found a further issue relating to the employment inputs to the NTEM.
- 1.2.8** Subsequently, the DfT announced that it intends to undertake further quality assurance checks on the planning data underlying NTEM 7.0 and intends to issue revised trip end forecasts that correct for issues that have occurred in the processing of input data in respect of employment and dwellings in January 2017. This was the subject of a notice published by DfT on 14 November 2016 (<http://assets.dft.gov.uk/tempro/version7/ntem-notice/ntem7-status.pdf>).
- 1.2.9** As an interim measure, the Welsh Government have been provided with corrected NTEM forecasts that contain the up to date Wales LDP housing projections, together with the employment correction. It is these forecasts that have been adopted in the revised model, now termed M4CaN transport model (TEMPRO 7 Wales). Therefore, the planning data in the M4CaN transport model is consistent with the data used in LDPs in Wales which are used to support planning decisions. Earlier reports which were based on NTEM/TEMPRO 6.2 are therefore now superseded. The DfT is due to publish the revised forecasts for Wales in December 2016.
- 1.2.10** Subject to the completion of their quality assurance checks, the DfT has advised that the nationwide update of NTEM and TEMPRO to be released in January 2017 will include the revised Welsh planning data and will address other issues identified in NTEM 7.0. It is expected that the updated versions of

NTEM/TEMPRO will be generally consistent with TEMPRO 7 Wales. If there are any differences, it is anticipated that they will be marginal and if there are any differences, these will be reported in evidence presented at the Public Local Inquiry.

Other Changes in Guidance

- 1.2.11** As part of the updates to WebTAG introduced in July 2016, the DfT has introduced new guidance on the value of travel time savings (or 'values of time'). The new values replace the previous values of time which were used to inform the reports published in March 2016.
- 1.2.12** Values of time determine the value that travellers place on changes in journey time. Values of time are used in the M4CaN transport model to predict the way travellers will behave in response to changes in travel times or the financial costs of transport. Both the M4CaN transport model and the economic appraisal of the Scheme have been updated such that they are based on the newly published values of time.

The Future of the Severn Crossing Tolls

- 1.2.13** The M4CaN transport model has also been updated to reflect the UK Government's announcement, contained within the Budget 2016, on the future of the Severn Crossing tolls following the end of the current concession arrangement.
- 1.2.14** The concession period is expected to come to an end either late in 2017 or early 2018, at which point the Severn Crossings will return to public ownership and the level of the toll will no longer be determined by the concession agreement. In accordance with the Severn Bridges Act 1992, the March 2016 EAR assumed there would be no tolls on the Severn Crossings when the new section of motorway south of Newport was due to be opened during 2021.
- 1.2.15** In the March 2016 Budget, the Government announced its intention to retain tolls on the Severn Crossings at half their current levels. On this basis, the updated M4CaN transport model assumes, under the 'Core Scenario', a 'half toll' scenario. It is further assumed that, once in public ownership, VAT will no longer be charged and, in line with previous Government announcements, that Light Goods Vehicles (Category 2 vehicles) will, in the future, pay the same toll price as for cars.
- 1.2.16** Notwithstanding the Budget 2016 announcement, it is the stated position of many Welsh Assembly members that tolls on the Severn Crossings should be removed in their entirety and appropriate sensitivity testing has been undertaken to take account of this.

1.3 Scheme Objectives and Reasons for the Scheme

- 1.3.1** The aims of the Welsh Government for the Scheme are to:
- a) Make it easier and safer for people to access their homes, workplaces and services by walking, cycling, public transport or road.

- b) Deliver a more efficient and sustainable transport network supporting and encouraging long-term prosperity in the region, across Wales, and enabling access to international markets.
- c) To produce positive effects overall on people and the environment, making a positive contribution to the over-arching Welsh Government goals to reduce greenhouse gas emissions and to making Wales more resilient to the effects of climate change.

1.3.2 The Scheme aims to help to achieve or facilitate these aims as part of a wider transport strategy for South East Wales, as outlined within the Prioritised National Transport Plan.

1.3.3 The Transport Planning Objectives (TPOs), or goals, are:

TPO 1: Safer, easier and more reliable travel east-west in South Wales.

TPO 2: Improved transport connections within Wales and to England, the Republic of Ireland and the rest of Europe on all modes on the international transport network.

TPO 3: More effective and integrated use of alternatives to the M4, including other parts of the transport network and other modes of transport for local and strategic journeys around Newport.

TPO 4: Best possible use of the existing M4, local road network and other transport networks.

TPO 5: More reliable journey times along the M4 Corridor.

TPO 6: Increased level of choice for all people making journeys within the transport Corridor by all modes between Magor and Castleton, commensurate with demand for alternatives.

TPO 7: Improved safety on the M4 Corridor between Magor and Castleton.

TPO 8: Improved air quality in areas next to the M4 around Newport.

TPO 9: Reduced disturbance to people from high noise levels, from all transport modes and traffic within the M4 Corridor.

TPO 10: Reduced greenhouse gas emissions per vehicle and/or person kilometre.

TPO 11: Improved travel experience into South Wales along the M4 Corridor.

TPO 12: An M4 attractive for strategic journeys that discourages local traffic use.

TPO 13: Improved traffic management in and around Newport on the M4 Corridor.

TPO 14: Easier access to local key services and residential and commercial centres.

TPO 15: A cultural shift in travel behaviour towards more sustainable choices.

1.3.4 The scheme-specific environmental objectives (EO), as set out in the Strategic Environmental Assessment of the Plan, are as follows:

EO1 - Improved air quality in areas next to the existing M4 around Newport;

EO2a - Reduce greenhouse gas emissions per vehicle and/or person kilometre;

EO2b - Ensure that effective adaptation measures to climate change are in place;

EO3 - Reduce disturbance to people from high noise levels, from all transport modes and traffic within the existing M4 Corridor;

EO4 - Ensure that biodiversity is protected, valued and enhanced;

EO5 - Improved access to all services and facilities and reduce severance;

EO6 - Protect and promote everyone's physical and mental wellbeing and safety;

EO7 - Reduce transport related contamination and safeguard soil function, quality and quantity;

EO8 - Minimise transport related effects on surface and groundwater quality, flood plains and areas of flood risk;

EO9 - Ensure the prudent and sustainable use of natural resources and energy;

EO10 - Ensure that diversity, local distinctiveness and cultural heritage are valued, protected, celebrated and enhanced;

EO11 - Ensure that landscape and townscape is properly valued, conserved and enhanced;

1.3.5 In addition, the Wales Transport Strategy includes the following environmental outcomes (WTSEO):

Outcome 11: The sustainability of the transport infrastructure - Increase the use of more sustainable materials in our country's transport assets and infrastructure;

Outcome 12: Greenhouse gas emissions - Reduce the impact of transport on greenhouse gas emissions;

Outcome 13: Adapting to climate change - Adapt to the impacts of climate change;

Outcome 14: Air pollution and other harmful emissions - Reduce the contribution of transport to air pollution and other harmful emissions;

Outcome 15: The local environment - Improve the positive impact of transport on the local environment;

Outcome 16: Our heritage - Improve the effect of transport on our heritage;

Outcome 17: Biodiversity - Improve the impact of transport on biodiversity.

2 Introduction

2.1 Scope of this Report

2.1.1 In March 2016, the Welsh Government published the Key Stage 3 Forecasting Report which formed part of the suite of documents which informed the Welsh Government's decision making. Draft Orders for the scheme were published in March 2016. Supplements and modifications to the draft orders were subsequently developed by the Welsh Government and published in September 2016. The March 2016 Forecasting Report presented the development of future year traffic forecasts and it also provided a description of the methods and assumptions used in preparing the forecasts.

2.1.2 The Key Stage 3 forecasting was undertaken in accordance with the Welsh Government's Transport Appraisal Guidance (WelTAG). In relation to data sources and other technical issues, WelTAG refers directly to UK Department for Transport Appraisal Guidance (WebTAG). Following the publication of the March 2016 Forecasting Report, a number of changes to the guidance governing traffic forecasting have been introduced which are material to the future year traffic forecasts and the economic appraisal of the published scheme. In view of this, the forecasting of the effects of the M4 Corridor around Newport (M4CaN) Scheme has been updated.

2.1.3 The M4CaN transport model is used to understand firstly, the impact of current traffic flows on the network around the M4 local to Newport, and secondly to provide evidence for the planning of changes to the transport network and to produce traffic forecasts that are used in the detailed economic, social and environmental appraisal of proposed interventions in the transport system. The model represents typical operating conditions on the highway network in terms of average flows and speeds on a normal day of operation. The model does not reflect those occasions when a major incident may have occurred which results in a severe reduction in network performance. In such instances higher than usual levels of congestion occur resulting in significant increases in journey times.

2.1.4 Traffic forecasts have been produced to inform the operational, economic and environmental evaluations of the new section of motorway to the south of Newport. The traffic forecasts take into account both the Budget 2015 and Budget 2016 announcements over toll charges on the Severn Crossings. In the 2015 budget, the Chancellor announced that VAT would be removed from the current toll prices when the Severn bridges return to public ownership and further that he intended to reduce the toll charge for Category 2 vehicles (Light Goods Vehicles) would be reduced to the level charged for Category 1 (Cars). In the 2016 budget the Chancellor announced that tolls would be halved when the Crossings returned to the public sector. For the purposes of M4CaN forecasting, the cumulative change of the two Budget announcements, including the half toll, has been assumed in the Core Scenario Central case.

2.1.5 Forecasts have been produced for the following cases;

- A 'Do Minimum' scenario, in which committed transport improvement schemes have been added to the base year network; and

- A 'Do Something' scenario, which includes the proposed new section of motorway to the south of Newport and reclassification of the existing M4 around Newport to an all-purpose road.

2.1.6 The purpose of this Traffic Forecasting Report is to document the development of these future year forecasts and to demonstrate that the methods and assumptions adopted are consistent with best practice and guidance to provide robust forecasts for the Scheme.

2.2 Report Structure

2.2.1 Following this introduction the report is structured as follows:

- Chapter 3 describes the technical model details;
- Chapter 4 provides an overview of the modelling of future year travel;
- Chapter 5 provides an overview of the tolling assumptions
- Chapter 6 provides details of the Reference Case travel demand;
- Chapter 7 describes the future year highway networks;
- Chapter 8 described the forecast public transport model;
- Chapter 9 describes the variable demand modelling; and
- Chapter 10 provides in-depth information on the forecast assignments;

3 Model Overview

3.1 Introduction

3.1.1 This report presents the development of the future year traffic forecasts, which provide inputs into the operational, social, economic and environmental assessments for the Scheme. It provides a description of the methods and assumptions used in preparing the forecasts. Scheme evaluation is undertaken through comparison of a 'Do Something' case (the future year scenario that consists of committed transport schemes together with the proposed new section of motorway south of Newport and the reclassification of the existing M4 north of Newport) against a 'Do Minimum' case (the future year scenario that consists of committed transport schemes without the proposed new section of motorway south of Newport and without the reclassification of the existing M4 north of Newport).

3.1.2 The M4CaN 2014 base year transport model has been validated in accordance with the guidance provided in the Department for Transport's WebTAG¹. The development and validation of the base year model is detailed in the Local Model Validation Report (LMVR).²

3.1.3 The main component of the transport model is a highway model which provides a representation of the highway network within the study area, the traffic using it and the resulting network conditions. In order to incorporate a choice between public and private modes, a separate public transport model was developed that comprises of a public transport network together with a matrix of the bus and rail trips using services that provide an alternative to highway travel on the M4.

3.1.4 Three future years have been defined for the traffic forecasting in accordance with guidance, namely the 2022 opening year, the 2037 design year and 2051 being the final appraisal year for which national traffic growth figures are available..

3.1.5 The transport model includes the two Severn River Crossings, which provide the main highway links between South Wales and England. These bridges are currently tolled in the westbound direction. Whilst the current tolls are modelled in the base year, in the forecast years of the proposed scheme a half toll representing the cumulative changes announced in both the Chancellors' Budgets of 2015 and 2016 is assumed in the Core Scenario.

3.1.6 A large number of web-based Transport Analysis Guidance (WebTAG) documents are published by the Department for Transport (DfT)³. TAG Unit M2⁴ suggests that the use of Variable Demand Modelling (VDM) may be appropriate/advisable in the majority of scheme appraisals. Any change to transport conditions will, in principle, lead to a change in travel demand. The purpose of variable demand modelling is to forecast and quantify these changes.

¹ Transport Analysis Guidance, Unit M3.1, Highway Assignment Modelling, Department for Transport, January 2014

² M4 Corridor Around Newport, Local Model Validation Report, Ove Arup & Partners, June 2015

³ www.gov.uk/transport-analysis-guidance-webtag

⁴ Transport Analysis Guidance, Unit M2, Variable Demand Modelling, Department for Transport, January 2014

VDM has been used in the traffic forecasting for the proposed new section of motorway to the south of Newport.

3.2 Highway Assignment Model

3.2.1 The M4CaN highway model uses SATURN software (Simulation and Assignment of Traffic in Urban Road Networks), which is a ‘congested assignment’ software suite developed by the Institute for Transport Studies at the University of Leeds.

3.2.2 The suite provides software for combined traffic simulation and assignment modelling and analysis of road proposals ranging from traffic management schemes over relatively localised networks to major infrastructure improvements. One of the key features of SATURN is its ability to simulate the operation of junctions in some detail, including the prediction of queues and delays, the effect of queues blocking back on adjacent junctions, and the influence of congestion at specific points in the network on route choice.

3.2.3 The basic inputs to a SATURN model are the ‘demand’, in the form of a matrix of trip movements between model zones, and the ‘supply’ in the form of a data file representing the road network. Following the network building procedure, the trip matrix is assigned to the network using an iterative series of loops between ‘assignments’ and ‘simulations’ until the model has converged.

3.2.4 SATURN version 11.3.10 was used for the highway modelling for the M4CaN.

3.3 Public Transport Model

3.3.1 A public transport model has been developed to provide the public transport demand and time and fare data which is required as input to the variable demand model used to predict the potential modal shift effects of the Scheme.

3.3.2 The public transport network and assignment model was developed using version 4.1.4 of the specialist transport modelling software EMME.

3.3.3 EMME is multi-modal travel demand forecasting software that has been used to assess public transport network performance. It has been used to model bus and rail trips for east-west movements that provide an alternative to car based travel on the M4 Corridor around Newport. The basic inputs were matrices representing demand on these public transport services and a representation of the public transport network, including routes, locations of stops / stations, service frequency, journey time and fares.

3.3.4 Comprehensive details of the public transport model development are given in the Local Model Validation Report (LMVR).

3.4 Variable Demand Modelling

3.4.1 Transport schemes that impact on journey times and cost will, in principle, influence the level of demand for travel. The opening of a new scheme can elicit a number of responses by travellers including trip reassignment, re-timing, re-distribution and modal shift. These responses can result in additional trips and additional vehicle mileage on the road network, known as “induced traffic”.

- 3.4.2** Conversely, in a ‘Do-Minimum’ scenario i.e. in the absence of the proposed Scheme, the effects of forecast traffic growth and the subsequent increase in traffic congestion can lead to “trip suppression” which could manifest itself as peak spreading, modal switching to public transport, and/or a reduction in the number, length or frequency of journeys. These responses, as well as re-distribution, can lead to reduced vehicle mileage on the road network.
- 3.4.3** TAG Unit M2 states that “the purpose of variable demand modelling is to predict and quantify these changes”, and goes on to say that “there should be a presumption that the effects of variable demand on scheme benefits will be estimated quantitatively unless there is a compelling reason for not doing so”.
- 3.4.4** The guidance also states that under certain circumstances it is acceptable to base the assessment of a scheme on a fixed demand traffic model. This is the case when the scheme is quite modest either spatially or financially and also in terms of its effect on travel costs. However, scheme costs for options considered for the M4 corridor around Newport are significantly in excess of the £5 million limit defined within WebTAG.
- 3.4.5** A fixed demand traffic model would therefore only be deemed sufficient to assess the M4 corridor around Newport if the following criteria were met:
- No congestion on the network in the forecast years in the absence of the Scheme; and
 - No appreciable effect on travel choices such as mode of travel or the distribution of travel patterns in the corridor containing the Scheme.
- 3.4.6** Assessing these criteria in the context of the M4CaN model indicated the need for variable demand modelling because even under existing conditions traffic congestion is regularly observed and it is forecast to worsen as a result of underlying growth in travel demand. There is also potential for the Scheme to have an appreciable effect on the distribution of travel patterns and the choice of mode between private and public transport in the study area. The use of a fixed demand traffic model would accordingly not have been appropriate.
- 3.4.7** The variable demand modelling (VDM) was undertaken using the Department for Transport’s DIADEM software (Version 5.0.9). Further details of the VDM are given in Section 8.1 of this report.

3.5 Model Time Periods

- 3.5.1** The variable demand model works on the basis of 24 hour trip productions and attractions, while the highway assignment model uses hourly trip origins and destinations covering the AM and PM peak hours and an average inter-peak hour.
- 3.5.2** Based on the analysis of traffic count data the assignment model time periods are as follows:
- AM peak hour – 08:00 to 09:00;
 - Inter-peak hour – average hour between 10:00 and 16:00; and
 - PM peak hour – 17:00 to 18:00.

3.5.3 For the peak period models, a pre-peak assignment was introduced, via the PASSQ function available within the SATURN software, as part of the calibration process. This enables any resultant queuing that may exist at the end of the pre-peak period assignment to be passed through into the adjoining peak hour assignment. This helps to improve the robustness of the route choice present within the peak assignment and the representation of journey times.

3.6 Demand Segments for VDM

3.6.1 Different types of journeys are likely to display different characteristics in terms of trip distribution, mode sensitivity, travel time sensitivity and growth patterns. For this reason, car demand was split into the following three trip purposes:

- Employer's business;
- Commuting; and
- Other purposes (including leisure, shopping and personal business trips).

3.6.2 Goods vehicles were separated into light goods vehicles (LGV) and heavy goods vehicles (HGV).

3.6.3 For the purposes of the VDM 'home-based' trips (trips starting or ending at home) were modelled in a 24 hour production/attraction (P/A) format, as recommended by WebTAG. This was necessary in order to retain the link between outbound and return legs when calculating the resulting demand response of a return trip starting and ending at home, rather than origin-destination format in which the linkage between outbound and return legs are lost. There was therefore a requirement to develop separate demand segments within each trip purpose, depending on whether the trips were 'home-based' (for trips starting or ending at home) or 'non-home-based' i.e. neither end of the trip being home.

3.6.4 Long distance trips without at least one trip end located in the 'Area of Detailed Modelling' or Rest of Fully Modelled Area were also separated out in the demand model, as changes in travel costs are not fully modelled for these movements and they should therefore be treated as fixed within the VDM process.

3.6.5 The public transport demand was further split into 'car available' and 'no car available' to separate those trips that have the opportunity to switch to private car from those that do not have that opportunity. In this respect, 'No car available' trips are assumed to be captive to public transport. They are only included in the demand model to ensure that they are considered in the competition for trip ends in the doubly-constrained distribution model, which forms part of the variable demand modelling process.

3.6.6 The demand segments used in the VDM are specified in Table 3.1.

Table 3.1 Demand Segments in the Variable Demand Model

Demand Segment			Vehicle Type / Purpose
Highway	Public Transport		
	Car avail.	No car avail.	
1	1	11	Cars – Home-Based Employers’ Business
2	2	12	Cars – Home-Based Others
3	3	13	Cars – Home-Based Work
4	N/A	N/A	Light Goods Vehicles (LGVs)
5	N/A	N/A	Heavy Goods Vehicles (HGVs)
6	6	14	Cars – Non-Home-Based Employers’ Business,
7	7	15	Cars – Non-Home-Based Other
8	N/A	N/A	Cars – Employers’ Business, Fixed
9	N/A	N/A	Cars – Other Purposes, Fixed
10	N/A	N/A	Cars – Commuting, Fixed

3.7 User Classes for Traffic Assignment

3.7.1 All demand matrices for the traffic assignment are required to be in origin-destination (O-D) format rather than the production/attraction (P/A) format used in the VDM, in accordance with the requirements of WebTAG. An O-D matrix stores trips according to the actual origin and destination zone of a trip. This information is needed so that the trips can be assigned onto the road network.

3.7.2 In the traffic assignments it is not necessary to retain the level of demand segmentation used in the VDM process. Instead, trip matrices for the traffic assignment are split into five different 'user classes'.

3.7.3 Table 3.2 lists the trip purposes and vehicle types that are used in the traffic assignment. Demand in the SATURN traffic assignment is expressed in terms of Passenger Car Units (PCU). The factors used to convert from vehicles to PCUs are also listed in this table.

Table 3.2 Modelled User Classes in the Traffic Assignment

User Class	Vehicle Type / Purpose	PCU Factor
1	Cars – Employers' Business	1.0
2	Cars – Other Purposes	1.0
3	Cars – Work	1.0
4	Light Goods Vehicles (LGVs)	1.0
5	Heavy Goods Vehicles (HGVs)	2.5

3.8 Assignment Method

3.8.1 The assignment process is an important element that predicts the routes that drivers will choose taking into account the level of traffic demand and the available road capacity. The assignment technique used in the updated M4CaN model is the Wardrop equilibrium assignment method for multiple user classes. The principle of this assignment is that traffic arranges itself on the network such that the cost of travel on all routes used between each origin and destination is equal to the minimum cost of travel and all unused routes have equal or greater cost.

3.9 Generalised Costs

3.9.1 In principle, the basis for route choice in a highway assignment model is that of generalised cost. The generalised cost of travel is based on a combination of factors that drivers take into account when choosing routes, mainly time and distance. Generalised cost parameters are used in a SATURN model to represent travellers' value of time by pence per minute (PPM) and distance by pence per kilometre (PPK). Values of PPK and PPM can be set universally for the entire model or individually by user class. Where a choice of route exists (as in nearly all cases) these values are used to determine which available route has a lower 'cost' to the traveller. Thus if PPK value is high, low cost routes will be those which minimise distance, conversely if PPM is high low cost routes will be those that minimise the travel time.

3.9.2 The SATURN assignment procedure uses the following generalised cost formulation, with everything converted to equivalent minutes:

$$\text{Generalised Cost} = \text{Time} + \text{PPK} / \text{PPM} * \text{Distance} + \text{Toll} / \text{PPM}.$$

Where: PPM = pence per minute, and

PPK = pence per kilometre.

3.9.3 The generalised cost coefficients used in the base model are based on data given in TAG Unit A1.3⁵, which provides the values of time, occupancy figures, purpose splits, Gross Domestic Product (GDP) growth rates and vehicle operating costs that are recommended by the Department for Transport (DfT) for use in the modelling and economic appraisal of transport projects.

3.9.4 The values of time used in the M4CaN Transport Model are those given in *WebTAG: TAG Databook, Spring 2016 (v1.6)* which incorporates the new values of travel time savings which were published in core guidance in November 2016.

3.9.5 Unit A1.3 provides monetary values of time in 2010 prices for different transport users, which can be used to derive values of time in an assignment model in terms of pence per minute (PPM). The conversion from 2010 to the modelled years was made in accordance with the forecast annual rates of growth in the value of time set out in Unit A1.3. This states that the value of time is assumed to increase in line with income, measured for this purpose as GDP per head.

3.9.6 Similarly Unit A1.3 provides parameters for the calculation of fuel costs and non-fuel vehicle operating costs. These parameters were used to calculate the fuel costs per kilometre for each user class. In converting fuel costs from 2010 to the modelled years, account was taken of the forecast growth in the cost of fuel and the predicted rate of increase in fuel efficiency, as set out in Tables 13 and 14 of Unit A1.3. As noted in the guidance, the non-fuel vehicle operating costs are assumed to remain constant in real terms, and so no adjustment was applied.

⁵ Transport Analysis Guidance Unit A1.3, User and Provider Impacts, Department for Transport, November 2014

3.9.7 When added together, the fuel and non-fuel elements give the total vehicle operating costs in terms of PPK for different transport users. The PPM and PPK parameters then give the overall generalised cost for each of the different user classes. The generalised costs (in 2014 prices) that were used in the base and forecast models are shown in Table 3.3.

Table 3.3 Base and Forecast Year Generalised Cost Parameter Values

2014	AM Peak		Inter-peak		PM Peak	
	PPM	PPK	PPM	PPK	PPM	PPK
Cars – Employers' Business	31.53	13.32	32.36	13.15	32.09	13.36
Cars – Other	13.99	7.19	14.89	7.17	14.65	7.28
Cars – Commuting	22.04	7.32	22.43	7.16	22.23	7.28
Light Goods Vehicle	26.46	15.77	24.45	15.97	25.23	15.79
Heavy Goods Vehicle	24.06	48.76	25.97	49.88	25.96	51.77
2022	AM Peak		Inter-peak		PM Peak	
	PPM	PPK	PPM	PPK	PPM	PPK
Cars – Employers' Business	35.51	12.16	36.45	11.88	36.14	12.24
Cars – Other	15.76	5.75	16.78	5.68	16.50	5.84
Cars – Commuting	24.82	5.88	25.26	5.68	25.04	5.87
Light Goods Vehicle	29.80	14.52	27.54	14.68	28.41	14.53
Heavy Goods Vehicle	27.10	48.93	29.25	49.78	29.24	51.79
2037	AM Peak		Inter-peak		PM Peak	
	PPM	PPK	PPM	PPK	PPM	PPK
Cars – Employers' Business	47.71	12.01	48.97	11.46	48.55	12.21
Cars – Other	21.18	5.48	22.54	5.28	22.17	5.60
Cars – Commuting	33.34	5.66	33.93	5.28	33.64	5.71
Light Goods Vehicle	40.04	14.71	36.99	14.79	38.17	14.71
Heavy Goods Vehicle	36.41	54.37	39.30	54.18	39.28	57.33
2051	AM Peak		Inter-peak		PM Peak	
	PPM	PPK	PPM	PPK	PPM	PPK
Cars – Employers' Business	63.95	12.33	65.65	11.42	65.08	12.72
Cars – Other	28.39	5.55	30.21	5.17	29.71	5.70
Cars – Commuting	44.70	5.79	45.49	5.18	45.09	5.95
Light Goods Vehicle	53.67	15.03	49.59	14.87	51.17	15.04
Heavy Goods Vehicle	48.80	58.26	52.68	55.95	52.66	61.39

3.10 Average Day Factors

3.10.1 In order to carry out environmental assessments, model data needs to be converted from peak hour to 18 hour traffic volumes. In addition, 24 hour traffic flows are required for reporting purposes. Historic Automatic Traffic Counter (ATC) data along the M4 corridor in the study area was used to derive a number of factors allowing the calculation of Annual Average Weekday Traffic (AAWT) and Annual Average Daily Traffic (AADT). The factors are given in Table 3.4.

Table 3.4 Average Day Factors

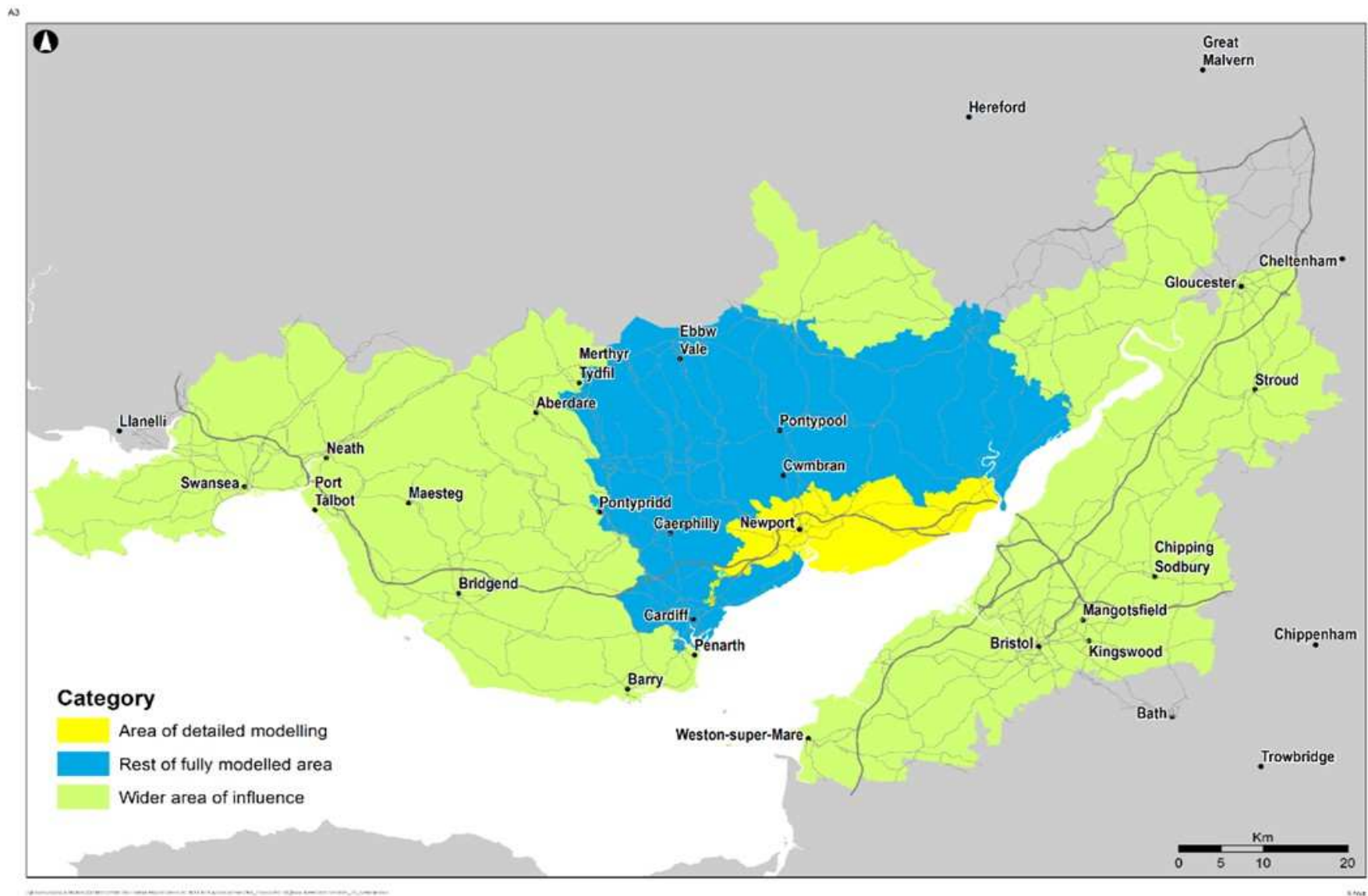
Peak Hour to Peak Period			12 Hour (07:00-19:00) To AAWT	AAWT to 18 hr (06:00-24:00)	AAWT to AADT
AM	Inter-peak	PM			
2.844	6.000	2.798	1.232	0.961	0.935

3.11 Geographical Coverage of the Model

3.11.1 Four geographic areas have been defined for model zoning and network coverage comprising:

1. Area of Detailed Modelling
2. Rest of Fully Modelled Area
3. Wider Area of Influence
4. External Area

3.11.2 Figure 3.1 shows the first three modelled areas, while the external area comprises the rest of the UK outside these areas.

Figure 3.1: Model Coverage and Study Area

3.11.3 SATURN networks can comprise either a 'simulation' network, in which the operation of junctions is simulated, or a less detailed 'buffer' network, which essentially functions as a more conventional link-based model. Frequently, SATURN networks are set up as a combination of the two, with the less-detailed 'buffer' area on the periphery ensuring that traffic from more remote areas enter the simulation part of the network at the correct locations on the network.

3.11.4 For the purpose of preparing traffic forecasts for the M4 Corridor around Newport model, the 'simulation' network or 'Area of Detailed Modelling' covers the M4 between Junction 30 in the west and Junction 21 in the east, as shown in Figure 3.1. This is the Core Simulation Area which also includes Junctions 29 and 23A, which form the western and eastern ends respectively of the proposed scheme. Within this core area are key roads and corridors of interest including:

- the existing M4 and proposed scheme;
- the M48 motorway;
- access routes to the existing M4 and M48 motorways from Cardiff, Newport, Chepstow and the hinterland north of Newport;
- the corridors on the east and west banks of the River Usk that could connect Central Newport to the Scheme via intermediate junctions; and
- east-west routes through Newport via Newport Bridge, George Street Bridge and the Southern Distributor Road (SDR).

3.11.5 Within this core area, all significant junctions are fully simulated, while links are coded where appropriate to give a representation of their speed and capacity. This level of detail reflects the significance of the key links and junctions in route choice decisions through the study network.

3.11.6 Outside the Core Simulation Area is the Rest of Fully Modelled Area, which includes Cardiff and is bounded north of Cardiff by the A470 to the west, the A465/A40 to the north, and the A466 to the east. While trips in this area are fully represented, the area is modelled in less detail as buffer network only, with no simulation of junctions. All links in this area are allocated speed-flow curves.

3.11.7 Outside the Rest of Fully Modelled Area is a large area of influence where changes in traffic flow may be experienced following opening of a new scheme. This area extends to Skewen (M4 Junction 43) in the west, the A465 Heads of the Valleys Road and M50 in the north, and the M5 J8 to 18a in the east. Major roads within this area-of-influence are also modelled as a 'buffer' network with a lower level of detail, using fixed speeds.

3.11.8 The traffic model includes all trips that travel within the Core Simulation Area and the Rest of Fully Modelled Area. The area of influence only includes trips that would travel through the first two areas or trips that would potentially divert to travel through these areas.

3.12 Zone System

Core Simulation Area

- 3.12.1** The Core Simulation Area of the model is centred on Newport, extending from the Severn River Crossings to the eastern edge of Cardiff. The zone system used in this area is shown in Figure 3.2. The zone boundaries have been drawn to ensure that they are consistent with both the DfT's National Trip End Model zoning system based on Office for National Statistics (ONS) middle-layer super output areas (MSOA's) and output areas (OA) which is the smallest geographic unit for which census data is published. Some 'empty' zones have also been included to allow for future developments, particularly in South East Newport.

Rest of Fully Modelled Area

- 3.12.2** The Rest of Fully Modelled Area is bounded to the west by the A470 and the western edge of Cardiff, by the A465 and the A40 to the north, and by the River Wye to the east.
- 3.12.3** In order to represent all trips in this area, it is necessary that a sufficiently detailed network is coded that provides sufficient available route choice alternatives. Therefore, the zone system in this area is designed so that the zones represent the most likely loading points for these trips.
- 3.12.4** As with the Area of Detailed Modelling, zone boundaries have been drawn to coincide with the boundaries of the DfT's National Trip End Model and the Census Output Areas. The zone system in this area is shown in Figure 3.3.

Wider Area of Influence

- 3.12.5** The 'Wider Area of Influence' is coded as a buffer network outside the Rest of Fully Modelled Area. It includes long-distance movements which could be influenced by a new route for the M4 motorway south of Newport. Fixed speeds are used on the links in this part of the network.
- 3.12.6** The zone system in the 'Wider Area of Influence' is shown in Figure 3.4 It is not as fine as those in the Core Simulation and 'Rest of Fully Modelled Area', but the zones have been drawn to ensure consistency with the DfT's National Trip End Model zoning system.

External Area

- 3.12.7** The external area comprises the rest of Great Britain outside the Wider Area of Influence, and does not have an explicit network representation. The external zones are connected to the network at the edge of the Wider Area of Influence by means of long distance centroid connectors, again using fixed speeds. Centroid connectors are defined as imaginary road network links that connect the zone centroid to the road network at nodes.
- 3.12.8** Because of the limited number of long distance routes available for this traffic to enter the main modelled areas, the zones in these areas are considerably larger. The external area zone system is consistent with DfT's National Trip End Model zoning system and is shown in Figure 3.5.

Figure 3.2 Model Zones, Core Simulation Area

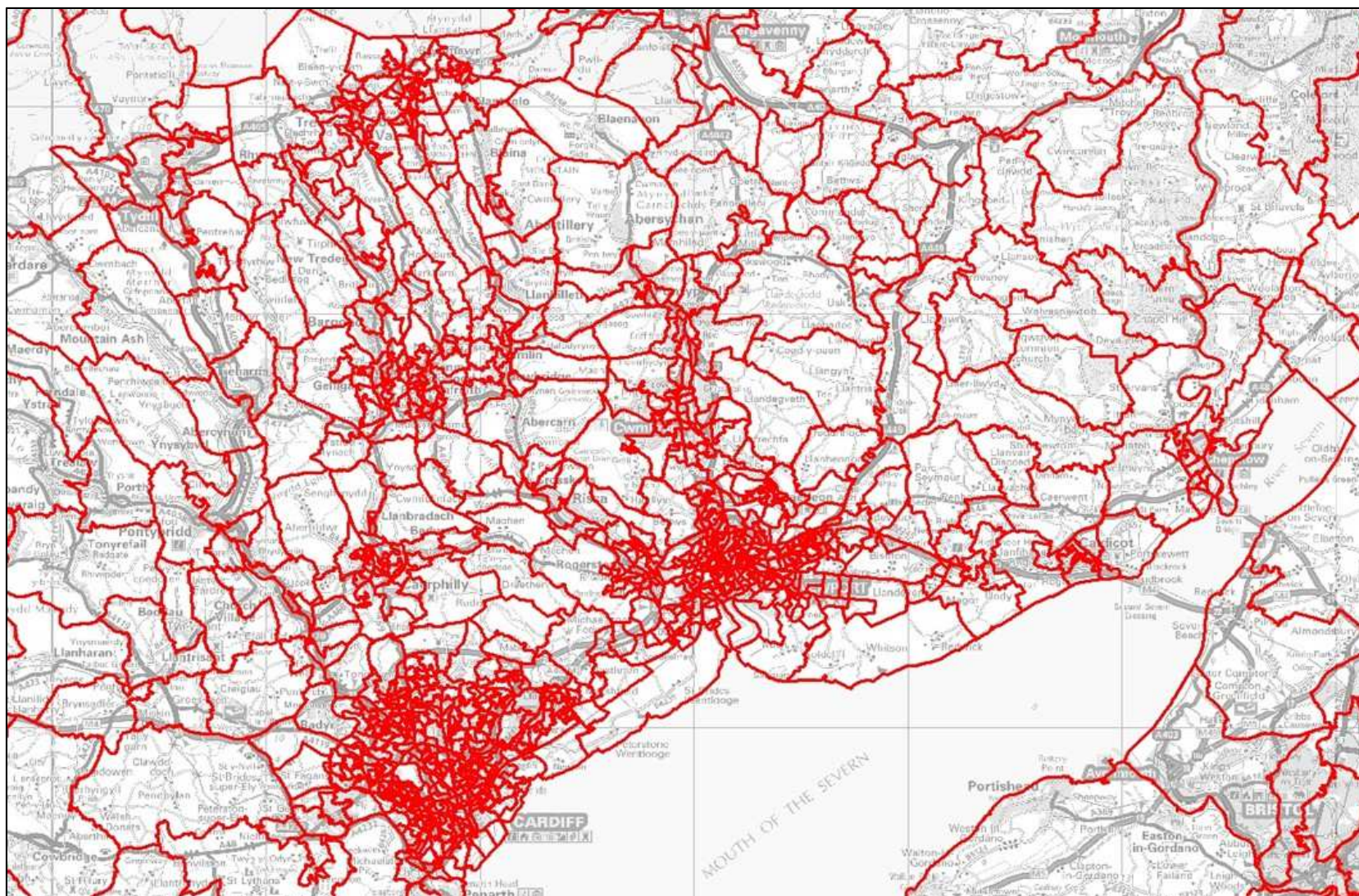
Figure 3.3 Model Zones, Rest of Fully Modelled Area

Figure 3.4 Model Zones, Wider Area of Influence

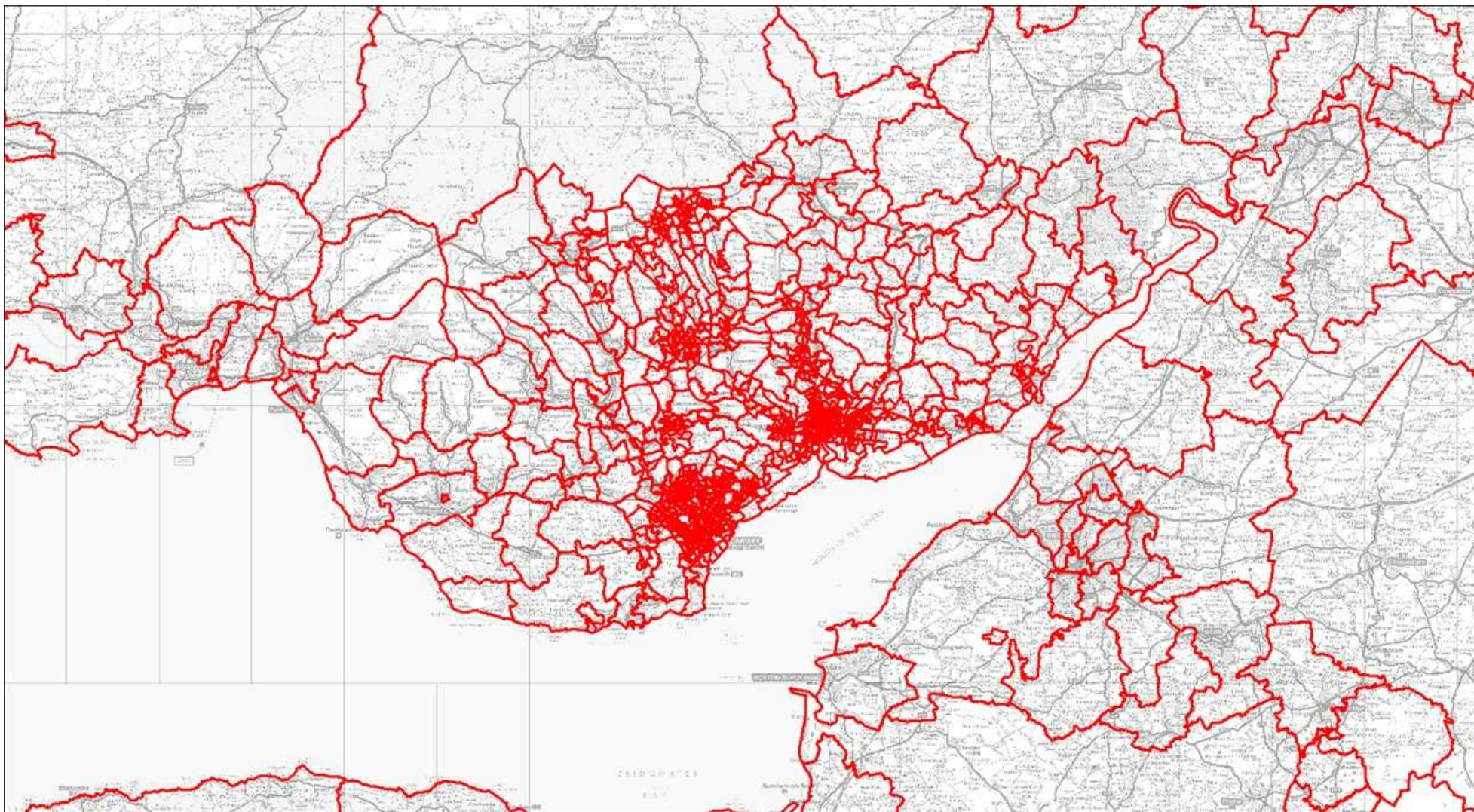
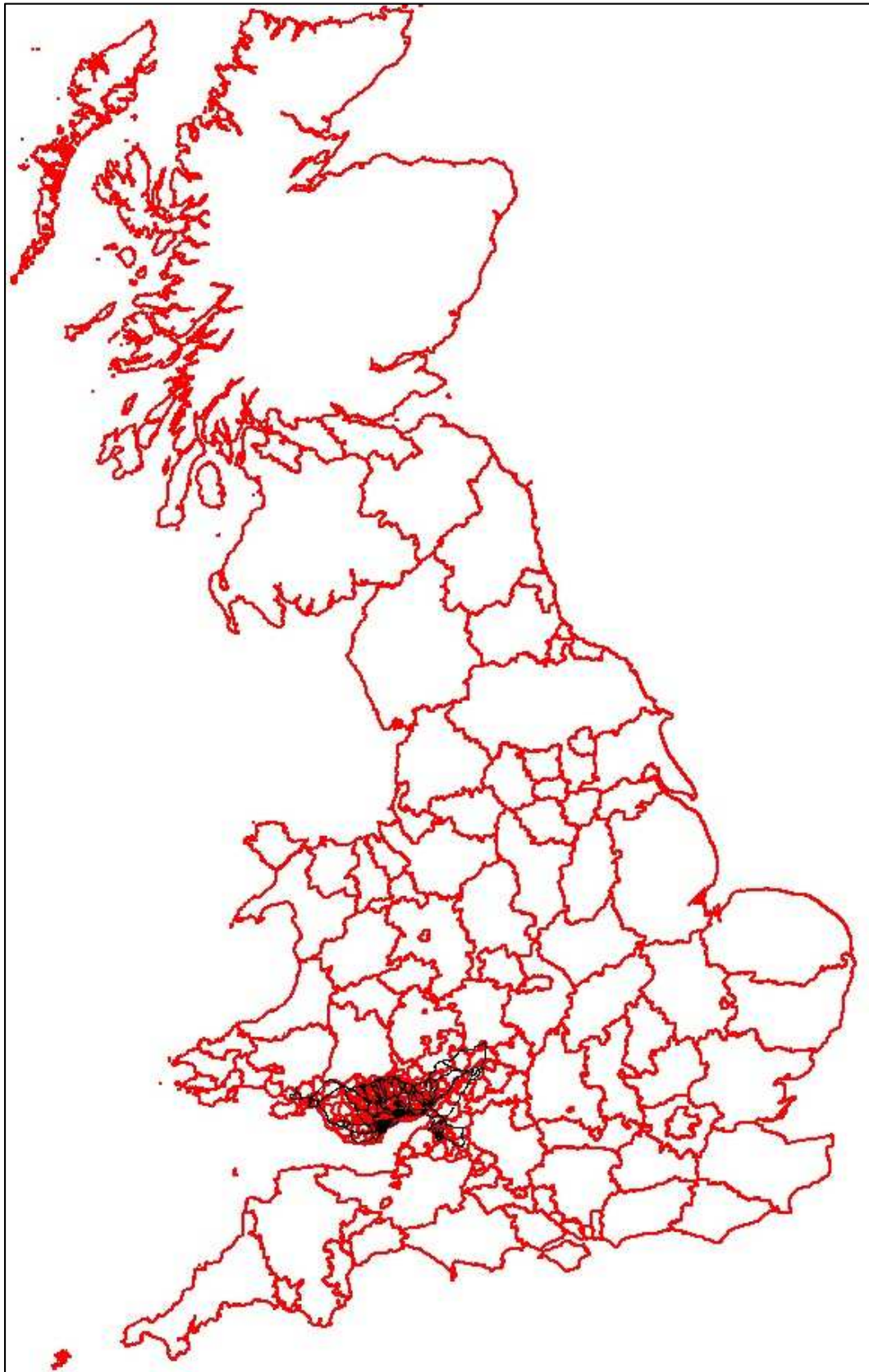


Figure 3.5 Model Zones, Wider Area of Influence

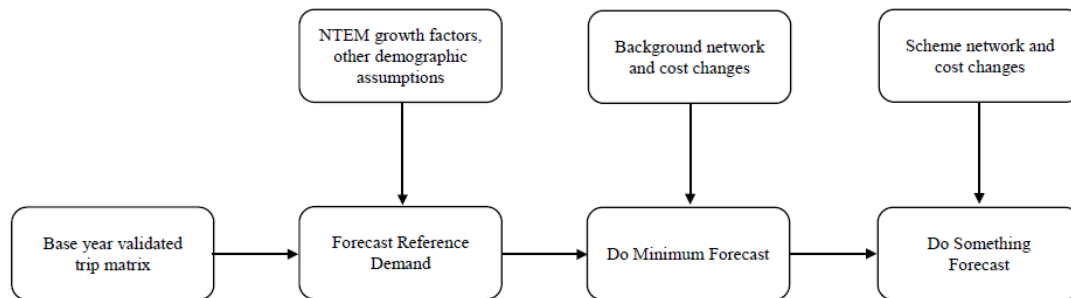


4 Modelling Future Year Travel

4.1 Overview of Demand Forecasting Procedure

4.1.1 Figure 1 of TAG Unit M4⁶ describes the general outline of the methodology to be followed to produce a set of forecasts. This figure is reproduced as Figure 4.1.

Figure 4.1 Basic Approach to Forecasting using a Transport Model



4.1.2 The base matrices were created from mobile phone, roadside interview data and synthesised demand, as described in the LMVR. These are termed the base year ‘prior’ matrices which form the input to the calibration and matrix estimation processes. For the purpose of assignment and validation, these matrices were constructed in origin-destination (O-D) format.

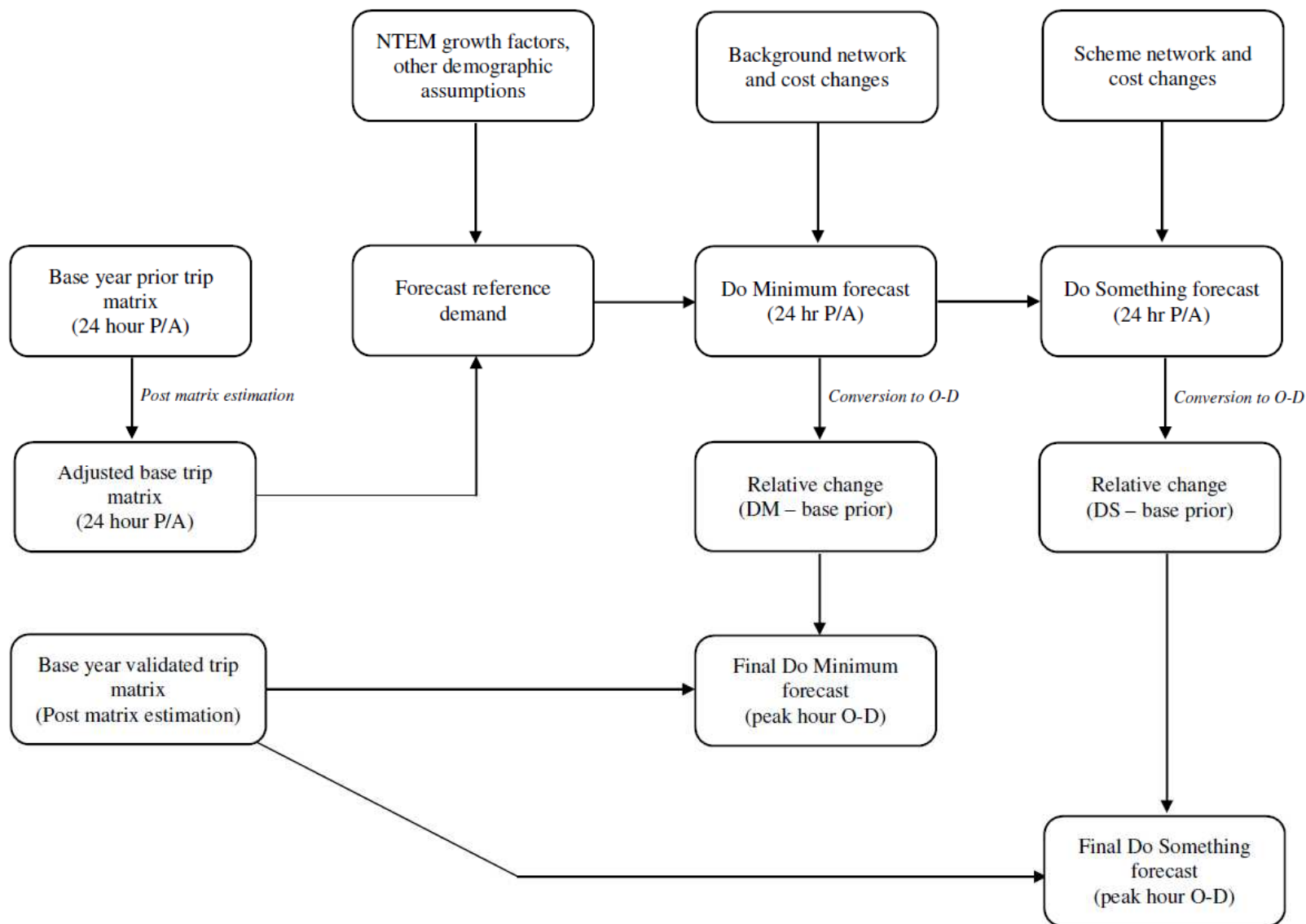
4.1.3 As the variable demand model works on the basis of 24 hour trip productions and attractions (P/A format), the above basic methodology was modified and expanded to reflect the approach suggested in Appendix B of TAG Unit M2. This is necessary, because when dealing with matrices in P/A format within a demand model, the linkage between origin-destination (O-D) and production/attraction (P/A) data is not retained during the matrix estimation process.

4.1.4 The validated base matrix can only be created at peak hour O-D and not at the 24 hour P/A level. As such, after converting the output of the forecast demand model from P/A to O/D, the resulting matrix is not directly assigned, but is compared with a base case, and the implied changes are used to adjust the independently validated base year matrix. This approach is shown in Figure 4.2.

4.1.5 The Reference Case forecast matrices form the starting point for the VDM process necessary to develop the Do Minimum and Do Something forecasts. This chapter describes the traffic growth and other demographic assumptions used to develop the Reference Case forecasts.

⁶ Transport Analysis Guidance Unit M4, Forecasting and Uncertainty, Department for Transport, November 2014

Figure 4.2: Approach to Forecasting when using P/A matrices in VDM



4.2 National Trip End Model (NTEM)

4.2.1 The National Trip End Model (NTEM) has been developed by the DfT and provides a set of predictions for growth in travel demand at trip end level for a range of different modes: walk, bicycle, car drivers, car passengers, bus and train. The NTEM datasets are long-term forecasts – they represent the Department's estimate of the long-term response to demographic and economic trends. The results from the NTEM forecasting suite are ultimately made available through the DfT's Trip End Model Presentation Program (TEMPRO) software.

4.2.2 TAG Unit M4 states that future year forecasts should be based on NTEM growth in demand thereby allowing local transport models to be developed on a fully consistent basis and through the medium of TEMPRO. Version 7 of TEMPRO, issued in July 2016, represents the DfT's definitive version of growth factors produced by the National Trip End Model. NTEM7 forecasts are run from 2011 base at five year intervals up to 2051. They include time-varying trip rates between 2011 and 2016 based on the latest evidence from the National Travel Survey. Within NTEM7, zones for England and Wales are consistent with Middle Super Output Areas (MSOA's). The number of zones for England and Wales in NTEM is 7,201 in comparison with 2,500 for the entirety of Great Britain that existed in the now superseded NTEM6.2.

4.2.3 NTEM includes forecasts for the future level of population, dwellings, workers and employment. The future number of dwellings is based on ONS mid-year population projections published in 2013. The future number of dwellings is based on a combination of LDPs, Unitary Development Plans and Annual Monitoring Reports. Following detailed inspection of the TEMPRO7 forecasts, it was found that there were some discrepancies between the dwelling numbers in Wales used by the DfT in TEMPRO7 and the most up to date data as published in the adopted LDPs in Wales.

4.2.4 The forecasts of dwellings numbers in Wales based on adopted LDPs were supplied to DfT which were input into a re-run of NTEM 7. It is these forecasts that have been used to derive the growth factors used in the future year demand forecasts for assessment of the proposed scheme. This means that the dwelling data used in the M4 Corridor around Newport model is consistent with the data used in the LDPs in Wales. The number of dwellings built between 2011 and 2016 was obtained by using Valuation Office completions for new dwellings up to 2016, and LDP dwellings numbers were used thereafter throughout the remainder of the Plan period. After the final year of the Plan periods, the practice recommended by Welsh Government Planners was followed which assumes that the average number of dwellings per year in the LDP period was used for the years beyond the Plan period. This means that the dwelling data used in the M4CaN model is consistent with the data used in the LDPs in Wales.

4.2.5 It should be noted that the issues with the traffic growth factors issued in the July 2016 release of TEMPRO 7 were not restricted to Wales. The DfT released a statement regarding the status of the NTEM 7.0 dataset in November 2016. This stated: 'Since the release, some localised issues have been identified with the NTEM7.0 dataset which arose from the use of incorrect data in the model. These issues occurred in the processing of input data for employment and dwellings for a small but significant number of local authorities.' DfT also announced that they

are planning to issue an addendum to NTEM 7.0 which will address these issues in January 2017.

4.2.6 The predicted growth in 24-hour car trip productions and attractions was controlled to the growth forecast derived from the National Trip End Model that incorporated the Welsh Government dwelling forecasts within TEMPRO for the spatial areas listed in Appendix A and were produced for the following car trip purposes:

- Home-based Work (HBW);
- Home-based Other (HBO);
- Non-Home-based Other (NHBO);
- Home-based Employer's Business (HBEB); and
- Non-Home-based Employer's Business (NHBEB).

4.2.7 Only one set of factors is provided in TEMPRO, representing the central growth case of what is likely to happen to travel demand in the future based on the assumptions input to NTEM. The factors are based on predicted demographic changes and do not take account of the level of congestion or other factors (such as traffic restraint measures) which may limit the potential for all the demand to use the network without an unrealistic deterioration in travel conditions.

4.2.8 Correspondence between the model zones and NTEM zones was made at the finest level practicable. Within the core of the study area, model zones were allocated to the NTEM zones, while model zones further out were allocated to local authority zones or regions as appropriate.

4.2.9 The base year all-day trip end productions and attractions for the car user classes were factored to the three forecast years using the NTEM growth in car trip end productions and attractions, by trip purpose, for an average weekday. The demand matrix was then updated using a furnishing technique, controlled to trip productions, which are likely to be more reliable than trip attractions.

4.2.10 For a fixed demand approach, TAG Unit M4 makes provision for an additional global factor to take account of two further variables, income adjustment and fuel price variability. However, it also advises that a model which accounts for variable demand, as is the case with the M4CaN model, invalidates the use of these additional variables, as these effects are modelled explicitly within the VDM process. Consequently, the NTEM car growth factors produced were not modified to include the income and fuel price factors, but were applied directly to the equivalent zone trip ends within the 2014 base matrices for car trips.

4.2.11 Further details of the NTEM traffic growth factors are given in Appendix A.

4.3 National Transport Model

4.3.1 NTEM does not produce growth factors for trips made by goods vehicles, and WebTAG advises that for modelling goods vehicle in highway models, growth factors from the National Transport Model (NTM) may be used. The NTM combines inputs from specialist freight models with passenger transport forecasts to produce a combined forecast of road traffic, taking into account the impact of freight and passenger traffic on congestion and the feedback to total traffic.

- 4.3.2** LGV demand is modelled outside of the NTM using an elasticity based approach where LGV demand is a function of diesel price, fuel efficiency and GDP. There is a long established link between GDP and LGV use which reflects the fact that increases in economic activity result in increases in demand for delivery and construction where LGVs are used.
- 4.3.3** HGV demand forecasts are derived from a bespoke multistage behavioural choice model (the GB Freight Model) Base year data are taken from domestic and international freight movements for a range of commodities. This is then grown based on forecasts of manufacturing growth for each of the commodities and the cost of moving goods using HGVs.
- 4.3.4** In both the GBFM and the LGV models, vehicle fuel efficiency and GDP forecasts have been updated to reflect the most recent data.
- 4.3.5** NTM provides estimates for the growth in road traffic between 2010 and 2040. The available data gives growth factors for light good vehicles (LGVs), articulated heavy vehicles and rigid heavy vehicles. A conservative view has been undertaken in the respect that there is no further growth beyond 2040 when defining the growth rates from 2014 to 2051. The resulting NTM central growth factors for the change in vehicle-kilometres for LGVs and HGVs in Wales are shown in Table 4.1.

Table 4.5 Goods Vehicle Growth Factors from NTM

User Class	2014 to 2022	2014 to 2037	2014 to 2051
LGV	1.215	1.604	1.676
HGV	1.047	1.153	1.177

4.4 Uncertainty in Forecasting

- 4.4.1** An Uncertainty Log relating to the Scheme is given in Appendix B. The following sections provide details of how local uncertainty in travel demand and supply has been addressed in the forecasting process.

Development Proposals

- 4.4.2** Trips generated by specific development sites in Newport, Monmouthshire and Cardiff were taken into account and included within the overall level of NTEM growth. The developments were represented by a concentration of traffic growth into the zones that correspond to their geographical locations and loaded onto the modelled highway network at the development access points. To offset this, growth factors applied across the remainder of the NTEM area were reduced so that the overall level of growth was constrained to the NTEM forecasts.
- 4.4.3** Developments outside Newport, Cardiff and Monmouthshire were deemed to be too far from the study area to have a direct impact on the Scheme and as such were not considered for explicit inclusion in the traffic forecasting. Traffic generated by these developments will be encapsulated in the NTEM growth for that particular region.
- 4.4.4** Information regarding the detailed proposals and planning status of future developments in the study area was obtained from the local planning authorities

in Newport, Monmouthshire and Cardiff. This takes on board information contained in:

- the Newport Local Development Plan, placed on deposit in April 2012 and subsequently adopted in January 2015; and
- the Monmouthshire Local Development Plan, which was placed on deposit in September 2011 and subsequently adopted in February 2014.
- the Cardiff Local Development Plan, which was placed on deposit in September 2013 and submitted for examination in August 2014. The Plan was adopted in January 2016.

4.4.5 The planning departments at each of these local authorities were consulted regarding the proposed developments and any feedback that was provided has been incorporated. During these consultations, it was confirmed that there are no 'dependant developments' within any of the programmes that would only go ahead if the proposed section of motorway to the south of Newport was constructed.

4.4.6 A 'screening' process was applied to determine which of the listed developments in Newport, Cardiff and Monmouthshire should explicitly be included in the model traffic forecasts. This removed housing sites of less than 100 units, so that traffic generated by these sites would be included within the background traffic growth as forecast by NTEM.

4.4.7 For Cardiff and Monmouthshire, only those developments situated within or adjacent to the Core Simulation Area were explicitly included within the Reference Case matrices. For any developments beyond this, it was assumed that the development traffic will be encapsulated within NTEM growth forecasts.

4.4.8 Each proposed development was considered in turn and classified in accordance with Table A2 of TAG Unit M4. Those developments which were the subject of a planning application or had been approved were classified as 'more than likely' and 'near certain' and were therefore taken into account in the future year Reference Case matrices.

4.4.9 The land use and quantum of each development was used to determine the total number of trips generated by each development. These were estimated using the Trip Rate Information Computer System (TRICS) database or, where available, were taken from development specific transport assessments.

4.4.10 The TRICS database contains over 2,100 site locations, 4,700 survey counts and 98 land use sub-categories, and is widely used for trip rate estimates for future year developments. In order to obtain a reasonable representation of future development generated trips, average trip rates were used for the relevant development land uses. The distribution of trips in such cases was based on that from the base year model for nearby 'reference' zones with a similar land use.

4.4.11 Table 4.2 lists the development proposals included in the forecast traffic models, together with the assumed proportion completed in each of the modelled forecast years.

Table 4.6: Development Proposals

Development		Land Use	Size	Completion	
				2022	2037
(A) Newport					
1	East Newport, north of railway line (Llanwern)	Housing	1100 units	65%	100%
2	Former Pirelli Works	Housing	250 units	100%	100%
3	Glebelands	Housing	153 units	100%	100%
4	Former Tredegar Park Golf Course	Housing	150 units	100%	100%
5	Allt yr Yn Campus	Housing	125 units	100%	100%
6	Monmouthshire Bank Sidings	Housing	575 units	42%	100%
7	Victoria Wharf	Housing	130 units	20%	100%
8	Penmaen Wharf	Housing	160 units	100%	100%
9	Former Sainsbury's site	Housing	140 units	96%	100%
10	City Vision	Housing	464 units	52%	68%
11	Lysaght Village (Orb Works)	Housing	517 units	46%	65%
12	Former Bettws Comprehensive	Housing	229 units	55%	55%
13	Lysaght Parc	Housing	100 units	100%	100%
14	East Newport, south of railway line (Glan Llyn)	Housing	4000 units	43%	100%
15	Whiteheads Works	Housing	400 units	45%	83%
16	Old Town Dock	Housing	350 units	60%	100%
17	Jubilee Park (Alcan Works)	Housing	1,064 units	50%	87%
18	Jigsaw site, Hartridge	Housing	200 units	80%	100%
19	Opposite Belmont Lodge	Housing	122 units	100%	100%
20	Panasonic	Housing	250 units	100%	100%
21	Duffryn	Industry	154,000m² GFA	-	100%
22	East of Queensway Meadows	Industry	108,000m2 GFA	-	100%
23	Celtic Springs Business Park	Offices	16,200m2 GFA	100%	100%
24	Gwent Europark	Warehousing	80,000m2 GFA	100%	100%
25	East Newport, south of railway line (Glan Llyn)	Industry	142,000m2 GFA	-	100%
26	Phoenix Park (former Pirelli works)	Industry	8,000m2 GFA	100%	100%
27	Newport City Centre redevelopment, Friars Walk	Mixed use	30,612m2 retail 2,314m2 cinema 3,440m2 restaurants	100%	100%

(B) Monmouthshire					
28	Crick Rd, Portskewett	Housing Offices	285 units 2,700m2 GFA	100%	100%
29	Fairfield Mabey, Chepstow	Housing Offices	350 units 8,100m2 GFA	100%	100%
30	Rockfield Farm, Undy	Housing Offices	270 units 5,600m2 GFA	100%	100%
31	Vinegar Hill, Undy	Housing	225 units	100%	100%
32	Sudbrook Paper Mill	Housing	190 units	100%	100%
33	Wales One, Magor	Offices	21,739m2 GFA	-	100%
34	Quay Point, Magor	Offices Industry Warehousing	10,584m2 GFA 23,520m2 GFA 49,000m2 GFA	-	100%
35	Gwent Europark, Magor	Warehousing	66,500m2 GFA	-	100%
36	Newhouse Farm, Chepstow	Industry	16,000m2 GFA	-	100%
37	Pill Row, Severnbridge Ind Est	Industry	4,000m2 GFA	-	100%
38	Beaufort Park, Chepstow	Offices	1,134m2 GFA	-	100%
(C) Cardiff					
39	NE Cardiff (west of Pontprennau)	Housing	4,500 units	66%	100%
40	East of Pontprennau Link Road (St. Edeyrns)	Housing	1,300 units	82%	100%
41	St Mellons Business Park	Offices	124,000m2 GFA	-	100%
42	Areas 9-12, St Mellons	Housing	150 units	-	100%
43	Cardiff Gate International Business Park	Offices	13,362m2 GFA	100%	100%

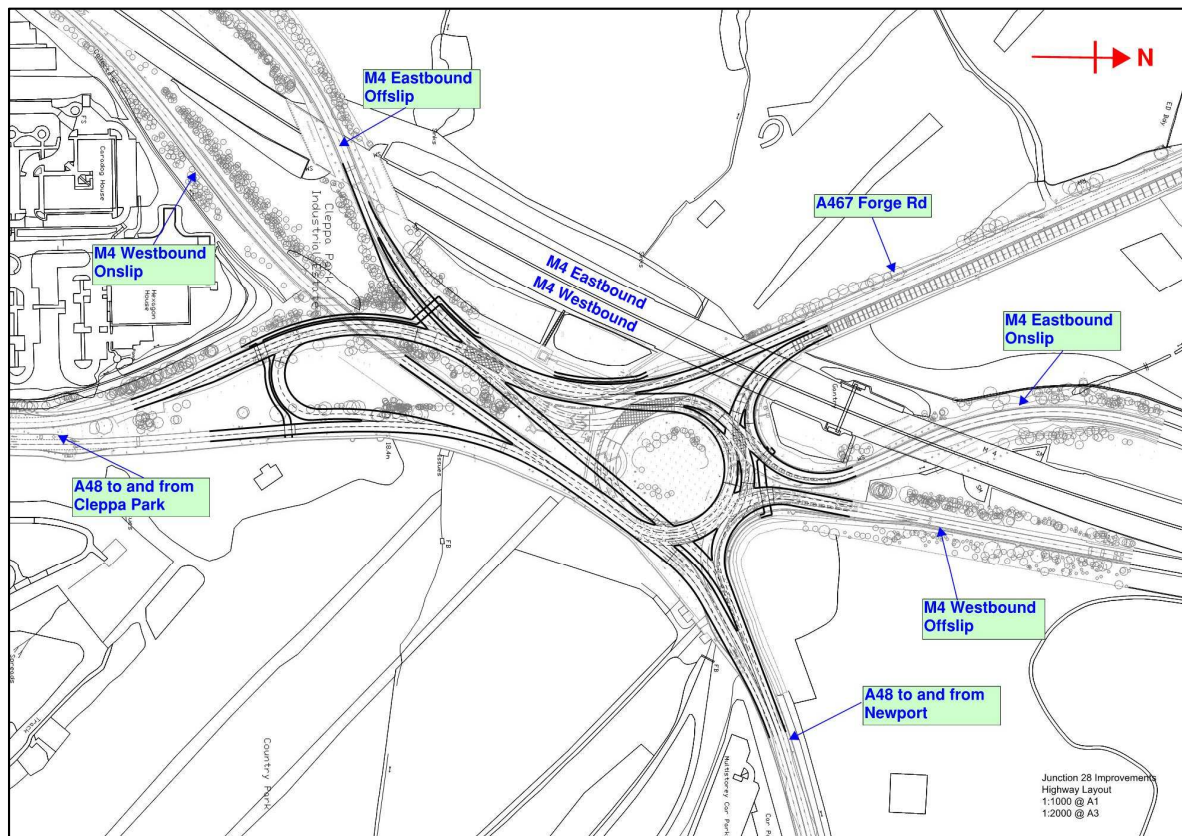
Highway Schemes

- 4.4.12** In addition to proposed developments, the treatment of uncertainty in model forecasting also needs to include any proposed highway infrastructure schemes.
- 4.4.13** The future year highway networks were developed for the years 2022, 2037 and 2051. Firmly proposed network improvements which are likely to be in place by the modelled forecast years are included in both the Do Minimum and Do Something networks.
- 4.4.14** The definition of the Do Minimum network requires the identification of any committed or probable highway schemes within the study area that should be included in the traffic model. The Welsh Government, together with Newport, Cardiff and Monmouthshire councils, were consulted to ascertain what transport schemes are likely to be implemented within the timeframes of the M4CaN traffic forecasts.
- 4.4.15** It was confirmed that there are no transport schemes that would be dependent on the proposed new section of motorway being constructed.
- 4.4.16** Following this consultation, the schemes described below were included in both the Do Minimum and Do Something network in the appropriate year.

1. Tredegar Park Roundabout (Junction 28)

4.4.17 As part of the M4 Corridor Enhancement Measures (CEM) Programme, a scheme to improve the operation of the Junction 28 roundabout at Tredegar Park is being promoted by the Welsh Government. The proposed design for this scheme is shown in Figure 4.3, and comprises an enlarged at-grade signalised gyratory, incorporating through links between the M4 (west) and the A48 Southern Distributor Road. The scheme is included in the 2022 network.

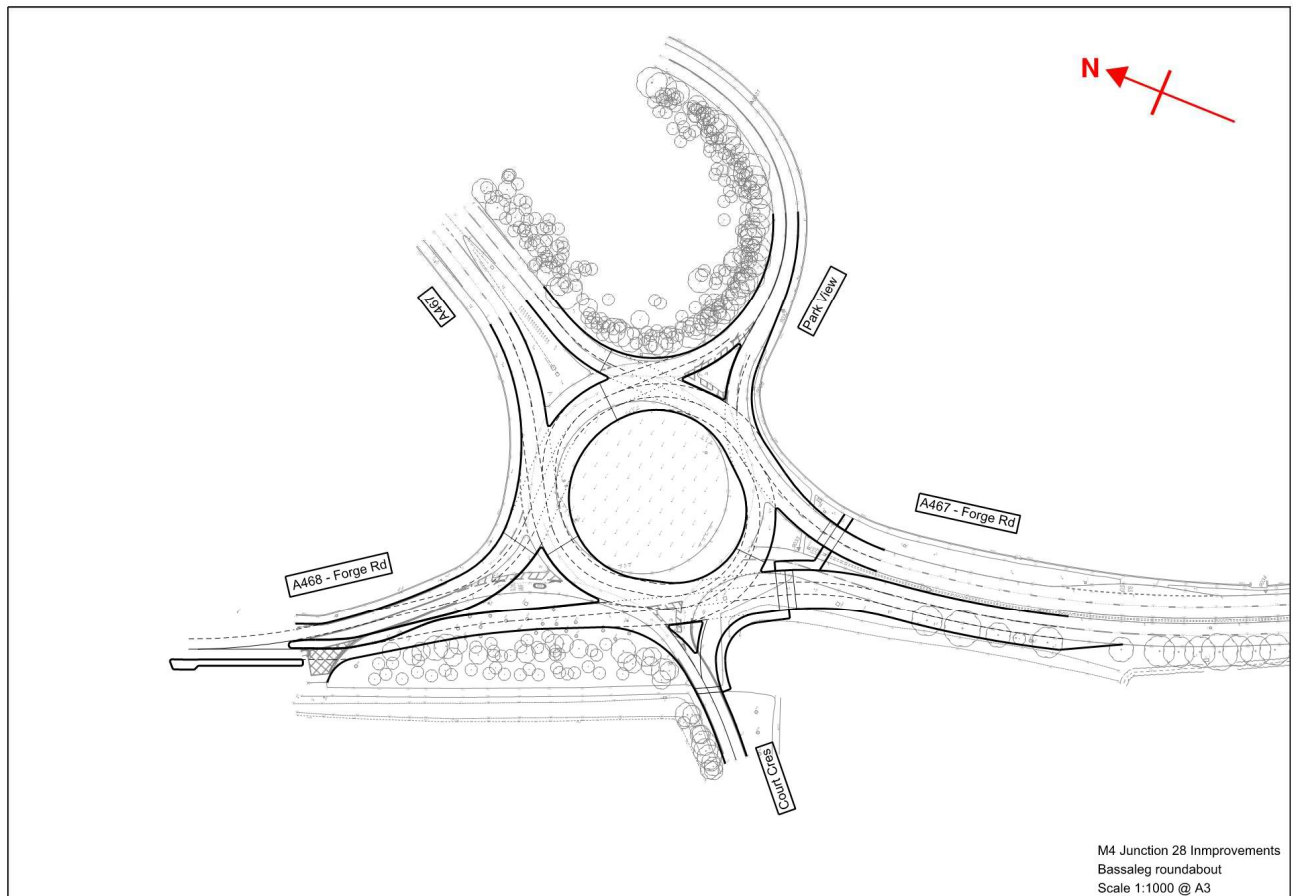
Figure 4.3 Tredegar Park Gyratory



2. A467 Bassaleg Roundabout

4.4.18 This improvement is also proposed as part of the CEM programme, and would convert the existing A467 Bassaleg roundabout into a signalised roundabout, as shown in Figure 4.4. The improvement is included in the 2022 networks.

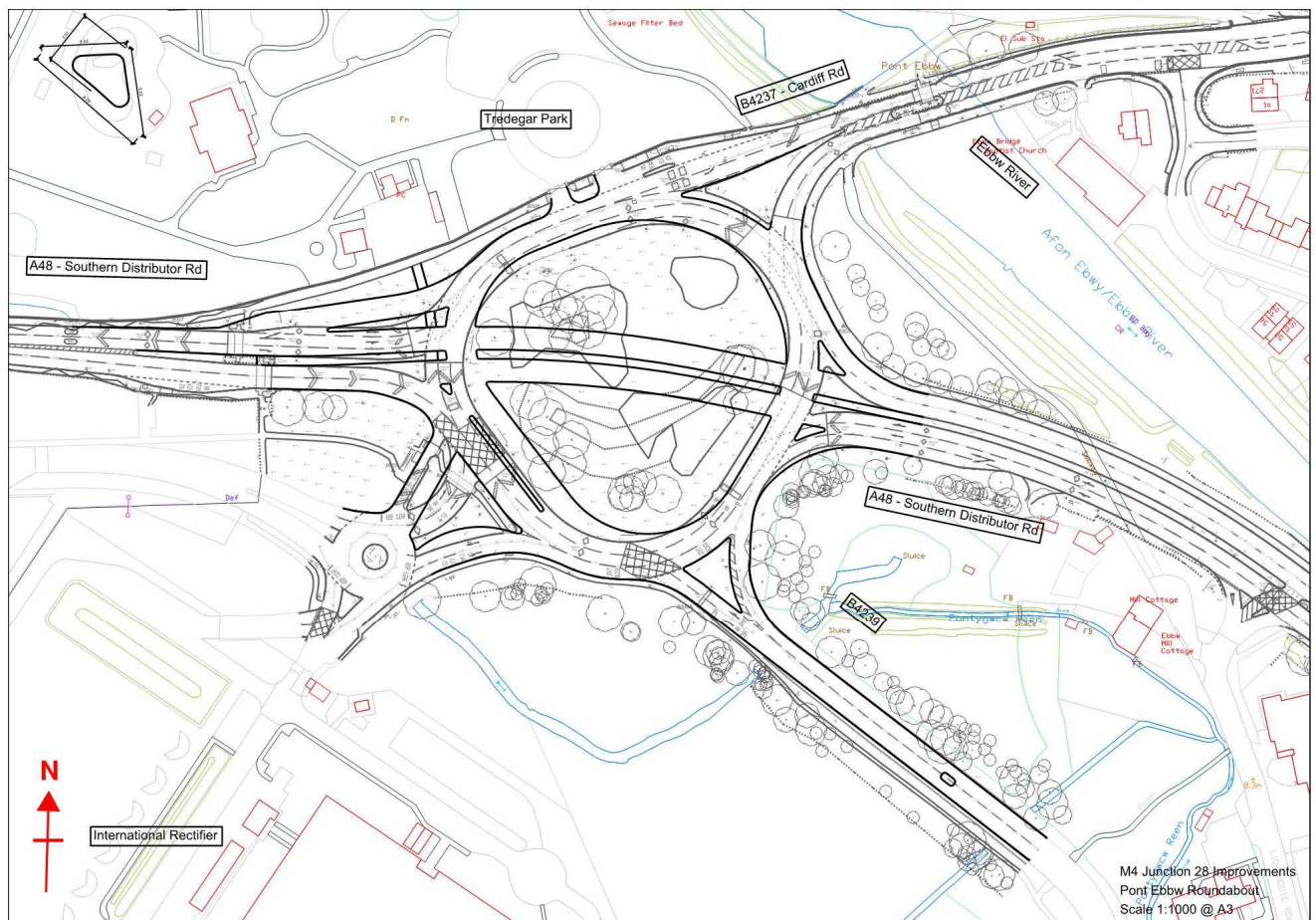
Figure 4.4 Bassaleg Roundabout Improvement



3. A48 Pont Ebbw Roundabout

- 4.4.19** This scheme would convert the existing signalised roundabout into a signalised 'throughabout', with a new link connecting the eastern and western arms of the A48 Southern Distributor Road. The design of this scheme is shown in Figure 4.5. The scheme is included in the 2022 network.

Figure 4.5 Pont Ebbw Roundabout Improvement



4. A465 Heads of the Valleys Dualling (Abergavenny to Hirwaun)

- 4.4.20** The A465 trunk road forms an alternative east-west strategic route to the M4, particularly for traffic travelling between the Midlands and West Wales. This improvement scheme upgrades the road to dual carriageway and comprises four sections:

- Section 3 (Brynmaur to Tredegar) was approved following a Public Inquiry in 2012, and was completed in 2015;
- Section 2 (Gilwern to Brynmaur) was approved following a Public Inquiry in spring 2014. Construction commenced in early 2015, and is scheduled for completion in 2018;
- Section 5 (Dowlais Top to A470) is not yet programmed, but is expected to commence in time for completion by 2022; and

- Section 6 (A470 to Hirwaun) is not yet programmed, but is expected to commence in time for completion by 2022.

5. Newport Eastern Expansion Area

4.4.21 Additional infrastructure is proposed to serve the major residential developments planned on the former steelworks site (Glan Llyn, ref 14 and 25 in Table 4.2) and the area north of the railway around the village of Llanwern (ref 1 in Table 4.2). The proposals comprise:

- A new north-south link over the mainline railway, connecting the A48 SDR and Llanwern village to the A4810; and
- Upgrading of the A48 SDR / Cot Hill junction, from the existing left-in/left-out priority arrangement to an all-movement signal-controlled junction.

4.4.22 The phasing of the development proposals has been extended, and it is now assumed that these infrastructure proposals will be in place prior to the 2037 design year.

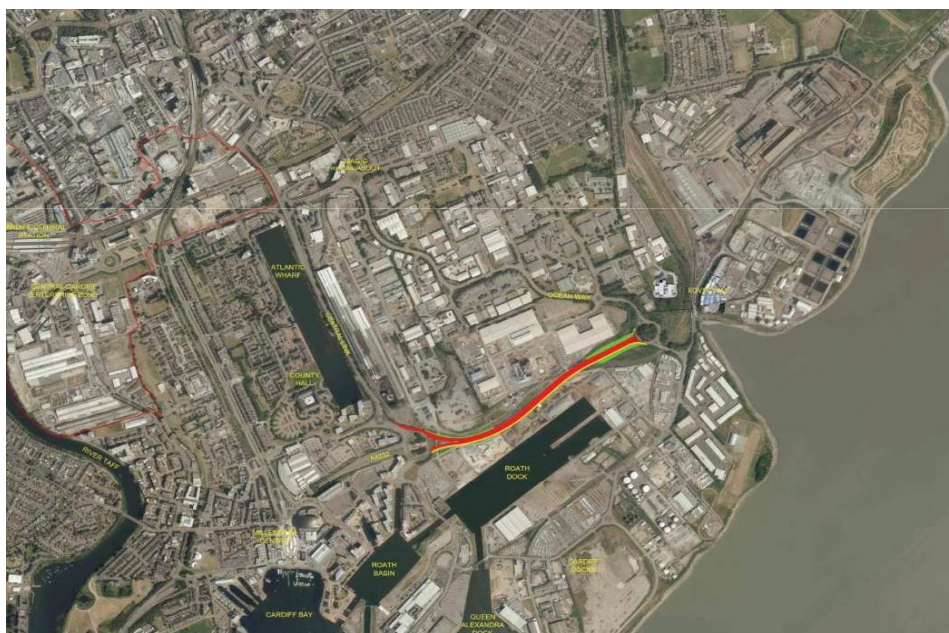
4.4.23 By the 2022 opening year, it is assumed that the only additional infrastructure will be the construction of a new junction on Cot Hill west of Llanwern village, to facilitate access for the initial development phases on the land north of the mainline railway.

6. Cardiff Eastern Bay Link, Phase 1

4.4.24 Construction of Phase 1 of the Eastern Bay link commenced in 2015. This will provide an at-grade dual two-lane all-purpose road connecting the Queensway roundabout at the southern end of Central Link with the existing roundabout at the southern end of Ocean Way, as shown in Figure 4.6.

4.4.25 There is currently no formal commitment to deliver the subsequent phase of the Eastern Bay Link scheme.

Figure 4.6 Cardiff Eastern Bay Link, Phase



5 Severn Crossing Tolls

5.1 Background



5.1.1 Tolls are currently levied on each of the Severn Crossings (the M48 Severn Bridge and the M4 Second Severn Crossing) in the westbound direction. The Severn Bridges Act 1992 set out the basis for a concession agreement for the Severn Crossings and empowered the Secretary of State to levy tolls. The Act established the conditions under which the concession will end, following which both bridges will revert to public ownership. Current expectations are that the concession agreement will come to an end either late in 2017 or early 2018. Following the end of the Concession Agreement, ownership (as well as the future maintenance burden) will transfer back to the UK Government.

5.1.2 Current tolls levels in 2016, as determined under the Severn Crossings Act, are £6.60 for Category 1 vehicles (cars and minibuses of up to nine seats), £13.20 for Category 2 vehicles (small buses up to 17 seats, goods vehicles up to 3,500kg), and £19.80 for Category 3 vehicles (buses with 18 seats or more, goods vehicles from 3,500kg).

5.2 Future Toll Levels

5.2.1 An announcement was made in the Budget 2015 that VAT would be removed from the toll prices when the bridges return to public ownership and that the toll charge for Category 2 vehicles would be reduced to the level charged for Category 1 vehicles. There was also a further announcement in the Budget 2016 that the tolls would be halved. Therefore, for the M4CaN forecasting, a half toll representing the cumulative changes announced in both Budgets is assumed in the Core Scenario. These are represented in the model in 2014 prices as shown below in Table 5.1; the 'half toll' represents a change from the 'no toll' assumption that was assumed to be the case in the core scenario in the March 2016 Traffic Forecasting Report. The updated toll assumption assumes no changes in the arrangements for toll collection as currently exists.

Table 5.1 Current and Future Toll Charges

	Category 1	Category 2	Category 3
	Car	Light Goods Vehicles	Heavy Goods Vehicles
2014 Toll Level	£6.40	£12.80	£19.20
 Budget 2015: VAT will no longer be payable on Severn Bridge tolls and light goods vehicles will pay the same as cars			
Budget 2015 Toll Level	£5.33	£5.33	£16.00
 Budget 2016: Severn Bridge toll will be halved			
Budget 2016 Toll Level	£2.67	£2.67	£8.00

5.2.2 The M4CaN model is not able on its own to fully model the full effect of the impacts arising from a toll change, as it does not include a sufficiently wide network area and travel demand detail on the English side of the crossings. However, since Draft Order publication, a detailed study investigating the demand response of traffic crossing the Severn Bridges has been undertaken for the DfT. That study was based on a more refined variable demand modelling approach which covered a wider geographic area and incorporated updated user delays assumptions representing the time lost at the toll booths. This time lost was derived from TrafficMaster observed journey time dataset. The M4CaN model takes the changes in demand resulting from changes in toll that are derived from the DfT Toll Model. Further details are provided in Chapter 9 referring to the Variable Demand Model.

6 Reference Case Demand

6.1 Introduction

6.1.1 The Core Scenario has been developed in line with the principles outlined in TAG Unit M4, and are based on:

- NTEM growth in demand, at a suitable spatial area;
- Sources of local uncertainty that are likely to occur; and
- Appropriate modelling assumptions.

6.1.2 In addition to the Core Scenarios, alternative scenarios are required to allow decision makers to see how scheme performance varies depending on the assumptions made within the assessment. High and low growth scenarios are required to test the impact of uncertainty in projections such as demographic data (population, households and employment), GDP growth and fuel price trends.

6.1.3 Optimistic and pessimistic sensitivity tests may be used to consider the impact of local uncertainty. This typically depends on whether developments or other planned transport schemes go ahead in the vicinity of the Scheme being built. A review of all planned developments and highway schemes was undertaken at the time of preparing the forecasts, as described in Section 4.4.

6.1.4 At this stage, all developments to be included in the test scenarios were identified based on their size, nature of the development, phasing, planning status and likely impact on traffic patterns within the study area. As Newport is a concentrated area, it was decided that there would be no changes to these to account for pessimistic or optimistic development scenarios for incorporation into the low and high growth scenarios. TAG Unit M4 stipulates that with developments taken into account, total growth should be constrained to the NTEM/NTM forecasts and the totals adjusted to reflect national uncertainty for the Low and High Growth scenarios. This is the approach adopted for the M4 Corridor around Newport forecasting.

6.2 Core Scenario

6.2.1 TAG Unit M4 defines a 'Core Scenario' for forecasting as '*a scenario based on the most unbiased and realistic set of assumptions that will form the central case that is presented in the Appraisal Summary Table (AST)*'.

6.2.2 The Core Scenario for the Scheme has been identified based on the above guidance and comprises:

- NTEM/NTM Growth assumptions detailed in Sections 4.2 and 4.3;
- inclusion of the proposed developments listed in Section 4.4;
- inclusion of the highway schemes listed in Section 4.4; and
- Severn Crossing Tolls half of current tolls in Section 5.2

6.3 Construction of Reference Case Matrices

- 6.3.1** The 2022 forecast trip matrices were developed from the 2014 base year 'prior' trip matrices (which form the input to the base model calibration), and these in turn formed the basis for the development of the 2037 forecast trip matrices. The reason why the Reference Case forecast matrices cannot be created using the validated base matrices is explained in section 4.1.
- 6.3.2** NTEM factors for the forecast years (excluding the adjustment for income and fuel cost growth) were extracted using TEMPRO 7 Wales for the three car trip purposes in the AM peak, inter-peak and PM peak periods. For each user class the relevant set of growth factors from NTEM, as detailed in Appendix A, was applied to the corresponding model zones in the base year 'prior' trip matrices.
- 6.3.3** The trips generated by the development proposals listed in Table 4.2 were then added to the factored matrices. TAG Unit M4 states that model forecasts should be controlled to the benchmark level of traffic growth provided by the NTEM data. In order to ensure that overall growth was constrained to the level set by the NTEM forecasts, the NTEM factored matrices were reduced by the equivalent number of development trips that were added separately.
- 6.3.4** This process ensures that the forecast trip matrices form a Reference Case for traffic growth that is consistent with NTEM growth forecasts at a district level while taking account of specific development proposals which would lead to pockets of higher growth in certain parts of the study area. A similar process is undertaken with the NTM growth applied to the LGV and HGV user class matrices.
- 6.3.5** The resulting forecast trip matrices, with the inclusion of the specific developments listed in Table 4.2, are controlled to the overall growth factors obtained from NTEM and NTM. The growth in trips by user class from 2014 to 2022 is shown in Table 6.1 growth in trips from 2022 to 2037 is shown in Table 6.2 and growth from 2037 to 2051 is shown in Table 6.3

Table 6.1: Forecast Reference Trip Matrix Totals, 2022 (Central Growth)

User Class	2014	2022				
	Base Trips	NTEM Reference Growth	Dvlpt Trips (a)	Revised NTEM Ref Growth (b)	Revised Growth with Dvlpts (a+b)	Total Growth from 2014
<u>AM (07:00-10:00)</u>						
Cars – EB	31,084	32,442	643	31,799	32,442	+4.4%
Cars – Other	287,291	301,536	6,213	295,323	301,536	+5.0%
Cars – Commuting	253,350	256,409	6,335	250,074	256,409	+1.2%
LGV	74,499	90,643	1,975	88,668	90,643	+21.7%
HGV	33,247	35,023	1,832	33,191	35,023	+5.3%
Total	679,471	716,053	16,998	699,055	716,053	+5.4%
<u>IP (10:00-16:00)</u>						
Cars – EB	76,894	80,218	1,492	78,726	80,218	+4.3%
Cars – Other	498,113	522,962	15,900	507,062	522,962	+5.0%
Cars – Commuting	123,410	125,057	3,443	121,614	125,057	+1.3%
LGV	116,766	142,015	2,497	139,518	142,015	+21.6%
HGV	59,584	62,738	3,592	59,146	62,738	+5.3%
Total	874,767	932,990	26,924	906,066	932,990	+6.7%
<u>PM (16:00-19:00)</u>						
Cars – EB	41,204	42,898	1,064	41,834	42,898	+4.1%
Cars – Other	300,480	315,764	9,533	306,231	315,764	+5.1%
Cars – Commuting	233,828	236,738	6,457	230,281	236,738	+1.2%
LGV	57,364	69,808	2,044	67,764	69,808	+21.7%
HGV	28,585	30,089	1,407	28,682	30,089	+5.3%
Total	661,461	695,297	20,505	674,792	695,297	+5.1%
<u>OP (19:00-07:00)</u>						
Cars – EB	30,981	32,449	693	31,756	32,449	+4.7%
Cars – Other	365,804	382,048	11,739	370,309	382,048	+4.4%
Cars – Commuting	151,845	153,675	5,441	148,234	153,675	+1.2%
LGV	57,719	70,129	1,797	68,332	70,129	+21.5%
HGV	23,495	24,599	3,493	21,106	24,599	+4.7%
Total	629,844	662,900	23,163	639,737	662,900	+5.2%

Table 6.2: Forecast Reference Trip Matrix Totals, 2037 (Central Growth)

User Class	2022	2037				
	Revised Growth with Dvlpts	NTEM Reference Growth	Dvlpt Trips (a)	Revised Growth from 2022 (b)	Revised Growth with Dvlpts (a+b)	Total Growth from 2022
<u>AM (07:00-10:00)</u>						
Cars – EB	32,442	35,620	810	34,810	35,620	+9.8%
Cars – Other	301,536	335,997	7,276	328,721	335,997	+11.4%
Cars – Commuting	256,409	279,850	7,873	271,977	279,850	+9.1%
LGV	90,643	119,630	2,891	116,739	119,630	+32.0%
HGV	35,023	38,656	1,606	37,050	38,656	+10.4%
Total	716,053	809,753	20,456	789,297	809,753	+13.1%
<u>IP (10:00-16:00)</u>						
Cars – EB	80,218	87,934	2,376	85,558	87,934	+9.6%
Cars – Other	522,962	583,829	19,277	564,552	583,829	+11.6%
Cars – Commuting	125,057	136,723	4,330	132,393	136,723	+9.3%
LGV	142,015	187,431	4,585	182,846	187,431	+32.0%
HGV	62,738	69,146	3,409	65,737	69,146	+10.2%
Total	932,990	1,065,063	33,977	1,031,086	1,065,063	+14.2%
<u>PM (16:00-19:00)</u>						
Cars – EB	42,898	47,001	971	46,030	47,001	+9.6%
Cars – Other	315,764	351,745	8,728	343,017	351,745	+11.4%
Cars – Commuting	236,738	258,485	7,398	251,087	258,485	+9.2%
LGV	69,808	91,960	2,662	89,298	91,960	+31.7%
HGV	30,089	33,143	1,236	31,907	33,143	+10.1%
Total	695,297	782,334	20,995	761,339	782,334	+12.5%
<u>OP (19:00-07:00)</u>						
Cars – EB	32,449	35,414	466	34,948	35,414	+9.1%
Cars – Other	382,048	424,379	6,925	417,454	424,379	+11.1%
Cars – Commuting	153,675	167,203	3,803	163,400	167,203	+8.8%
LGV	70,129	92,582	1,487	91,095	92,582	+32.0%
HGV	24,599	27,089	2,811	24,278	27,089	+10.1%
Total	662,900	746,667	15,492	731,175	746,667	+12.6%

Table 6.3: Forecast Reference Trip Matrix Totals, 2051 (Central Growth)

User Class	2037	2051				
	Ref Case	NTEM Reference Growth	Dvlpt Trips (a)	Revised NTEM Ref. Growth (b)	Revised Growth with Dvlpts (a+b)	Total Growth from 2037
<u>AM (07:00-10:00)</u>						
Cars – EB	35,620	38,835	810	38,025	38,835	+9.0%
Cars – Other	335,997	360,785	7,276	353,509	360,785	+7.4%
Cars – Commuting	279,850	302,875	7,873	295,002	302,875	+8.2%
LGV	119,630	124,998	2,891	122,107	124,998	+4.5%
HGV	38,656	39,455	1,606	37,849	39,455	+2.1%
Total	809,753	866,948	20,456	846,492	866,948	+7.1%
<u>IP (10:00-16:00)</u>						
Cars – EB	87,934	95,666	2,376	93,290	95,666	+8.8%
Cars – Other	583,829	627,677	19,277	608,400	627,677	+7.5%
Cars – Commuting	136,723	148,045	4,330	143,715	148,045	+8.3%
LGV	187,431	195,823	4,585	191,238	195,823	+4.5%
HGV	69,146	70,585	3,409	67,176	70,585	+2.1%
Total	1,065,063	1,137,796	33,977	1,103,819	1,137,796	+6.8%
<u>PM (16:00-19:00)</u>						
Cars – EB	47,001	51,108	971	50,137	51,108	+8.7%
Cars – Other	351,745	377,606	8,728	368,878	377,606	+7.4%
Cars – Commuting	258,485	279,802	7,398	272,404	279,802	+8.2%
LGV	91,960	96,097	2,662	93,435	96,097	+4.5%
HGV	33,143	33,833	1,236	32,597	33,833	+2.1%
Total	782,334	838,446	20,995	817,451	838,446	+7.2%
<u>OP (19:00-07:00)</u>						
Cars – EB	35,414	38,569	466	38,103	38,569	+8.9%
Cars – Other	424,379	454,712	6,925	447,787	454,712	+7.1%
Cars – Commuting	167,203	180,670	3,803	176,867	180,670	+8.1%
LGV	92,582	96,738	1,487	95,251	96,738	+4.5%
HGV	27,089	27,653	2,811	24,842	27,653	+2.1%
Total	746,667	798,342	15,492	782,850	798,342	+6.9%

7 Future Year Highway Networks

7.1 Do Minimum Scenario

- 7.1.1** A review of proposed highway schemes within the study area has been undertaken. From this, a list of highway improvements for inclusion in the M4CaN traffic model was identified, as detailed in Section 4.4 of this report. All of these schemes are coded into the forecast Do Minimum Scenario networks.

7.2 Do Something Scenario

- 7.2.1** In order to define the Do Something network, the Scheme was added to the Do Minimum network described in Section 6.1. The Scheme provides a new section of dual 3-lane motorway between Junction 23 (Magor) and Junction 29 (Castleton). The Scheme is some 24km in length, and is shown in Figure 7.1.
- 7.2.2** In addition to the junctions at Castleton and Magor, two new junctions are provided along the route of the proposed new section of motorway (at Newport Docks and at Glan Llyn).
- 7.2.3** The proposed new section of motorway has been designed with a 120 kilometres per hour design speed and a mandatory 70 mph enforced speed limit for all of its length. The speed limits at either end of the new section of motorway are generally 70 mph, with the exception of the toll booth area associated with the Second Severn Crossing.
- 7.2.4** The existing Castleton junction on the M4 (J29) would be modified to incorporate the new section of motorway. The junction has been designed to provide a free flowing interchange giving priority to the M4 motorway (including the new section of motorway) with three lanes in both directions. The layout would also provide access to and from the A48 (M) and the existing M4 motorway to the east, which would be reclassified following completion of the new section of motorway.
- 7.2.5** The alignment would follow the centreline of the existing M4 before curving away from the existing motorway corridor to the south east. To the east of the River Ebbw, the alignment would continue to the north east towards Newport Docks. A new junction would be provided in this location.
- 7.2.6** The Docks Way Junction has been designed to provide a grade-separated roundabout with four slip roads and a gyratory, which would be positioned beneath the new section of motorway. This junction would provide a connection from the new section of motorway onto the A48 Southern Distributor Road (SDR) and to the centre of Newport. This would be provided through a secondary roundabout to the north of the new section of motorway, which would connect to the gyratory via a short dual carriageway connector road (Docks Way Link Road).

- 7.2.7** The River Usk Crossing would cross the Newport Docks between the South Dock and North Dock, before straightening out over the main bridge crossing of the River Usk.
- 7.2.8** A new junction would be provided at Glan Llyn, in the form of a grade separated roundabout. This would provide a connection from the new section of motorway, via a link road, to the A4810. The new link road would connect with the existing SAR roundabout via a remodelled southern arm.
- 7.2.9** The alignment would then run in a north easterly direction towards Magor. In the vicinity of St Bride's Road to the north west of Magor, the new section of motorway would utilise the existing M4, but there would be no connection with the existing Junction 23A.
- 7.2.10** Junction 23 to the east of Magor and Undy would become an all-movement signalised roundabout. The M48 from Chepstow would connect into the roundabout directly, with slip road connections to the Scheme in both directions, and a link to the B4245. A new D2AP trunk road would link the Junction 23 roundabout to the existing M4 at Junction 23A, running alongside the proposed new section of motorway.
- 7.2.11** There would be a grade-separated westbound link from the Second Severn Crossing onto the J23 to J23A trunk road link to the existing M4, while in the eastbound direction traffic would travel through Junction 23 via a 'throughabout' link.

Reclassified M4

- 7.2.12** Reclassification works on the existing M4 would consist of the reconfiguration of Junction 25 for Caerleon and associated works, to reopen access to the existing M4 on the west side of the junction. This would require the closure of the existing slip roads at Junction 25A, so that traffic travelling between the A4042 Malpas Bypass and the existing M4 (east) would travel through the Junction 25 roundabout.
- 7.2.13** Works on the existing M4 as part of its reclassification to a trunk road would comprise installation of traffic control measures, such as changes to signage, lighting and road markings. Revised layout arrangements would include:
1. A48(M), Junction 29A to Junction 29 – D2AP Trunk Road;
 2. Junction 29 to Junction 26 – Dual 3-lane All-Purpose (D3AP) Trunk Road but with a lane drop/lane gain between the slips at Junction 28 where it becomes D2AP;
 3. Junction 26 to Junction 25 – D2AP (maximum speed limit 60mph);
 4. Removal of Junction 25A slips, replaced by new west-facing slips from Junction 25 roundabout, with signalisation of roundabout;
 5. Junction 25 to Junction 24 – All-Purpose Trunk Road, 3-lanes eastbound and 2-lanes westbound; and
 6. Junction 24 to Junction 23A – D2AP Trunk Road.

7.2.14 There would be amendments to the merge and diverge layouts at all of the junctions.

7.2.15 The existing Variable Speed Limit would continue to operate along the existing M4 between Junction 24 (Coldra) and Junction 28 (Tredegar Park), but with a maximum speed limit of 60 miles per hour imposed at the Brynglas Tunnels, as identified at (3) above.

7.3 Forecast Network Checks

7.3.1 Checks of the future year networks were undertaken to ensure that all future year schemes are accurately represented. The future year schemes were coded using GIS. Link distances were derived directly from this software, and visual checks were also made.

7.3.2 Traffic signal information was not available for all of the schemes. In these cases, the initial assignments were checked, and signal timings manually adjusted to ensure the most efficient operation practicable at the junction. It should be noted that SATURN has not been used to optimise signal timings, as it is known that doing so can lead to questionable results within the SATURN assignment process.

7.3.3 In addition to the above, time and distance skim matrices were examined and any large differences between the 2014 base, Do Minimum and Do Something costs were checked to ensure that these are realistic given the network changes taking place in each scenario.

8 Public Transport Model

8.1 Overview

8.1.1 The public transport model has been designed specifically to provide public transport inputs to the M4CaN VDM. It is not designed to forecast public transport impacts, passenger volumes or benefits of other highway or public transport projects. The model provides the public transport demands and times/costs required to enable mode choice modelling within the VDM as a consequence of the Scheme.

8.1.2 Forecast public transport trip demand matrices were derived starting with a set of base matrices developed specifically for this study using bus and rail passenger counts, surveys and existing models, as reported in the Local Model Validation Report.

8.2 Forecast Year Timetables and Fares

8.2.1 The future year public transport timetables were modified to reflect the increased service frequencies and improved journey times that could be achieved with electrification of the Great Western Main Line and electrification of the Valley Lines (heavy rail), together with recently opened stations on the valley lines.

8.2.2 Transport for Wales (on behalf of Welsh Government) and the Wales and Borders rail franchise bidders are currently undertaking further development on the possible services and modes that will form part of the South Wales Metro. It is noted that these Metro proposals for Valley Lines Modernisation 'Metro Phase 2' to be delivered by 2023 may lead to changes in public transport provision which supersede the former Valley Lines electrification scheme currently assumed in the M4CaN model. However, the details of these proposals is not yet known and the inclusion of the improved rail services on the Valley Lines in the model (in terms of journey time and service pattern improvements) means that account has been taken of those aspects of Metro which are most relevant in consideration of the M4 proposals.

8.2.3 There are other potential future elements of the Metro proposals 'Metro Phase 3' to be delivered beyond 2023 which may include bus rapid transit services, bus lanes and extensions/additions to the rail-based public transport network, but due to the lack of certainty or opening date of these schemes, they have not been included in the M4CaN model. Fig 8.1 shows the modified rail network for the South Wales area in the forecast years which includes new stations at Energlyn, Pye Corner and Ebbw Vale Town (already delivered as part of 'Metro Phase 1')

8.2.4 Forecast bus service timetables and timetabled bus stop locations were assumed to remain the same as in the base year scenario. This is based on the assumption that if traffic volumes grow sufficiently to slow buses down, then bus priority schemes would be likely to be put in place. Technological changes, such as smart ticketing, are also likely to reduce future bus dwell times and hence offset a likely increase in delay due to congestion increases.

8.2.5 Public transport fares were assumed to rise in line with the retail price index over the forecast period and as such were treated as being constant in real terms.

8.3 Demand Growth

8.3.1 The predicted growth in 24-hour bus and rail trip productions and attractions was controlled to the growth forecast by the National Trip End Model for the spatial areas listed in Appendix A. This data was extracted using TEMPRO7 Wales.

8.3.2 NTEM forecasts were produced separately for the following public transport users:

- Home-based work (HBW);
- Home-based other (HBO);
- Non-home-based other (NHBO);
- Home-based employers' business (HBEB); and
- Non-home-based employers' business (NHBEB).

8.3.3 Total rail and bus person trips contained within the demand matrices in the base and forecast years are shown in Tables 8.1 and 8.2 respectively.

Table 8.1: Forecast Rail Person Trips (Central Growth)

User Class	2014	2022		2037		2051	
	Base Trips	Ref. Case Trips	Total Growth from 2014	Ref. Case Trips	Total Growth from 2022	Ref. Case Trips	Total Growth from 2037
<u>AM (07:00-10:00)</u>							
HBW	3,063	3,025	-1.3%	3,158	+4.4%	3,239	+2.6%
HBEB	1,177	1,173	-0.4%	1,236	+5.3%	1,255	+1.6%
HBO	1,146	1,165	+1.6%	1,206	+3.5%	1,238	+2.7%
NHBEB	203	205	+0.9%	211	+3.0%	217	+2.6%
NHBO	275	277	+0.9%	283	+2.2%	286	+1.0%
Total	5,864	5,844	-0.3%	6,093	+4.3%	6,235	+2.3%
<u>IP (10:00-16:00)</u>							
HBW	1,283	1,275	-0.7%	1,338	+5.0%	1,376	+2.9%
HBEB	1,425	1,419	-0.5%	1,491	+5.1%	1,514	+1.5%
HBO	4,724	4,817	+2.0%	5,003	+3.9%	5,148	+2.9%
NHBEB	935	946	+1.2%	976	+3.2%	1,001	+2.6%
NHBO	788	797	+1.1%	816	+2.5%	826	+1.2%
Total	9,155	9,252	+1.1%	9,624	+4.0%	9,865	+2.5%
<u>PM (16:00-19:00)</u>							
HBW	2,926	2,886	-1.4%	3,001	+4.0%	3,074	+2.4%
HBEB	1,461	1,457	-0.3%	1,536	+5.4%	1,560	+1.6%
HBO	2,332	2,371	+1.7%	2,453	+3.5%	2,519	+2.7%
NHBEB	247	249	+1.0%	257	+3.1%	264	+2.6%
NHBO	337	340	+0.9%	347	+2.2%	351	+1.0%
Total	7,303	7,302	-0.0%	7,595	+4.0%	7,767	+2.3%
<u>OP (19:00-07:00)</u>							
HBW	967	963	-0.4%	1,014	+5.3%	1,045	+3.0%
HBEB	905	903	-0.2%	954	+5.7%	970	+1.7%

User Class	2014	2022		2037		2051	
	Base Trips	Ref. Case Trips	Total Growth from 2014	Ref. Case Trips	Total Growth from 2022	Ref. Case Trips	Total Growth from 2037
HBO	2,648	2,708	+2.3%	2,822	+4.2%	2,909	+3.1%
NHBEB	617	625	+1.3%	646	+3.3%	663	+2.6%
NHBO	476	483	+1.3%	496	+2.8%	503	+1.4%
Total	5,614	5,682	+1.2%	5,932	+4.4%	6,090	+2.6%

Table 8.2: Forecast Bus Person Trips (Central Growth)

User Class	2014	2022		2037		2051	
	Base Trips	Ref. Case Trips	Total Growth from 2014	Ref. Case Trips	Total Growth from 2022	Ref. Case Trips	Total Growth from 2037
<u>AM (07:00-10:00)</u>							
HBW	519	484	-6.8%	464	-4.1%	425	-8.4%
HBEB	20	20	-1.3%	20	+0.5%	19	-3.6%
HBO	338	319	-5.6%	299	-6.4%	266	-11.0%
NHBEB	0	0	---	0	---	0	---
NHBO	50	49	-2.1%	48	-2.9%	46	-4.9%
Total	928	872	-6.0%	830	-4.8%	756	-9.0%
<u>IP (10:00-16:00)</u>							
HBW	313	293	-6.4%	284	-3.3%	262	-7.7%
HBEB	24	24	-1.2%	24	+1.0%	23	-3.7%
HBO	1,109	1,050	-5.3%	989	-5.9%	884	-10.6%
NHBEB	0	0	---	0	---	0	---
NHBO	177	173	-2.1%	168	-2.8%	160	-4.9%
Total	1,623	1,540	-5.1%	1,464	-4.9%	1,328	-9.3%
<u>PM (16:00-19:00)</u>							
HBW	547	513	-6.3%	496	-3.1%	461	-7.2%
HBEB	21	21	-0.8%	21	+1.3%	21	-3.1%
HBO	356	337	-5.2%	318	-5.7%	286	-10.2%
NHBEB	0	0	---	0	---	0	---
NHBO	53	52	-2.1%	50	-2.8%	48	-4.8%
Total	977	923	-5.6%	886	-4.0%	815	-8.0%
<u>OP (19:00-07:00)</u>							
HBW	83	77	-6.3%	75	-3.1%	69	-7.4%
HBEB	6	6	+0.0%	6	+0.0%	6	+0.0%
HBO	292	277	-5.1%	262	-5.6%	235	-10.2%
NHBEB	0	0	---	0	---	0	---
NHBO	47	46	-2.1%	44	-3.2%	42	-4.9%
Total	427	406	-4.9%	387	-4.8%	353	-8.9%

The map illustrates the proposed rail network for the South Wales Metro project. It shows existing rail lines (solid grey) and new rail services (dashed grey). A legend in the bottom right corner identifies the symbols: a solid line with a circle for 'Rail Station / Interchange', a dashed line with a circle for 'New Rail Station / Interchange', and a green line for 'New Public Transport Route'. The map includes numerous stations such as Cardiff Central, Cardiff Queen St, Cardiff Bay, Newport, Swansea, Aberystwyth, and many others. A green line segment is highlighted near Ebbw Vale Town, indicating a new public transport route.

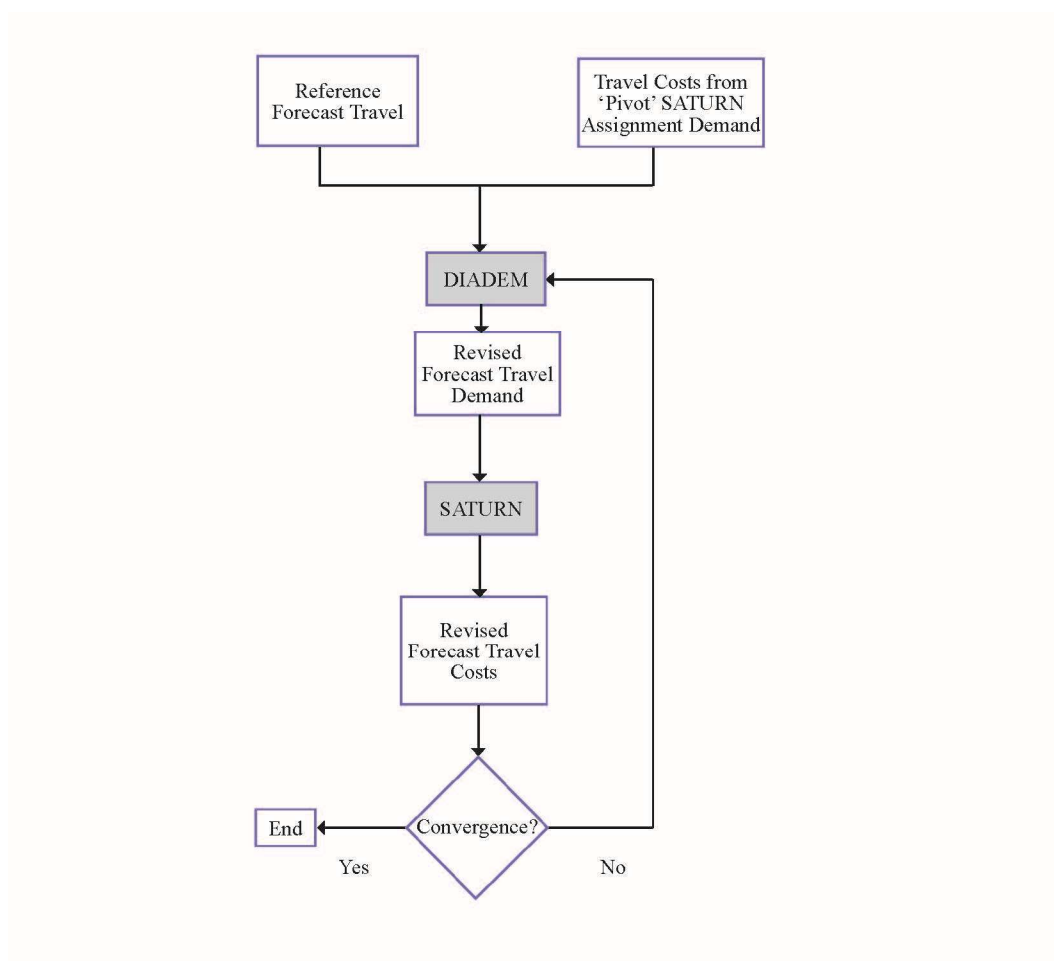
9 Variable Demand Model

9.1 VDM Methodology

The VDM Process

- 9.1.1** An overview and background to the variable demand model process is given in Section 3.4 of this report.
- 9.1.2** The DfT have a long-established preference for the use of incremental rather than absolute models, as outlined in TAG Unit M2 and so the M4 Corridor around Newport uses an incremental model form.
- 9.1.3** The VDM was undertaken using the DfT's DIADEM software (version 5.0.9, 64-bit), which makes use of the SATURN highway assignment model. The acronym DIADEM stands for Dynamic Integrated Assignment and Demand Modelling. Figure 9.1 illustrates the high level variable demand modelling process in forecasting mode.

Figure 9.1: The Variable Demand Modelling Process



9.1.4 The variable demand modelling process for the M4CaN traffic model uses trip demand matrices in production/attraction (P/A) format rather than origin-destination (O-D) format as required in the traffic assignments. This is to retain the linkage between outbound and return journeys for home-based trips. Using this format, demand response calculations take into account both legs of a home-based journey as part of the calculation of an overall resulting demand response.

9.1.5 The use of P/A matrices introduces additional complexities in the variable demand model runs, as the correlation between the prior matrix in 24 hour P/A format and the validated base matrices in peak hour O-D format are lost during the application of the matrix estimation technique. This is because matrix estimation is carried out at individual peak hour level and does not retain information about the home-end of home-based trips. For that reason it was necessary to run the variable demand model for the forecast Do Minimums by pivoting off an equilibrium assignment that used the base year prior matrices instead of the validated base matrices. The output from these DIADDEM runs are used to calculate incremental changes between the base year and the forecast year, which are then applied to the validated base year 'assignment' matrices. This approach is shown in Figure 9.2. The methodology is consistent with Appendix B of TAG unit M2.

9.1.6 Chapter 6 provides a description of the derivation of the Reference Case forecast matrices, which are input to the demand model in the creation of future year Do Minimum scenarios. The Reference Case forecast matrices are also created using the base year 'prior' matrices rather than the validated base matrices for consistency with the overall approach mentioned above. These matrices reflect the changes in demand from the base year attributable to demographic changes such as the number of jobs in an area, the number of residents in an area and the number of cars they own. They represent the travel demand that would arise if there were no changes in travel costs from the base year model.

9.1.7 The demand model then creates forecast assignments using the Reference Case matrices to extract travel costs which are pivoted off the base year assignment. Using this methodology the Do Minimum forecast matrices are created accounting for:

- Transport interventions between the base year and the forecast year;
- Increases in the value of time resulting from real increases in income;
- Increases in levels of congestion arising from increased car usage; and
- Increases in fuel efficiency that make car travel cheaper.

9.1.8 The Do Something scenario is then generated by using travel costs from the converged Do Minimum Scenario as the pivot point.

The variable demand model approach for the creation of Do Something scenarios is shown in Figure 9.3. The current tolls across the two Severn River Crossings were included in the forecast year scenarios. The toll charges in the forecast networks were retained at the same values, in real terms, as in the base model. The underlying assumption for this is that the tolls would increase in line with inflation in future years and are kept constant in terms of 2014 prices which maintains consistency with the other route choice generalised costs, PPM and PPK, as detailed in Section 3.9. The VDM therefore accounted for all changes in travel demand except those arising from a change in toll.

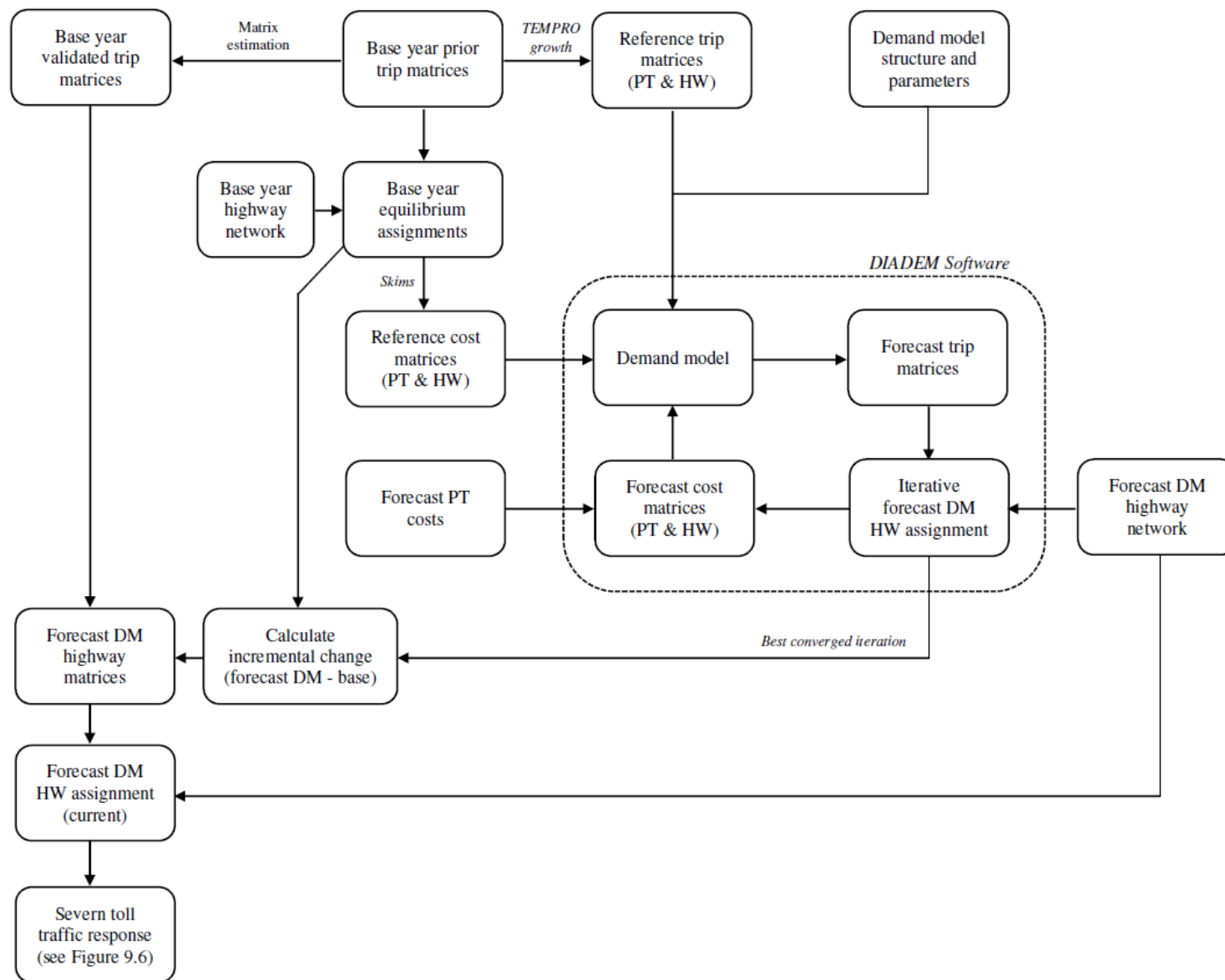
Figure 9.2: The Structure of the M4CaN Do Minimum Forecast Model run

Figure 9.3: The Structure of the M4CaN Do Something Forecast Model run

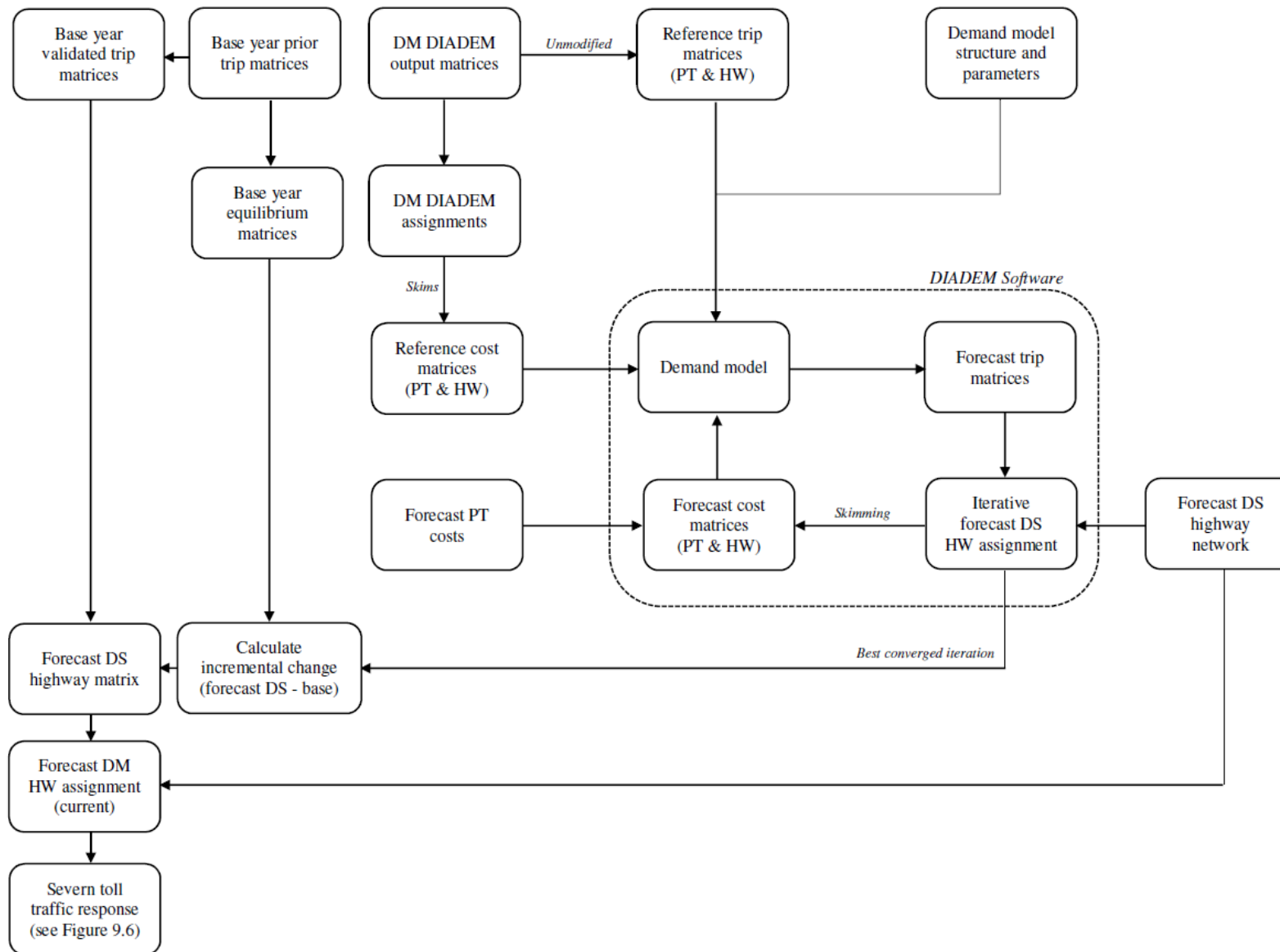


Figure 9.4: The Structure of the Severn Toll Forecast Model run (with current toll on Severn Crossings)

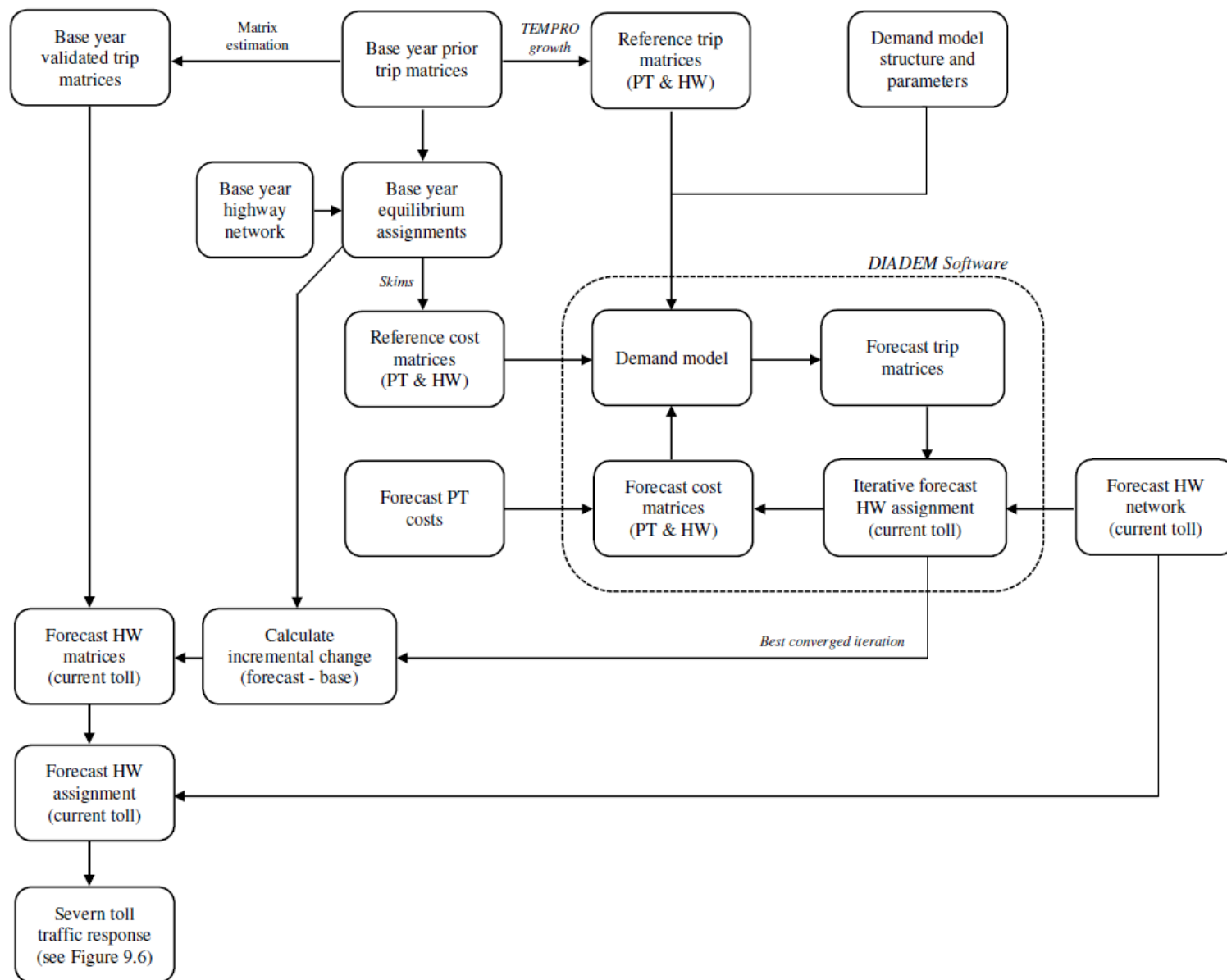


Figure 9.5: The Structure of the Severn Toll Forecast Model run (with half toll on Severn Crossings)

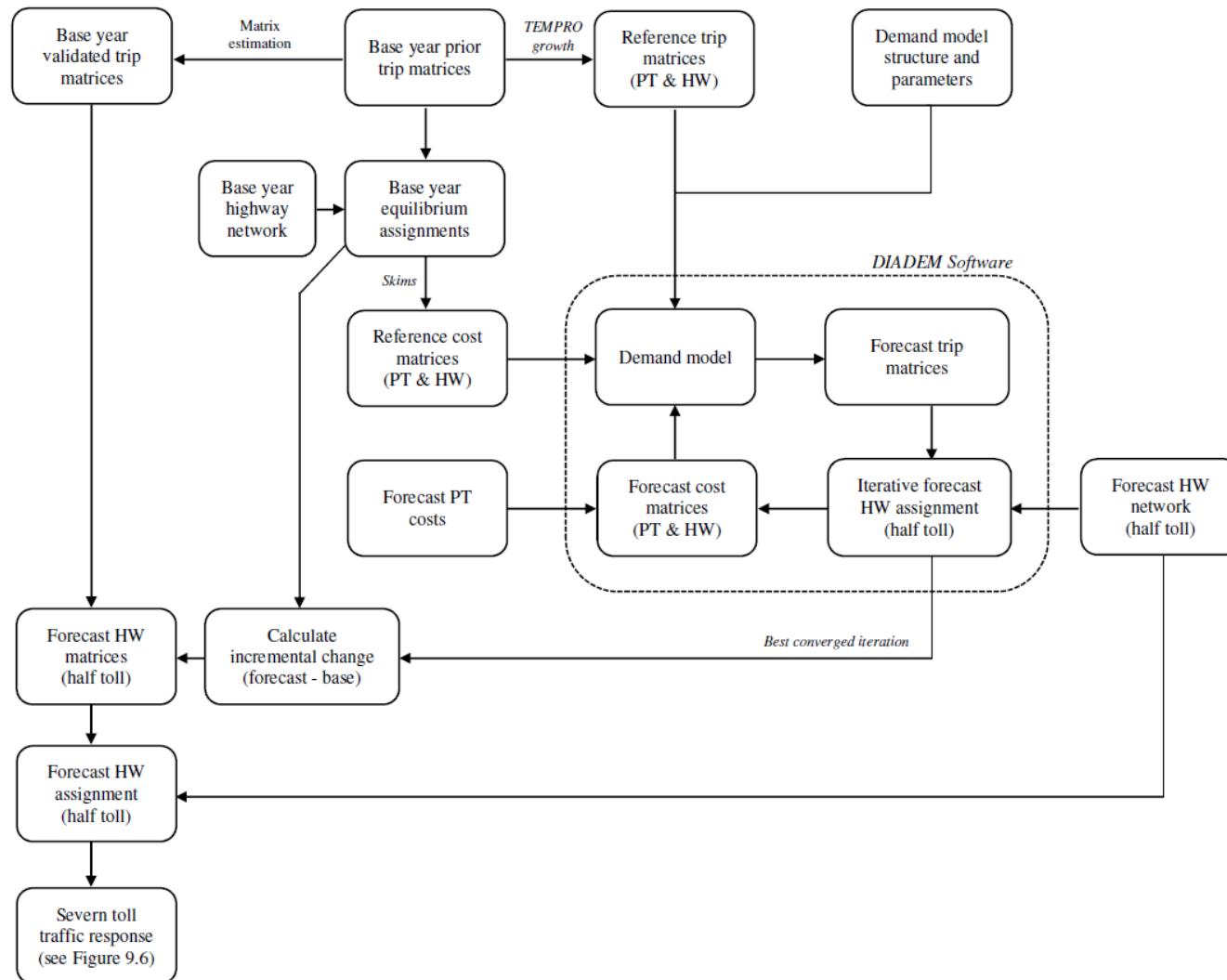
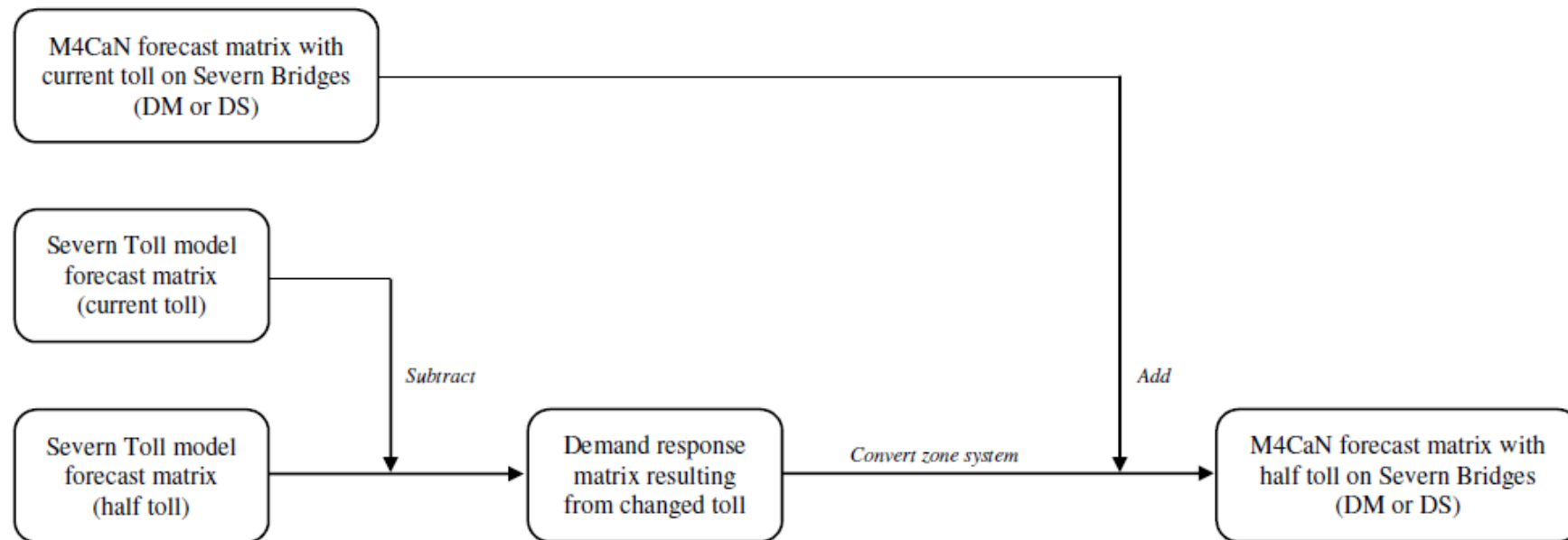


Figure 9.6: The Model Structure to Apply the Traffic Response to Changes in Severn Tolls to the M4CaN Model

- 9.1.9** The responses in the variable demand model are such that, if the generalised cost for a trip is greater than the cost in the reference case assignment, then there would be some degree of trip suppression. Similarly, a decrease in travel cost would lead to trip induction (an increase in trip numbers). The extent of trip suppression or induction is governed by the spread parameter λ and the scaling parameter θ , for which, in the absence of local data, illustrative values are provided in TAG Unit M2.
- 9.1.10** Prior to traffic forecasting using VDM, realism testing on the base year traffic model was undertaken to ensure that the M4CaN transport model responds to changes in travel costs in a realistic way. Further details of the calibration of the VDM and base year realism tests carried out to demonstrate realistic model responses are given in the Local Model Validation Report (LMVR).
- 9.1.11** In developing the variable demand model parameters to be used in forecasting, the initial values were based on the median illustrative values of λ by journey purpose quoted in WebTAG. A systematic approach was then followed to calibrate the parameters. This process also involved the incorporation of cost damping parameters to weaken the response of long distance journeys, as advised in WebTAG guidance.
- 9.1.12** In order to reflect the traffic response that would arise from changes in toll charges on the Severn Crossings, a separate Variable Demand model was set up as shown in Figures 9.4 and 9.5 above. This was based on the DfT Severn Toll model which had a similar structure to that of the M4CaN model. Separate demand responses to the changes in toll charges were derived for scenarios without and with the Scheme in place and applied to the Do-Minimum and Do-Something scenarios within the M4CaN traffic model respectively.
- 9.1.13** An automated process was developed to adopt the changes in demand contained within the DfT Severn Toll model into the M4CaN traffic model demand matrix. The first step was to develop a zone correlation between the two models because the Severn Toll model uses a different zone system to the M4CaN traffic model. Where M4CaN zones had originally been disaggregated to create the Severn Toll model zone system, a simple approach of aggregating zones was undertaken to reverse the process. Where M4CaN zones had originally been aggregated, the data contained within the M4CaN demand matrix was used to determine proportional splits to convert changes from the Severn Toll demand matrix back into the M4CaN zone system. This process is shown in Fig 9.6.
- 9.1.14** In practice, the full effect of changes in toll levels on traffic demand will take a number of years to play out. Changes in traffic demand are the result of a complex set of behavioural changes. Some behavioural changes, mode choice for example, may occur in the immediate aftermath of a change in toll levels. Other behavioural changes, for example by choosing to work in a different location or by moving house, are much longer term processes. In accordance with WebTAG (TAG Unit M2), the transport model is calibrated such that the response to changes in travel costs is in line with empirical evidence. For this purpose, an elasticity of demand for car travel (measured as vehicle kilometres travelled) with respect to changes in fuel cost of -0.3 is applied. This is characterised as a long term elasticity. Therefore, in effect (without adjustment) the transport model assumes that all behavioural changes occur simultaneously. This is a simplifying assumption not limited to tolls.

- 9.1.15** However, in the case of the Severn Tolls, the issue of the timing of demand responses is amplified by the fact that halving or removing the tolls results in a large change in generalised travel costs (as compared to highway improvement schemes). Therefore, there is good reason to believe that the traffic response to this change depends, to a greater degree than is usually the case, on long term behavioural responses such as those involving labour market or land use changes.
- 9.1.16** WebTAG (TAG Unit M2) characterises the fuel cost elasticity of -0.3 as broadly reflective of a 10 year demand response. At five years, an elasticity of -0.2 is suggested in WebTAG. By inference, two-thirds of the long term demand response is realised in the first five years after the change in travel costs. Whilst there is considerable uncertainty over the timing of the proposed changes to the Severn Tolls, any change will not come into force until the end of the current concession arrangements in late-2017 or early-2018. By the Scheme opening year of 2022, the change in toll levels will only have been in place for a maximum of 4 or 5 years. In view of this, it is considered appropriate to apply a 'ramp-up' factor to the predicted traffic response to changes in the Severn Tolls in this year. Reflecting the evidence set out in WebTAG, a ramp up factor of 0.67 has been applied (such that the actual response is two thirds of the modelled response). By the design year of 2037, the change in toll prices is likely to have been in place for many years. Therefore, no such ramp up factor has been applied to the design year.

Elastic / Fixed Demand Segments

- 9.1.17** Variable Demand Modelling is only carried out for certain private trips, both by car and by public transport, but not for freight trips, as it is assumed that the total freight traffic is fixed, but susceptible to re-routeing. This follows WebTAG guidance.
- 9.1.18** For private trips, the variable demand parameters (the spread parameter λ and scaling parameter θ) can vary significantly between different trip purposes. This reflects the likelihood that the number, mode and distribution of more essential trips, such as employers' business trips, are less affected by congestion than discretionary travel, such as leisure trips.
- 9.1.19** Some private trips are also treated as fixed. This is the case for long distance external-external movements without one or both trip ends in the South East Wales area and for trips that are classed as 'no car available', which are therefore captive to public transport.

9.2 VDM Convergence

- 9.2.1** DIADEM software undertakes the variable demand modelling process in response to changing travel times or costs. The process is iterative and modifies the model demand matrices between SATURN assignments until a balance is achieved between demand and the capacity of the road network. The success in achieving this balance or equilibrium is defined using convergence criteria such as the demand/supply gap, commonly termed '%Gap'.
- 9.2.2** The objective of this process is to achieve well converged models with realistic demand responses, thereby improving the accuracy of the Scheme benefit calculations. TAG Unit M2 recommends, where possible, to aim to achieve a

demand/supply gap of less than 0.1%. If that cannot be reached then a demand/supply gap of no greater than 0.2% is recommended.

- 9.2.3** The results achieved from the convergence of the variable demand model for the Core Scenarios are shown in Table 9.1.

Table 9.1: Variable Demand Model Convergence – Core Scenario

Year	Demand / Supply Gap	
	Do Minimum	Do Something
2022	0.09%	0.11%
2037	0.08%	0.08%
2051	0.10%	0.09%

- 9.2.4** The results show that the variable demand model achieves the recommended demand/supply gap for the Do Minimum and the Do Something for the forecast years of 2022, 2037 and 2051.

9.3 VDM Results

- 9.3.1** The output matrix resulting from VDM varies between the Base and the Do Minimum and the Do Minimum and Something scenarios in respect of changes in the total number of trips, vehicle kilometres travelled and total vehicle hours.

- 9.3.2** The relative change in vehicles, kilometres and hours travelled between the key scenarios is summarised in Tables 9.2 to 9.4.

Table 9.2: Changes in Trips in the Core Scenario

Year	Scenario	AM Peak Hour	Inter-peak Hour	PM Peak Hour
2022	Base to Do Minimum	+6.1%	+7.6%	+6.1%
	Do Minimum to Do Something	0.0%	0.0%	0.0%
2037	Base to Do Minimum	+21.0%	+24.0%	+20.5%
	Do Minimum to Do Something	+0.1%	+0.1%	+0.1%
2051	Base to Do Minimum	+29.8%	+33.0%	+29.7%
	Do Minimum to Do Something	+0.2%	0.0%	+0.1%

- 9.3.3** The increase in trips between the base year and forecast Do Minimum is largely a result of traffic growth together with an increase arising from redistribution effects that result from the reduction of the toll charge across the Severn Crossings. Slightly counteracting this is a modal shift response from car to public transport as people would respond to changes in highway network congestion.

- 9.3.4** The difference in highway trips between the Do Minimum and Do Something in the forecast years captures the modal shift response that is predicted to result directly from the introduction of the Scheme, together with a small increase as a

result of the toll change. As the Do Something also includes the reclassification of the existing M4 this also impacts on modal shift.

Table 9.3 Changes in Vehicle-Kilometres in the Core Scenario

Year	Scenario	AM Peak Hour	Inter-peak Hour	PM Peak Hour
2022	Base to Do Minimum	+9.9%	+11.2%	+9.9%
	Do Minimum to Do Something	0.0%	-0.2%	-0.1%
2037	Base to Do Minimum	+29.7%	+33.0%	+29.8%
	Do Minimum to Do Something	+0.3%	0.0%	+0.2%
2051	Base to Do Minimum	+40.4%	+45.4%	+41.4%
	Do Minimum to Do Something	+1.0%	-0.1%	+0.6%

9.3.5 The increase in vehicle-kilometres between the base year and forecast Do Minimum in the three forecast years is predicted to be slightly higher than the growth in number of trips cited above as a result of average trip lengths increasing slightly over time, partly as a result of the change in toll. This response is also linked to the reducing cost of car travel in real terms as a result of factors such as increased fuel efficiency and also increases in average income levels.

9.3.6 The difference in highway vehicle-kilometres between the Do Minimum and Do Something captures the overall distance savings that are predicted to result from the introduction of the Scheme. This results in a large number of trips experiencing shorter journeys on the motorway around Newport, notwithstanding that for some trips, an increase in vehicle-kilometres occurs as a result of redistribution which to some extent occurs as a result of the toll reduction. The vehicle-kilometre savings are achieved despite the number of trips increasing slightly and trips lengthening in response to the Scheme.

Table 9.4 Effects of VDM on Vehicle-Hours in the Core Scenario

Year	Scenario	AM Peak Hour	Inter-peak Hour	PM Peak Hour
2022	Base to Do Minimum	+11.7%	+12.4%	+11.2%
	Do Minimum to Do Something	-0.6%	-0.4%	-0.5%
2037	Base to Do Minimum	+41.8%	+36.5%	+39.7%
	Do Minimum to Do Something	-0.9%	-0.7%	-0.8%
2051	Base to Do Minimum	+66.4 %	+51.9%	+63.4%
	Do Minimum to Do Something	-0.2%	-1.1%	-0.4%

- 9.3.7** The increase in vehicle-hours between the base year and forecast Do Minimum in 2022 is predicted to be slightly higher than the growth in the number of vehicle-kilometres discussed above. By 2037 and 2051 this difference is forecast to become significant. This illustrates the increasing level of traffic congestion predicted to result from general traffic growth.
- 9.3.8** There is a slight decrease in vehicle-hours predicted between the Do Minimum and Do Something scenarios in all three forecast years. This is despite a small increase in the number of highway trips.

10 Core Scenario Traffic Forecasts

10.1 Introduction

- 10.1.1** This chapter presents the Core Scenario traffic forecasts and an assessment of the likely future traffic patterns and journey times in forecast years within the M4CaN model area.
- 10.1.2** Traffic forecasts have been prepared for three future years, 2022, 2037 and 2051. These cover the three modelled periods of the AM peak hour, the average inter-peak hour and the PM peak hour.

10.2 Model Convergence

- 10.2.1** Guidance on the degree of model convergence is given in ((TAG Unit 3.1)).
- 10.2.2** A comparison of the convergence statistics from each of the forecast scenarios with those achieved in the 2014 base model is given in Appendix C. This shows that the level of convergence achieved in the forecast models is consistent with that achieved in the validated base model and that the convergence for all of the forecast scenarios meets the requirement of WebTAG.

10.3 Traffic Flows

- 10.3.1** The traffic flows from the 2014 base model are shown in Figures 10.1 and 10.2 to enable a comparison of forecast traffic flows with current volumes. These Figures show that the most heavily trafficked sections of the existing M4 around Newport are those between Junctions 27 and 29, with between 4,300 and 5,300 vehicles travelling in each direction during the peak hours and in excess of 100,000 vehicles per day on these sections. The least trafficked part of the motorway is the two-lane section through the Brynglas Tunnels (Junctions 25a to 26). At this location there are around 2,600 to 3,300 vehicles travelling in each direction during the peak hours and around 68,000 daily two-way trips. The figures show little tidality in traffic patterns, with the peak hour volumes being roughly equal in each direction along the M4 around Newport.
- 10.3.2** The forecast Do Minimum and Do Something traffic flows for the central growth Core Scenario are presented in Figures 10.3 to 10.14 for the AM peak hour, inter-peak, PM peak hour and Annual Average Daily Traffic (AADT) in 2022, 2037 and 2051.
- 10.3.3** The AADT flows shown in Figures 10.6 and 10.10 and 10.14 indicate that, with the Scheme in place, the two-way AADT traffic flows would reduce on the existing route between Junctions 28 and 29 by about 42%, 41% and 39% respectively in 2022, 2037 and 2051. At Brynglas Tunnel, the two-way AADT traffic flows reduce by 39%, 32% and 36% respectively in 2022, 2037 and 2051. Finally between Junction 23A and 24, the two-way traffic flows reduce by 57%, 54% and 53% respectively in 2022, 2037 and 2051. There would also be a reduction in traffic on the local roads within Newport. Through traffic travelling between east of Junction 23 and west of Junction 29 would use the proposed new section of motorway to the south of Newport, which is shorter and better aligned than the existing M4. In addition, some traffic accessing Newport would

also use the proposed new section of motorway, utilising the intermediate junctions.

10.3.4 Traffic from the Valleys communities to the north of Newport and strategic traffic from the A449 corridor joining the existing M4 at Junction 24 (Coldra) would continue to use the existing M4 as this traffic would not have direct access onto the new section of motorway. There would also be some further reassignment within Newport arising on the local road network as a result of the relief that has been provided by the new section of motorway

10.3.5 Traffic forecasts for the scenario with the proposed new section of motorway south of Newport indicate that, in 2037, around 61,000 vehicles per day (AADT) will use the Brynglas Tunnels compared to around 89,000 vehicles per day (AADT) for the Do Minimum Scenario; whilst around 70,000 vehicles per day (AADT) are forecast to use the Usk River Crossing on the proposed new section of motorway south of Newport.

10.4 Motorway Level of Service

10.4.1 The traffic forecast flow diagrams referred to above also provide an indication of the level of service on the motorway network around Newport, based on the ratio of flow to capacity (RFC) and the congestion reference flow (CRF).

10.4.2 There is no absolute measure of 'congestion' in the same way as there is no trigger point of capacity at which the network fails. It is simply a matter of increased traffic flows leading to decreasing speeds, deterioration of operating conditions and a declining level of service as perceived by road users. The Design Manual for Roads and Bridges (DMRB) uses the concept of the CRF as a measure against which to judge acceptable performance for rural roads, while the performance of urban roads is assessed by comparing the peak hour flows with theoretical capacity, where a three-lane motorway has an estimated capacity of 5,600 vehicles per hour in each direction, reducing to 4,000 vehicles per hour on two-lane sections.

10.4.3 In addition to its rural nature, the M4 around Newport also displays characteristics of an urban motorway, as defined in DMRB, passing through a built up area with closely spaced junctions. The assessment of the existing corridor has therefore been based on both CRF and theoretical capacity.

10.4.4 When the ratio of the AADT flow to CRF reaches 100% it is estimated that congestion will occur in approximately half of the weekday peak periods, in the peak direction. However, some reliability problems with journey times may occur before the ratio reaches 100%. In the assessment of journey time reliability for rural roads, Transport Analysis Guidance adopts a stress-based approach, which considers the change in the ratio of flow to CRF between 75% and 125%.

10.4.5 The operational assessment has also included analysis of the one-way capacity, or maximum hourly throughput, of the M4 compared with the peak hour forecasts. It is generally accepted that once hourly flows reach about 80% of the theoretical capacity, operational problems can also be expected.

10.4.6 For the purposes of this assessment of level of service, 80% of CRF or hourly capacity has been taken as the point at which journey time reliability becomes adversely affected and congestion begins to be experienced.

- 10.4.7** Congestion, with frequent incidents, is currently an everyday occurrence on the existing M4 between Junctions 23 and 29. Figure 9.1 shows that some sections of the motorway, particularly between the Brynglas Tunnels and Junction 29 (Castleton), are approaching peak hour capacity on a regular basis under current conditions, while Figure 10.2 shows a similar picture with the CRF assessment. The restricted capacity of the tunnels forms a regular bottleneck on the motorway at peak times, while traffic queuing to leave the motorway at Junctions 26 and 28 frequently extends onto the mainline, exacerbating the problems presented by the poor alignment of the motorway between these junctions.
- 10.4.8** Under the Do Minimum Scenario, congestion would be expected to worsen as traffic volumes increase over time and 'peak spreading' is likely to occur where the duration of peak periods gets longer. Higher traffic flows will also lead to unstable conditions where a higher number of incidents and accidents are likely to occur, which in turn could produce increasing stop-start conditions on the motorway on a more regular basis. This would lead to a deterioration of journey time reliability.
- 10.4.9** Figures 10.3 and 10.5, showing the peak hour traffic flows for 2022, indicate that the existing M4 around Newport could be expected to experience frequent peak period congestion on specific motorway links. The situation is expected to worsen between 2022 and 2037 and 2037 and 2051 due to traffic volumes growing over time, as demonstrated in Figures 10.7, 10.9 and 10.11, 10.14. These trends are reinforced by Figures 10.6, 10.10 and 10.14 which show the AADTs increasing over time to exceed the threshold CRF values along the whole route between Junctions 24 and 28.
- 10.4.10** In the Do Something scenario, the proposed new section of motorway would be expected to operate within capacity. The reclassification of the existing motorway north of Newport with the Scheme in place includes a reduction in the number of lanes from three to two lanes on some sections where three lanes are currently in place. This reduction in capacity leads to some sections of the existing motorway corridor being flagged as likely to experience some traffic congestion even with the new motorway to the south of Newport in place. However, traffic conditions on the existing M4 would still be expected to be better in the Do Something situation compared to the Do Minimum situation due to the traffic relief provided by the new section of motorway.
- 10.4.11** In practical terms, the lower degree of saturation on the existing M4 coupled with the provision of a new motorway corridor operating within capacity would lead to smoother operation of the highway network around Newport. A lower frequency of incidents would also be expected and the provision of an alternative route for east-west traffic will further improving network resilience when incidents do occur.

10.5 Motorway Traffic Patterns

- 10.5.1** Analysis of the forecast traffic patterns in 2037 for the Do Minimum Scenario has shown that around 52% of the 89,000 daily traffic (AADT) passing through the Brynglas Tunnels (Junctions 25a to 26) would be likely to be 'through' trips travelling along the full length of the existing M4 north of Newport between Junctions 23 and 29. A further 36% would be likely to either join or leave the motorway between Junctions 23 and 29. The remaining 12% of daily traffic would be likely to both join and leave the motorway between Junctions 23 and 29.

Figure 10.15 illustrates this breakdown of traffic movements through the Brynglas tunnels for the 2037 scenario without the proposed new section of motorway to the south of Newport.

10.5.2 Analysis of the forecast traffic patterns in 2037 for the scenario with the proposed new section of motorway to the south of Newport has shown that around 67% of daily traffic (AADT) on the River Usk Crossing would be likely to be 'through' trips travelling along the full length of the proposed new section of motorway between Junctions 23 and 29, with no 'through' trips using the existing M4. A further 26% of daily traffic using the proposed new section of motorway would be likely to either join or leave the motorway at Newport, either via the Docks Way Junction or Glan Llyn Junction. Some 7% of daily traffic using the proposed new section of motorway would be likely to both join and leave the motorway around Newport, travelling between the Docks Junction and Glan Llyn Junction. This breakdown of traffic movements using Brynglas tunnels and the proposed new section of motorway Usk River crossing is illustrated in Figures 10.16 and 10.17 respectively.

10.6 Journey Times

10.6.1 Information on journey times through the network was extracted from the Core Scenario traffic forecasts. The journey times between Junction 30 of the M4 and the toll plaza at the Second Severn Crossing were analysed in order to ascertain the journey time changes on the motorway that would result from the construction of the proposed new section of motorway to the south of Newport. The results of the journey time analysis are presented in Table 10.1.

10.6.2 The journey times along the existing M4 in the Do Something scenario in comparison to the Do-minimum are provided as an indicative benchmark only. In practice, traffic travelling the full length of M4 between Junction 30 and the Second Severn Crossing would use the new motorway. Traffic travelling along the existing M4 when the new M4 is in place, would therefore only be travelling on part of the route between Junctions 23 and 29.

10.6.3 Journey times along the existing M4 would be affected by the following components of the Do Something as follows;

- a slight increase in distance due to the realignment of the existing M4 to accommodate the tie-in with the proposed new section of motorway. Eastbound traffic would need to negotiate a roundabout to access the M4 approach to the Second Severn Crossing, whilst westbound traffic would be free flow. In consequence, this is likely to result in a slight localised increase in journey times on these sections.
- reclassification of the existing M4 includes a speed limit reduction and capacity reduction on some sections of the motorway which leads to a slight increase in journey time on those sections.
- reduced volumes of traffic arising from the relief provided by the proposed new section of motorway reduces journey times on those sections not affected by reclassification.

10.6.4 The motorway journey times in 2022 along the existing M4 north of Newport would reduce slightly in both directions at peak times by up to 1.5 minutes. A slight increase in journey time occurs during the inter-peak period up to a

maximum of 23 seconds when travelling the full distance on the existing M4 between Junction 30 and the M4 Toll, which diminishes in subsequent years as traffic growth occurs. As above this is calculated for indicative purposes only as in practice traffic would use the new motorway. For intermediate travel on the existing M4 in the inter-peak period between the same points, the maximum delay of 23 seconds decreases as a function of the shorter distances travelled, which also diminishes in subsequent years. By 2037, the journey time analysis shows that travel times along the existing M4 would reduce in both directions during all times of the day up to 4.5 minutes.

10.6.5 Through traffic using the proposed new section of motorway to travel east-west between Magor and Castleton would experience more significant journey time savings due to the shorter distance and reduced congestion levels. During the inter-peak, the time savings would be expected, on average, to be around 2.5 minutes in 2022, increasing to between 3 and 4 minutes by 2037. During the peak hours, the journey time savings could be expected to be, on average, between around 3.5 to 5 minutes in 2022, increasing to between 5.5 and 8 minutes in 2037 rising to 7 and 11.5 minutes in 2051.

Table 10.1: Journey Time between Junction 30 and M4 Toll Plaza (min:sec)

Direction	Time	Route	2022 Central Growth		2037 Central Growth		2051 Central Growth	
			Do Min	Do Som	Do Min	Do Som	Do Min	Do Som
East	AM	Via existing M4	19:30	18:59	24:23	19:55	28:00	20:49
	IP	Via existing M4	17:30	17:53	19:34	18:26	22:10	18:49
	PM	Via existing M4	18:04	18:08	20:51	18:55	23:02	19:27
	AM	Via new motorway		15:03		16:03		16:34
	IP	Via new motorway		14:50		15:29		15:49
	PM	Via new motorway		14:53		15:34		15:51
West	AM	Via existing M4	19:56	18:23	23:19	20:15	26:08	21:37
	IP	Via existing M4	17:12	17:07	18:08	17:44	18:53	18:11
	PM	Via existing M4	19:33	18:27	24:04	19:57	27:22	21:07
	AM	Via new motorway		15:35		16:38		17:29
	IP	Via new motorway		14:40		15:11		15:30
	PM	Via new motorway		15:32		16:38		17:27

- 10.6.6** It should be noted that the traffic model assumes 'typical' conditions without any incidents to disrupt traffic. In reality, as traffic volumes increase on the existing M4 without the proposed new section of motorway in place, conditions are likely to become more unstable leading to a higher frequency of incidents. Incidents on the existing M4 have been seen to result in stop-start conditions, sometimes even bringing traffic to a standstill. These impacts on journey time reliability are not taken into account by the traffic model.

10.7 Low and High Growth Forecasts

- 10.7.1** As noted in Section 5.1, scenarios for low and high growth assumptions were also tested in addition to the central growth Core Scenario.
- 10.7.2** Trip matrices for the low and high growth scenarios were developed from the central growth assignment matrices after completion of the variable demand process. This follows the guidelines contained in ((TAG Unit M4)), in which a proportion of the base year matrix is subtracted from or added to the central growth matrix. This proportion changes in proportion to the square root of the number of years from the base. Table 10.2 shows the calculated proportion of the base matrix added to or subtracted from the central growth matrices.

Table 10.2 Adjustment of Central Growth Matrices for Low and High Growth

	Low Growth	High Growth
2022	-7.07%	+7.07%
2037	-11.99%	+11.99%
2051	-15.00%	+15.00%

- 10.7.3** Figures showing the forecast traffic flows for the low growth scenario are given in Appendix D, together with the results of the journey time analysis. Corresponding results and figures for the high growth scenario are shown in Appendix E.
- 10.7.4** The motorway journey times in 2022 show that travel times along the existing M4 north of Newport could increase slightly in the low growth scenario due to the realignment around Junction 23a. This is especially the case in the eastbound direction due to the need to negotiate a roundabout for traffic to access the M4 approach to the Second Severn Crossing. By 2037 and 2051, the effects of the increased travel distance would be expected to be countered by further traffic growth and travel times along the existing M4 would be expected to reduce compared to the Do Minimum scenario.
- 10.7.5** Under high growth assumptions, travel times along the existing M4 would be expected to reduce in both directions in all time periods, with peak hour time savings of around 1 minute eastbound and 2 to 3 minutes westbound in 2022. The peak hour time savings could be expected to increase to over 7 minutes by 2037 and over 10 minutes in 2051.
- 10.7.6** During the inter-peak, the time savings by 2037 for through traffic using the proposed new section of motorway between Magor and Castleton would be expected, on average, to be around 3 minutes at low growth, and up to 7 minutes at high growth, whilst in 2051 the time savings would be in the order of 5 minutes at low growth and 9 minutes at high growth. During the 2037 peak hours, the

journey time savings could be expected to be, around 6 minutes at low growth, increasing to 12 minutes at high growth.

- 10.7.7** As for the central growth core scenario, it should be noted that the high and low growth forecast scenarios represent average conditions on a typical weekday. The effect of incidents and unusually busy periods are not taken into account in the forecasting.

10.8 Summary Conclusion

- 10.8.1** The M4CaN transport model has been used to produce traffic forecasts that will inform the operational, economic and environmental evaluations of the proposed new section of motorway to the south of Newport. The traffic forecasts have been based on the latest available national traffic forecasts from NTEM, as provided by the DfT that contains the most recently available LDP dwelling predictions for Wales. Furthermore, the latest available values of time have been incorporated into the M4CaN model. Additionally, the tolling assumption adopted reflects the UK Government Budget 2015 and 2016 announcements, that following handover of the Severn Crossings to the public sector following the expiry of the current Concession Agreement, that VAT will no longer apply to future tolling, LGV (Category 2 vehicles) will in the future pay the same as for cars and finally the tolls will be halved

- 10.8.2** The following scenarios were tested:

- A 'Do Minimum' scenario, in which committed transport improvement schemes have been added to the base year network; and
- A 'Do Something' scenario, which includes the proposed new section of motorway to the south of Newport and reclassification of the existing M4 around Newport to a 2-lane dual carriageway.

- 10.8.3** Traffic forecasts have been produced for the AM peak, inter-peak and PM peak hours for the forecast years of 2022 (the opening year for the proposed new section of motorway south of Newport) and 2037 (the design year) and 2051, being the final year for which forecasts of traffic growth are available. The approach used in developing the forecasts and undertaking variable demand modelling has been undertaken in accordance with Department for Transport Guidance (WebTAG).

- 10.8.4** The traffic forecasts for the Do Minimum Core Scenario indicate that future traffic growth will result in severe congestion on the existing M4 which will result in increased journey times. The results indicate that one-way flows on the M4 motorway links would be constrained by the capacity of the motorway.

- 10.8.5** For the Do Something Core Scenario, with the inclusion of the proposed new section of motorway to the south of Newport, the traffic volumes on the existing M4 between Junctions 23 to 29 would be reduced. Unlike the Do Minimum Scenario, this section of the route around Newport is not expected to be congested in 2037. Journey times along the existing M4 would be expected to reduce during peak hours as a result of the relief provided by the new motorway. However, in the specific case of inter-peak journey times along the existing M4 in 2022, a slight increase in journey times occurs which subsequently diminishes in subsequent years for the reasons explained in 10.6.4.

- 10.8.6** The proposed new section of motorway is also expected to reduce traffic flows on local roads within Newport as capacity is released on the existing M4 and the Newport Southern Distributor Road. Journey times along the proposed new section of motorway would be expected to reduce compared to those on the existing M4 in the Do Minimum scenario.
- 10.8.7** It should be noted that the model represents typical operating conditions during the AM, PM and Inter-Peak periods of a normal day. It does not therefore take into account conditions on those occasions when an incident takes place on the network and the resultant disruption, increasing congestion and increased journey times that arise. In such instances, the improved network resilience and relief offered by the Scheme, which provides an alternative route and an increase in network capacity, would minimise the disruption caused by the incident.
- 10.8.8** This Traffic Forecasting Report has documented the development of the future year forecasts for the Scheme.

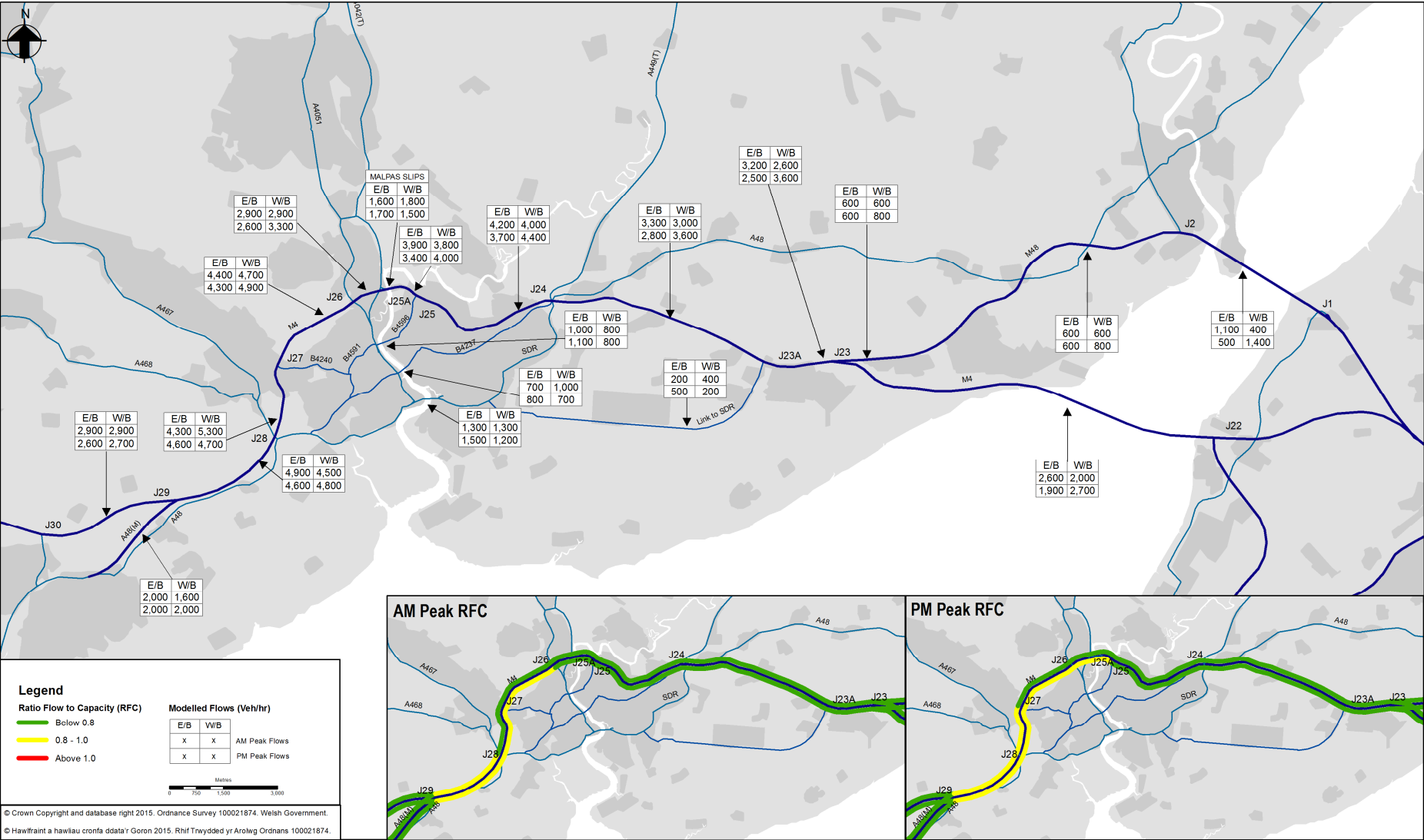


Figure 10.1: Base Year Peak Hour Traffic Flows



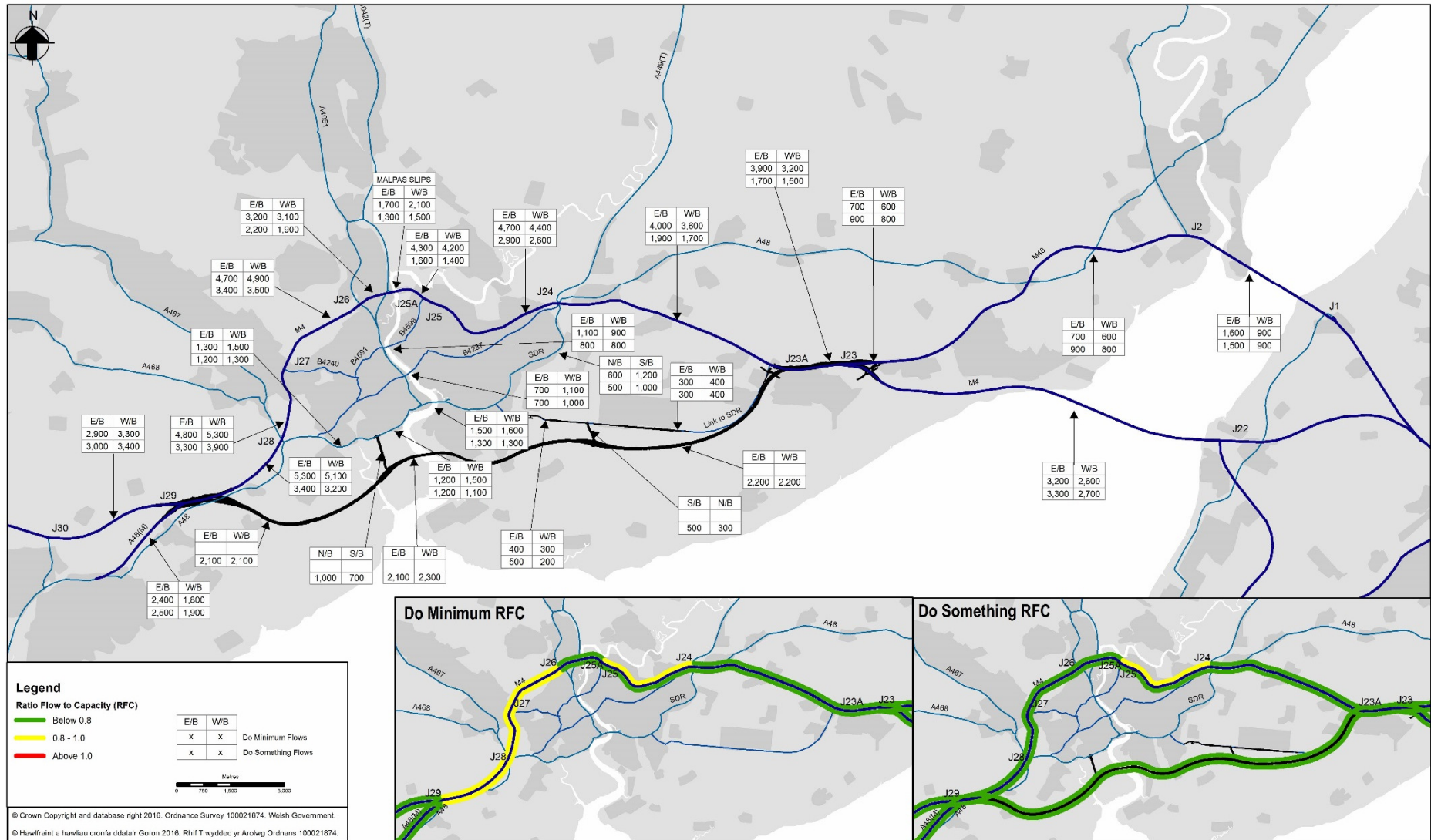


Figure 10.3: 2022 Forecast AM Peak Hour Traffic Flows, Core Scenario

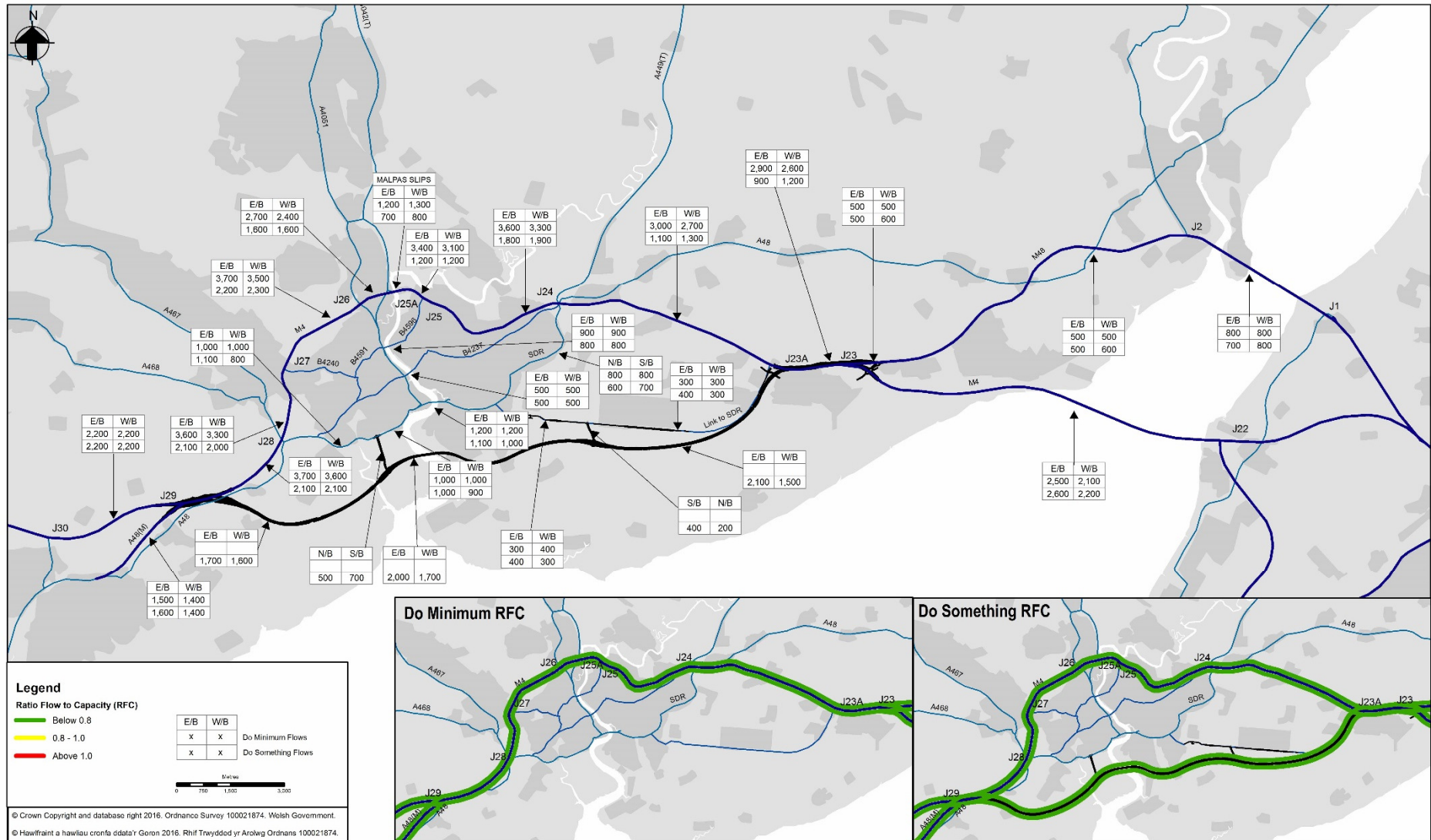


Figure 10.4: 2022 Forecast Inter-peak Hour Traffic Flows, Core Scenario

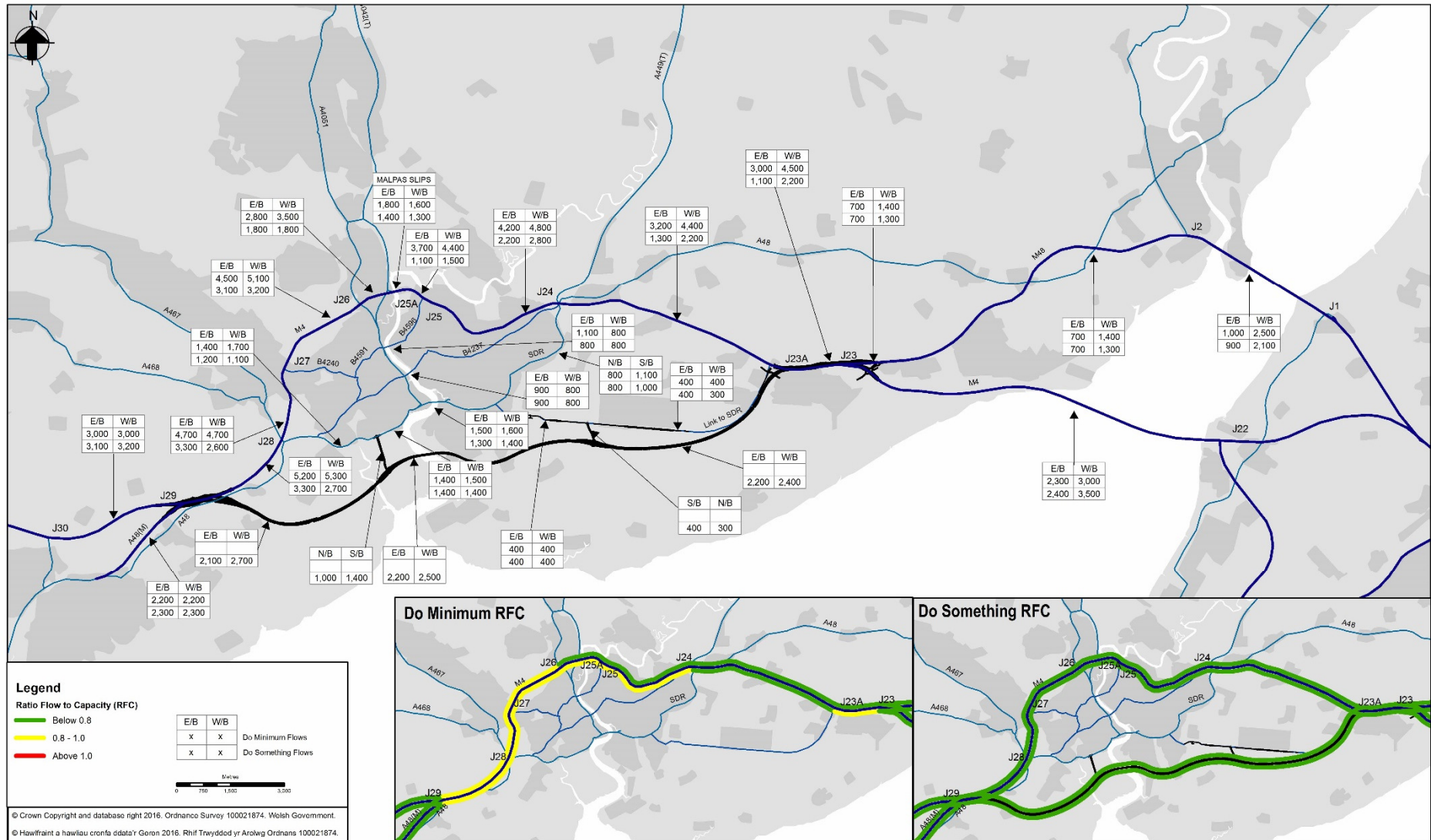


Figure 10.5: 2022 Forecast PM Peak Hour Traffic Flows, Core Scenario

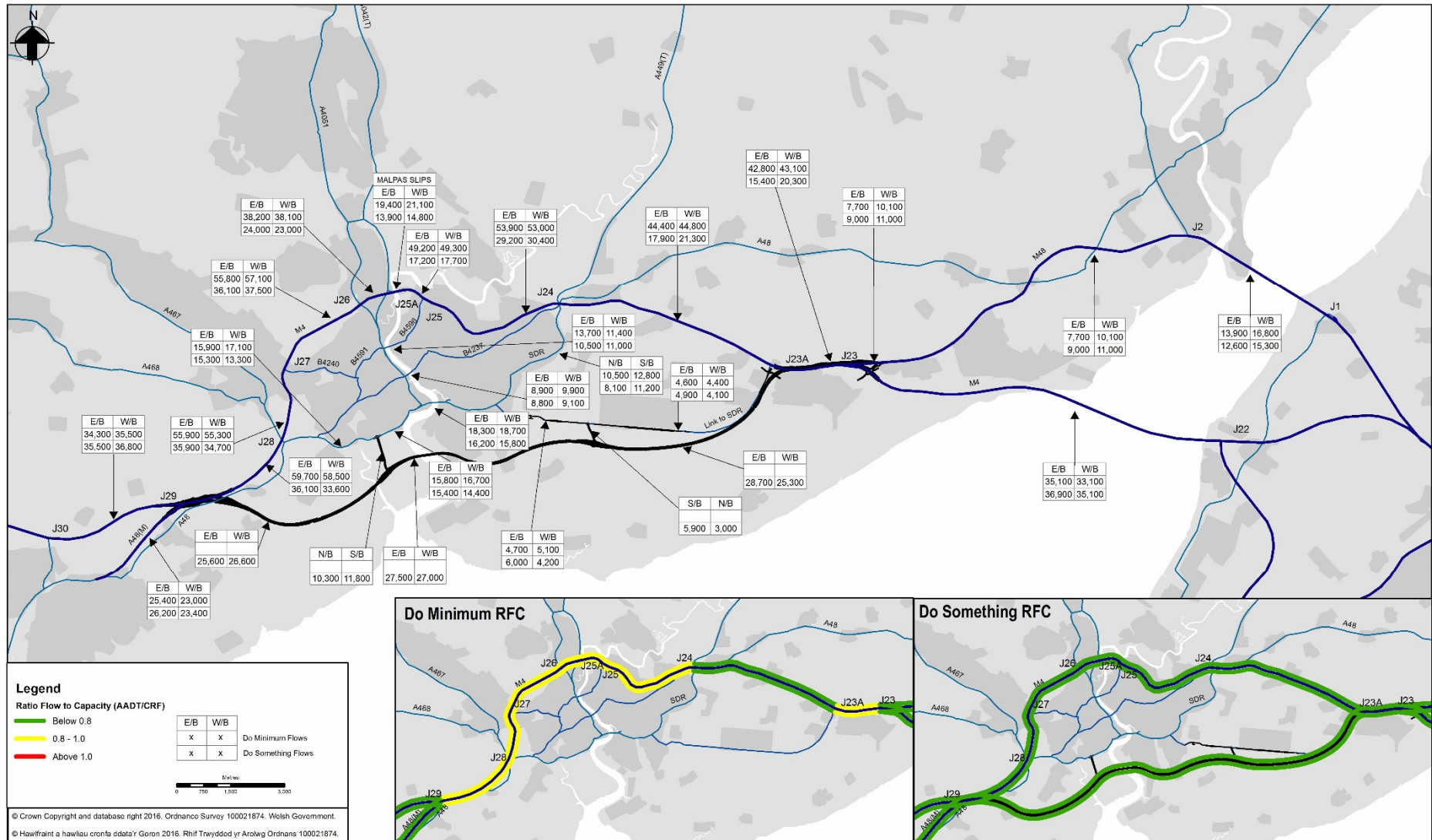


Figure 10.6: 2022 Forecast Annual Average Daily Traffic Flows, Core Scenario

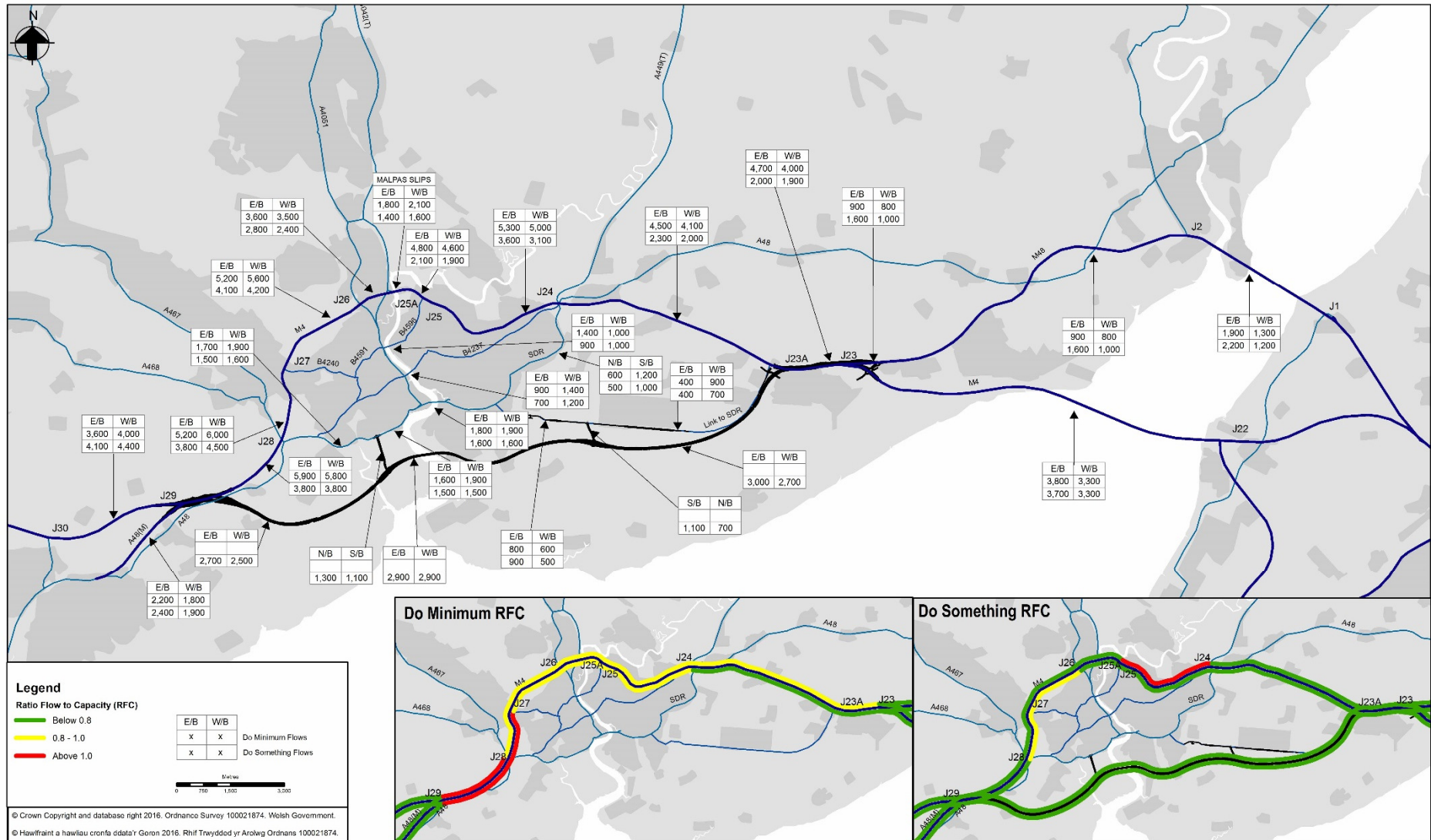


Figure 10.7: 2037 Forecast AM Peak Hour Traffic Flows, Core Scenario

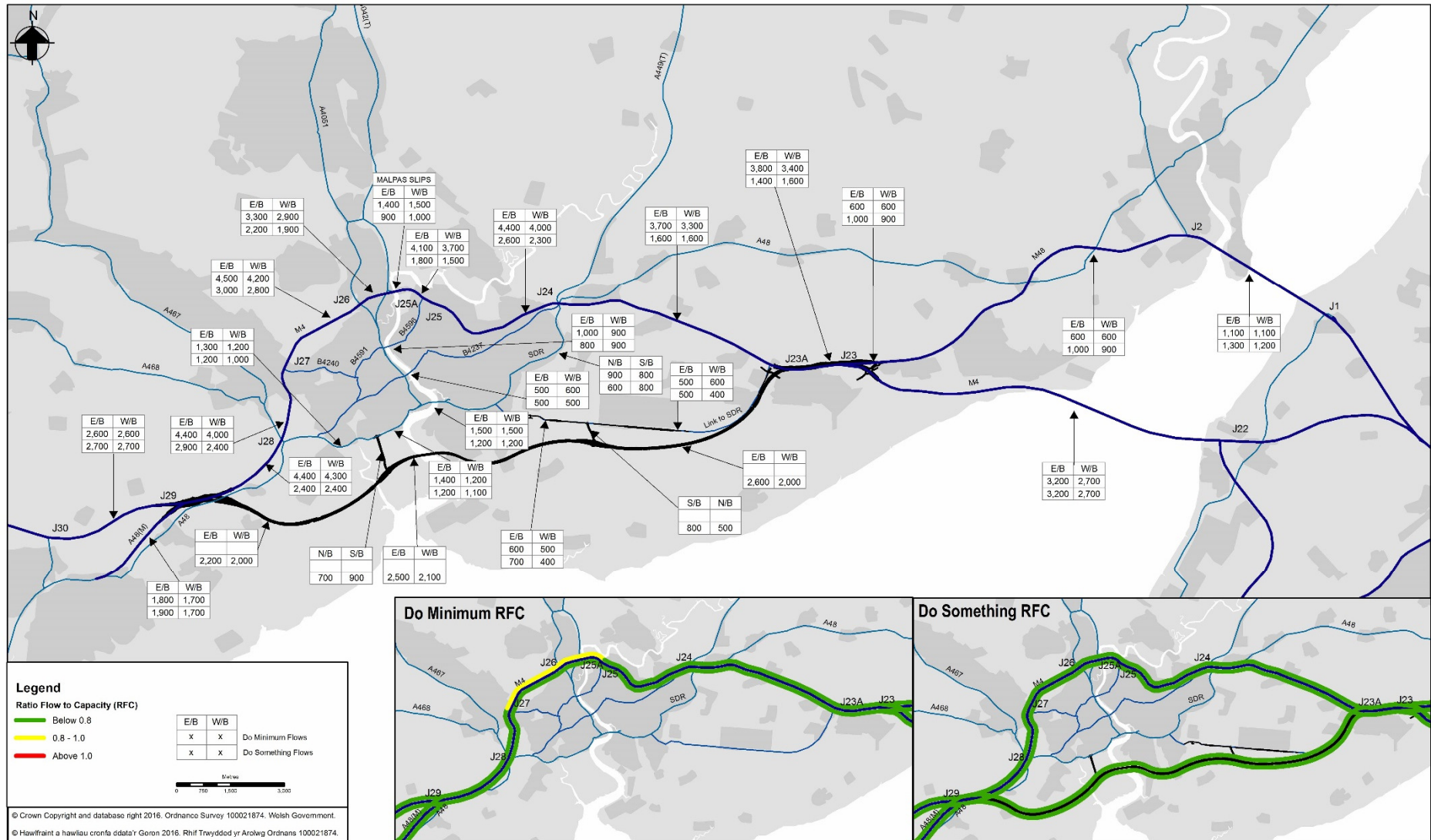


Figure 10.8: 2037 Forecast Inter-Peak Hour Traffic Flows, Core Scenario

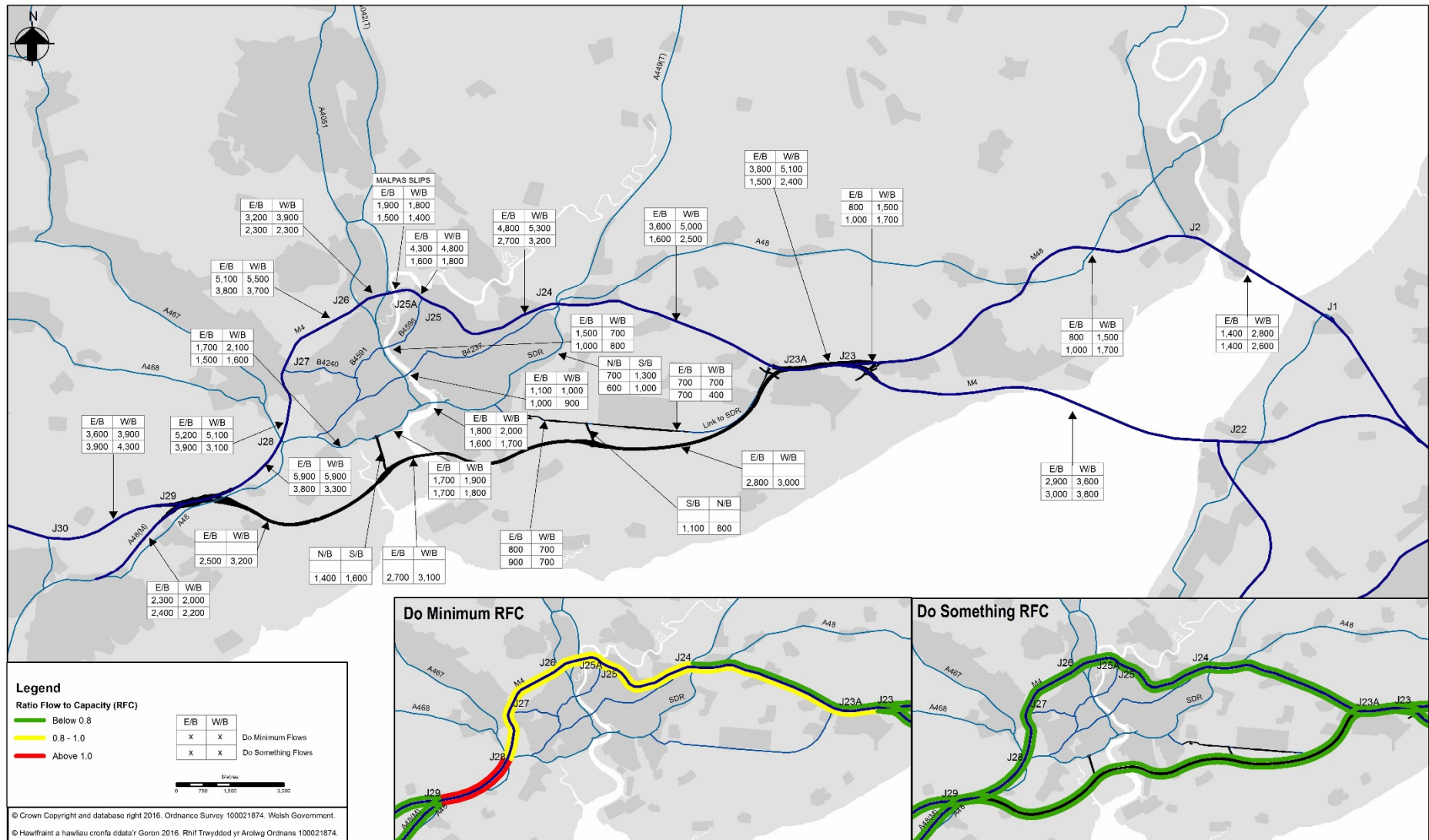


Figure 10.9: 2037 Forecast PM Peak Hour Traffic Flows, Core Scenario

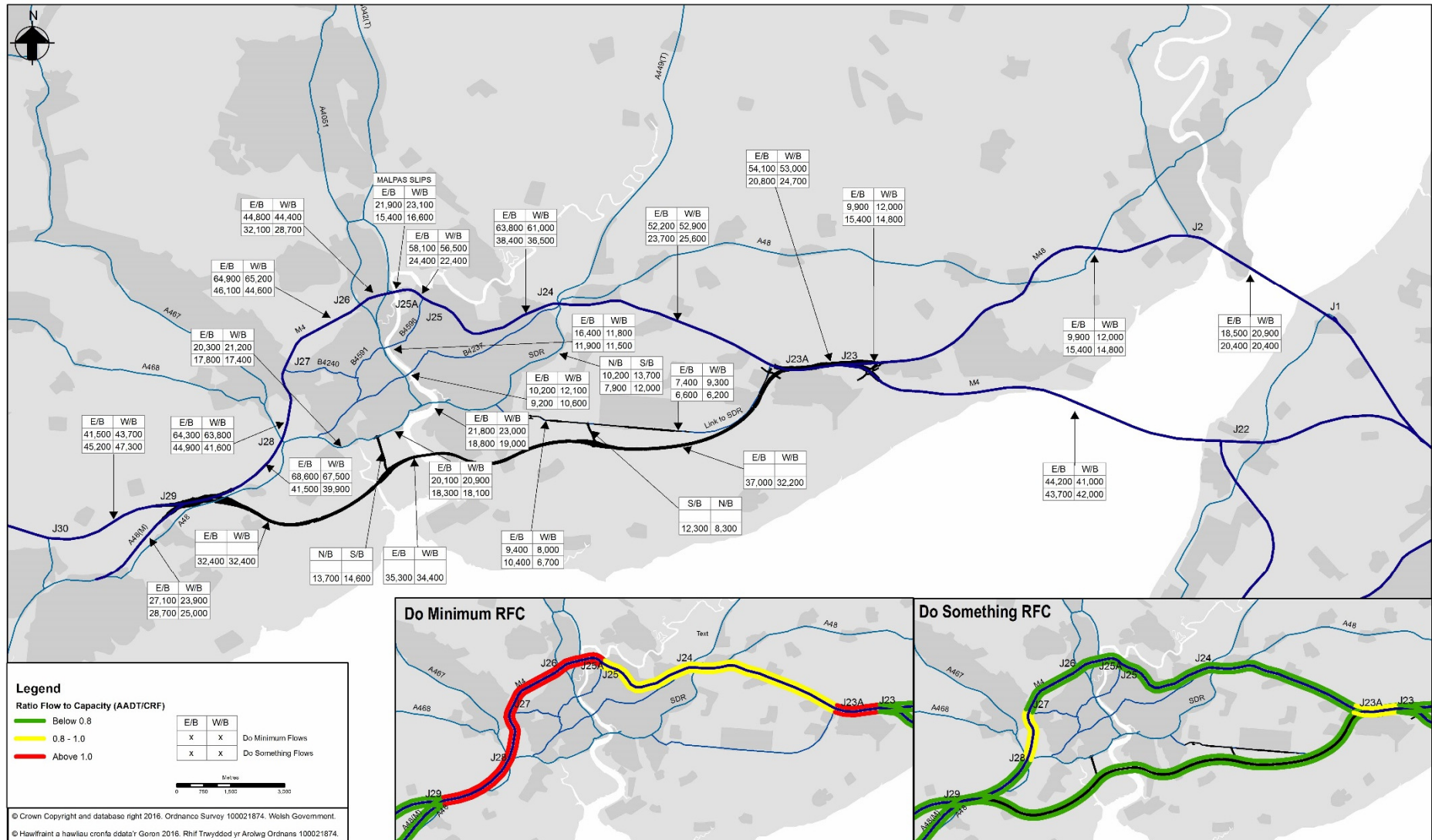


Figure 10.10: 2037 Forecast Annual Average Daily Traffic Flows, Core Scenario

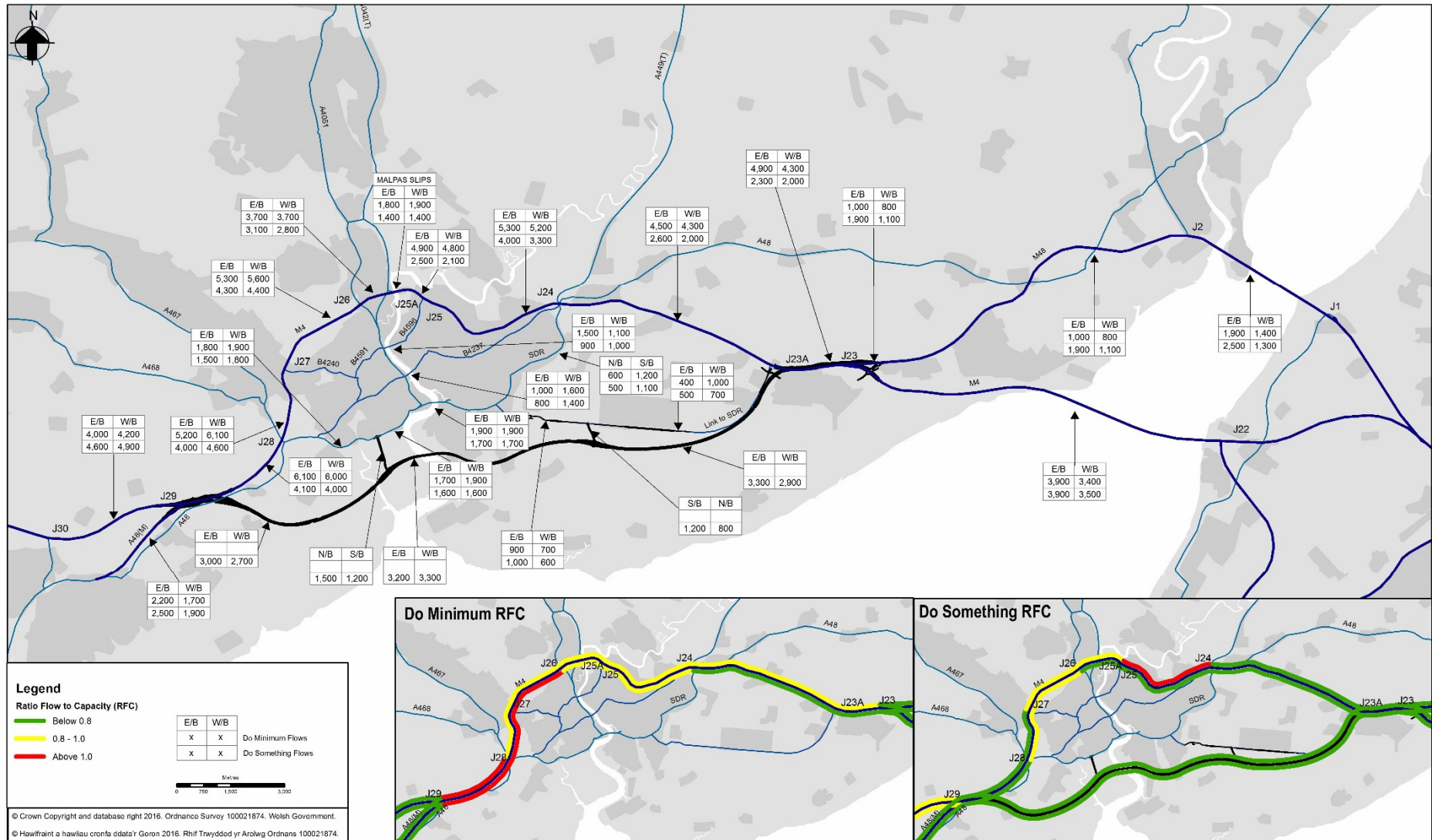


Figure 10.11: 2051 Forecast AM Peak Hour Traffic Flows, Core Scenario

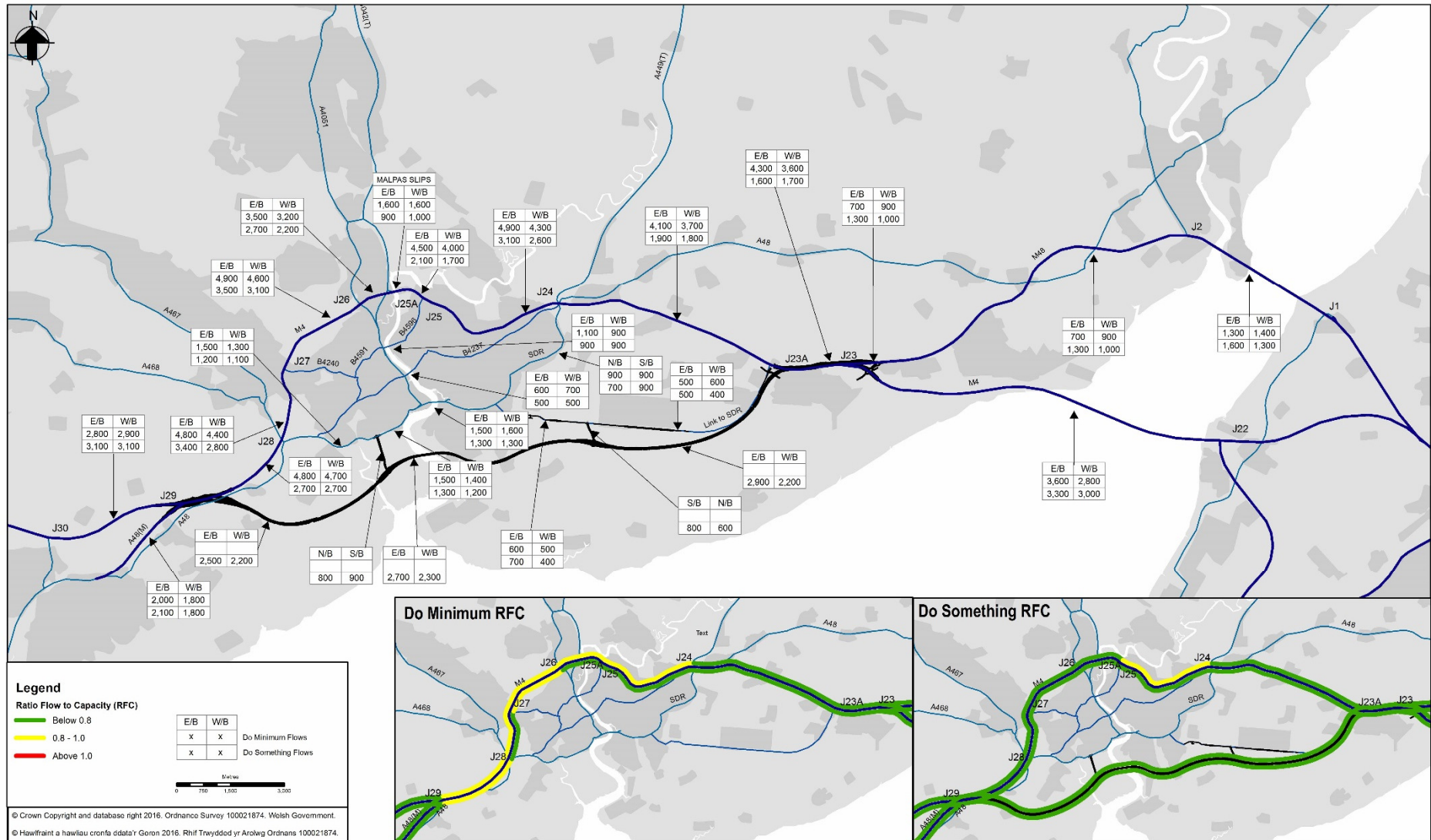


Figure 10.12: 2051 Forecast Inter-Peak Hour Traffic Flows, Core Scenario

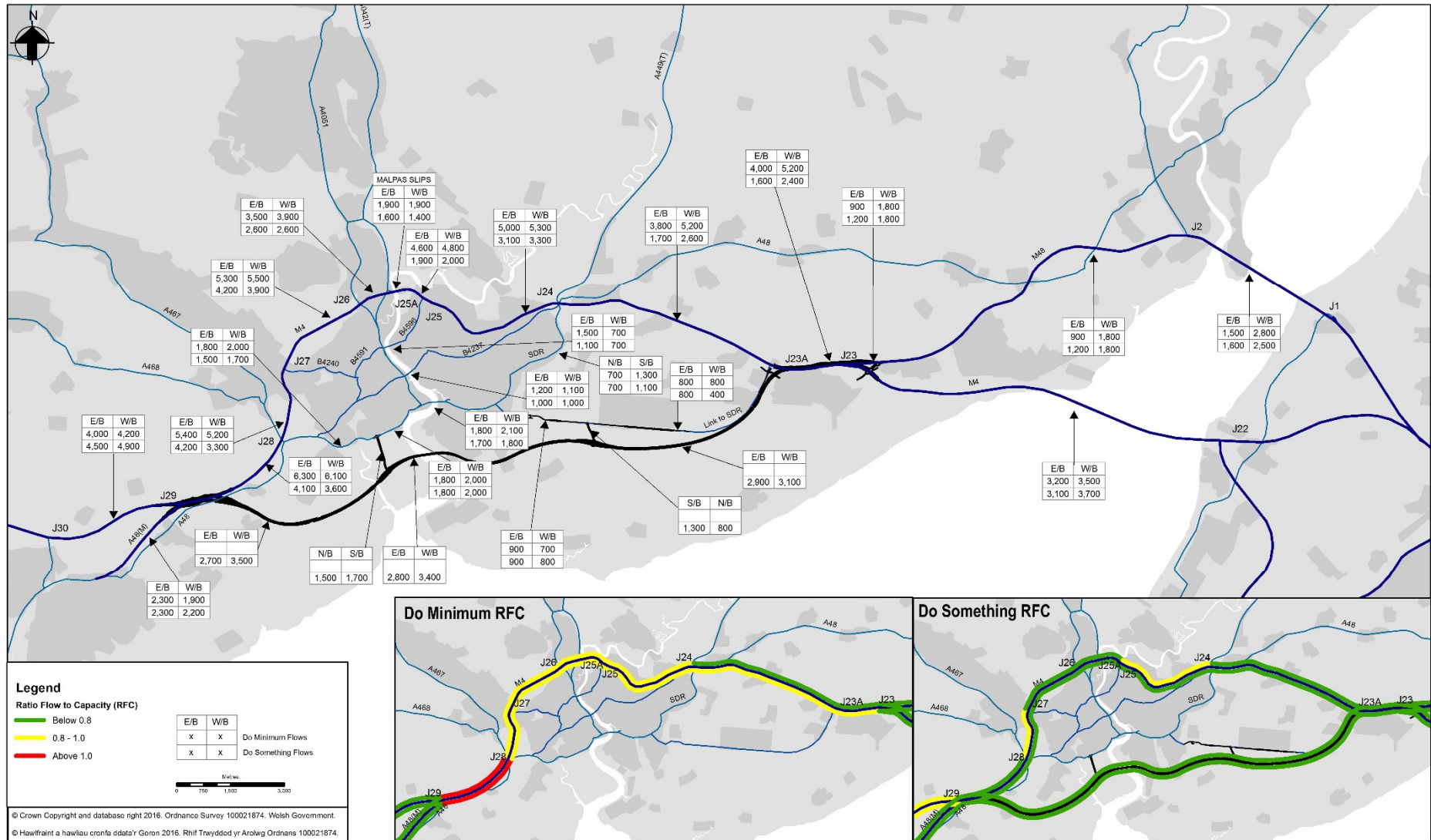


Figure 10.13: 2051 Forecast PM Peak Hour Traffic Flows, Core Scenario

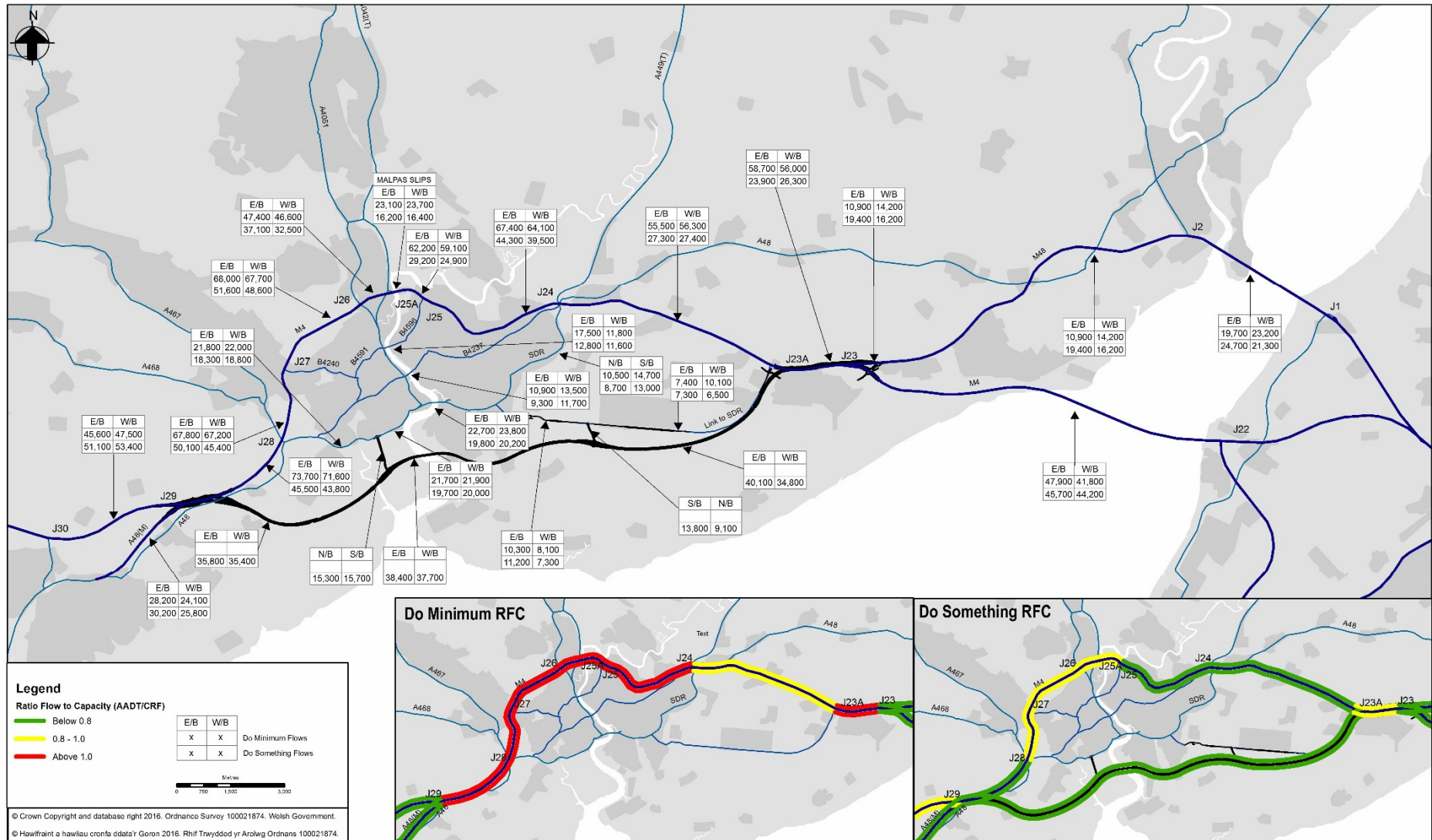


Figure 10.14: 2051 Forecast Annual Average Daily Traffic Flows, Core Scenario

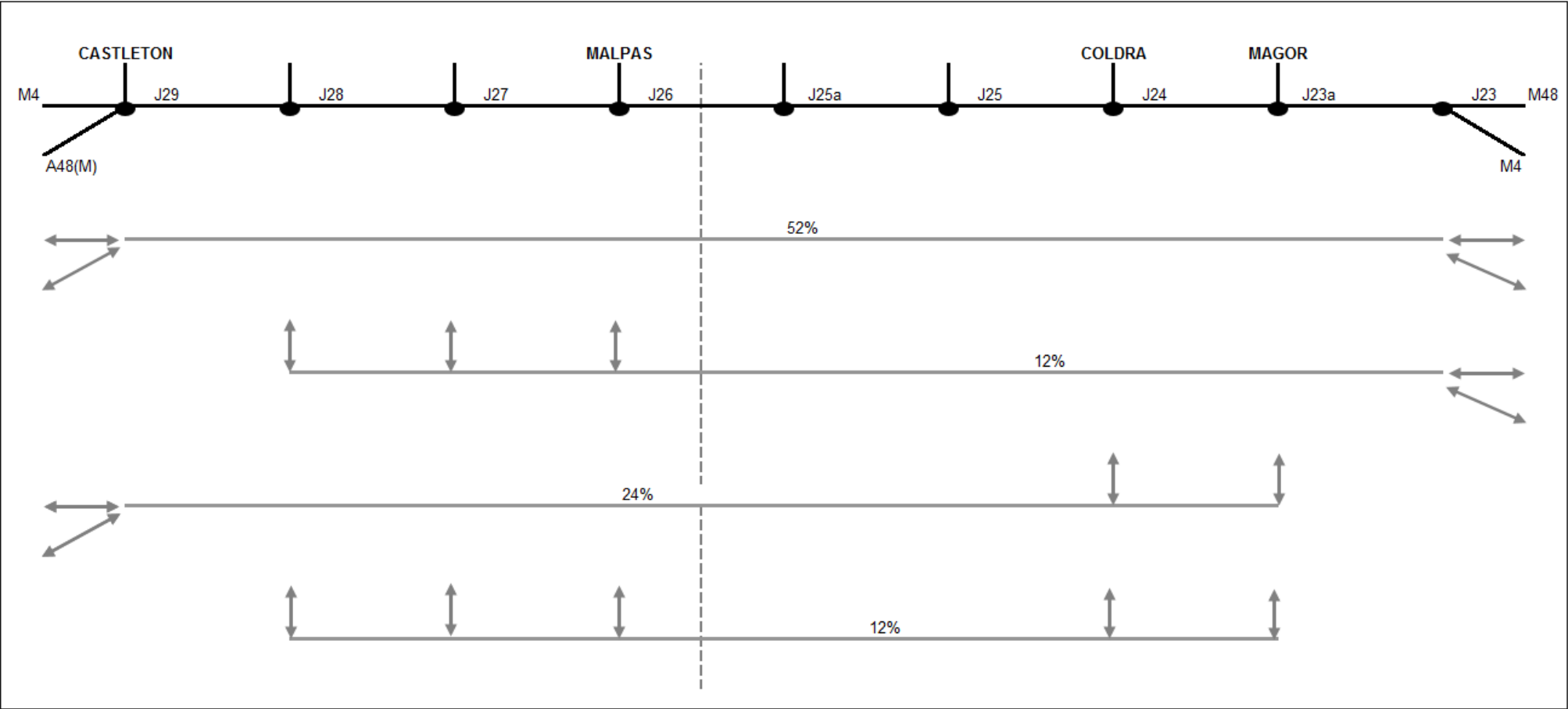


Figure 10.15
Analysis of Traffic Through Brynglas Tunnels 2037
Do Minimum
(vehicles/day)

52%	Through traffic travelling between east of J23 and west of J29
12%	Two way traffic Joining or Leaving at J28,27,26 travelling through tunnels to east of J23a
24%	Two way traffic travelling from west of J28 through tunnels and joining or leaving at J24 or J23a
12%	Two way traffic both joining and leaving between junctions 23 and 29
100%	Total Brynglas tunnels flow

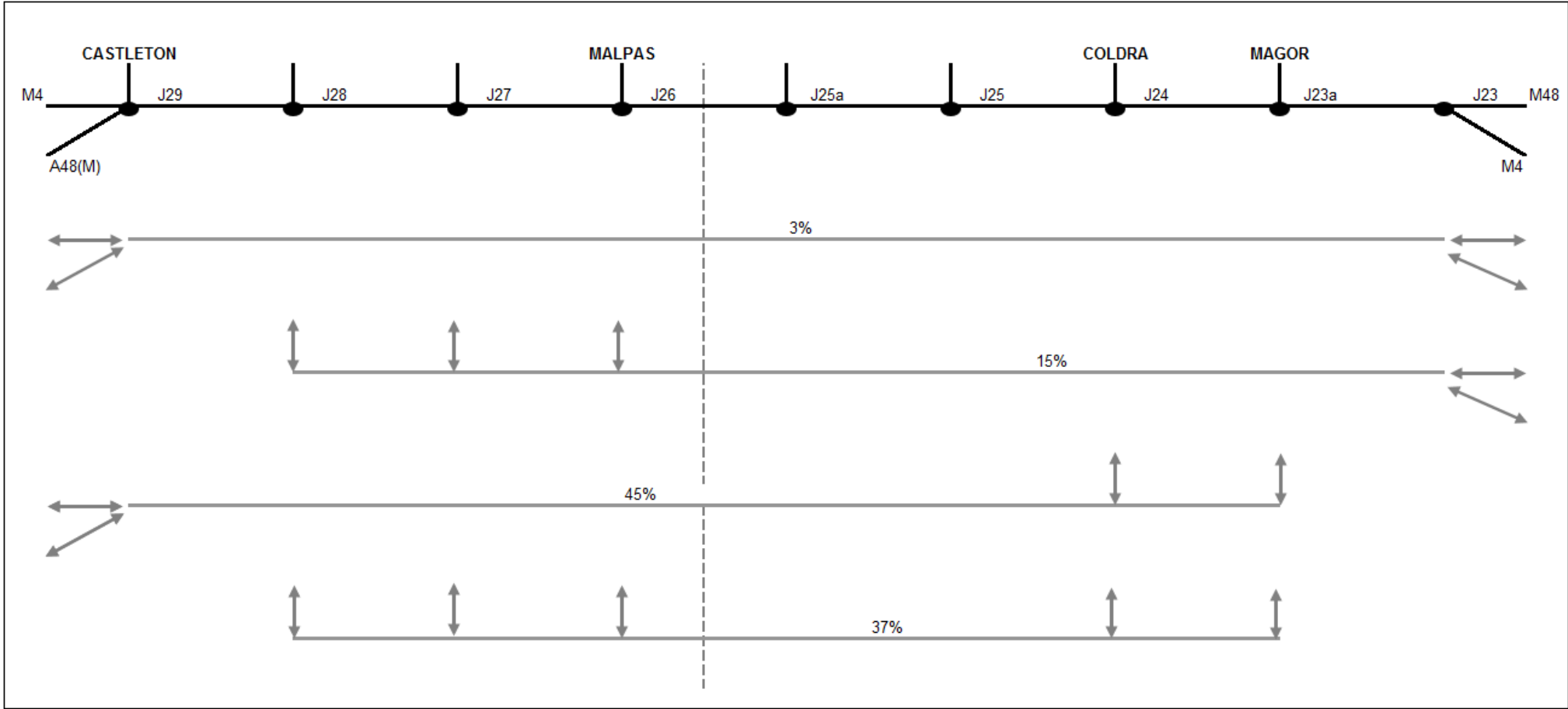


Figure 10.16
Analysis of Traffic Through Brynglas Tunnels 2037
Do Something
(vehicles/day)

3%	Through traffic travelling between east of J23 and west of J29
15%	Two way traffic Joining or Leaving at J28,27,26 travelling through tunnels to east of 23a
45%	Two way traffic travelling from west of J28 through tunnels and joining or leaving at 24 or 23a
37%	Two way traffic both joining and leaving between junctions 23 and 29
100%	Total Brynglas tunnels flow

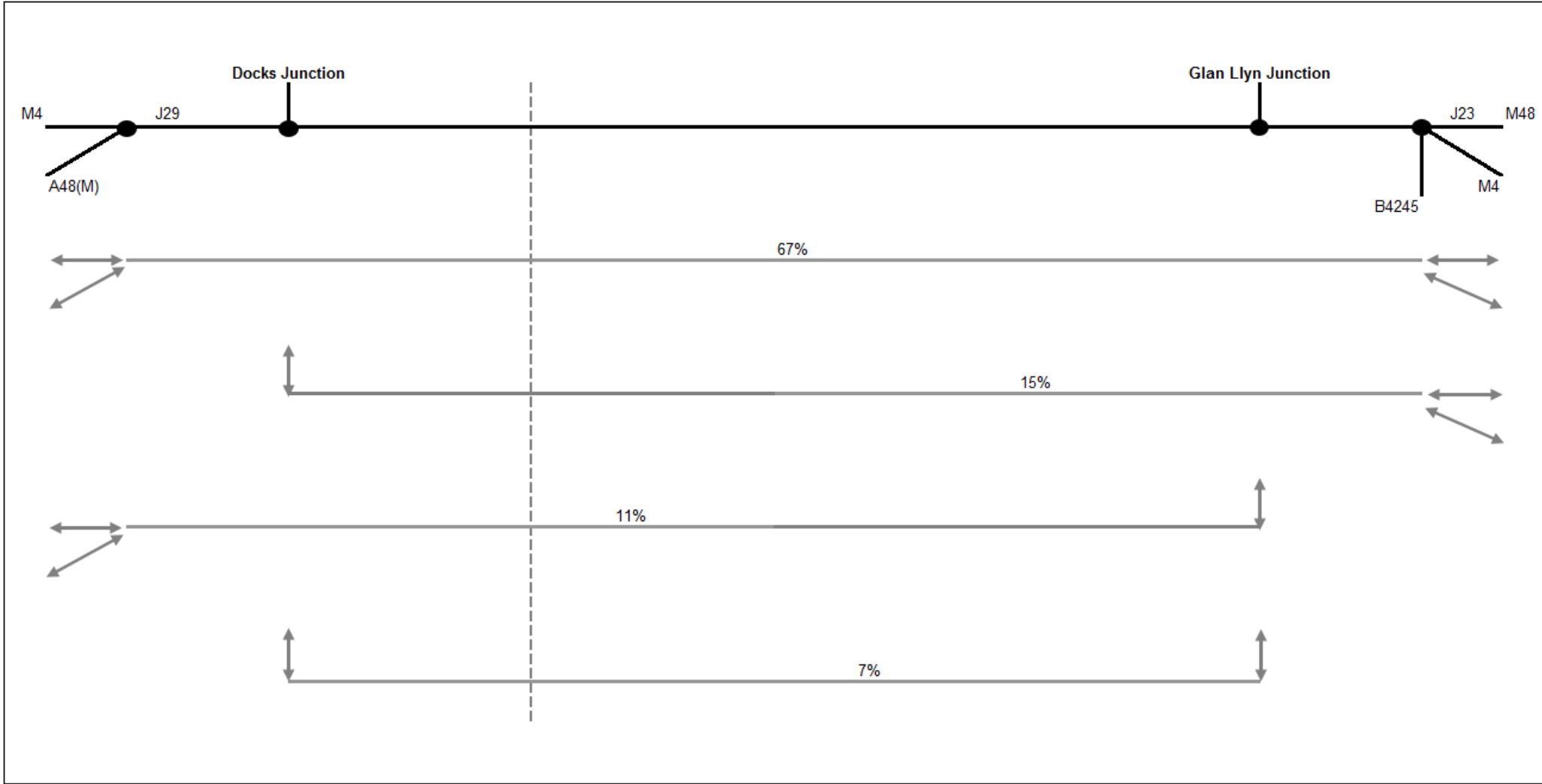


Figure 10.17
Analysis of Traffic on Proposed New Section of Motorway, 2037
Do Something
(vehicles/day)

67%	Through traffic travelling whole length of proposed new section of motorway
15%	Two way traffic Joining or Leaving at Docks Junction and using proposed new section of motorway to East of J23
11%	Two way traffic Joining or Leaving at Glan Llyn Junction and using proposed new section of motorway to West of J29
7%	Two way traffic travelling between Docks Junction and Glan Llyn Junction on proposed new section of motorway
100%	Total Usk River crossing flow on proposed new section of motorway

Appendix A – NTEM Growth Factors

A1 Car Driver

Table A1: NTEM Car Driver Growth, 2014 to 2022, Average Weekday

Area Description		Car Driver Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.023	1.023	1.065	1.065	1.035	1.035	1.039	1.039	1.058	1.058	1.051	1.051
Region	East of England	1.015	1.024	1.056	1.066	1.051	1.051	1.044	1.041	1.085	1.089	1.071	1.071
Region	East Midlands	1.009	1.009	1.049	1.049	1.025	1.025	1.026	1.026	1.052	1.052	1.043	1.043
Region	London	1.071	1.051	1.112	1.094	1.065	1.060	1.070	1.070	1.086	1.084	1.079	1.080
Region	North East	1.025	1.025	1.067	1.067	1.022	1.022	1.036	1.036	1.035	1.035	1.036	1.036
Region	North West	1.024	1.024	1.063	1.063	1.025	1.025	1.035	1.035	1.039	1.039	1.038	1.038
Region	Scotland	1.011	1.011	1.048	1.048	1.018	1.018	1.023	1.023	1.047	1.047	1.038	1.038
Region	South East	1.028	1.032	1.070	1.075	1.045	1.045	1.049	1.048	1.071	1.068	1.061	1.061
Region	South West	1.017	1.017	1.057	1.057	1.029	1.029	1.033	1.033	1.052	1.052	1.046	1.046
Region	Wales	1.003	1.003	1.045	1.045	1.017	1.017	1.020	1.020	1.044	1.044	1.036	1.036
County	Mid Wales	0.978	0.987	1.016	1.026	0.986	0.992	1.001	0.999	1.025	1.018	1.014	1.011
County	North Wales	0.997	0.995	1.039	1.038	1.010	1.009	1.013	1.013	1.036	1.036	1.028	1.029
County	South East Wales	1.014	1.013	1.056	1.055	1.026	1.026	1.029	1.029	1.052	1.052	1.043	1.043
Authority	Blaenau Gwent	1.011	1.016	1.055	1.057	1.032	1.029	1.032	1.031	1.041	1.043	1.040	1.038
Authority	Bridgend	1.011	1.013	1.056	1.055	1.025	1.026	1.029	1.030	1.050	1.053	1.044	1.045
Authority	Caerphilly	0.999	1.014	1.041	1.056	1.024	1.027	1.030	1.030	1.043	1.043	1.038	1.041
Authority	Cardiff	1.052	1.009	1.096	1.050	1.022	1.022	1.024	1.025	1.080	1.058	1.043	1.045
Authority	Merthyr Tydfil	1.029	1.014	1.074	1.057	1.027	1.027	1.030	1.032	1.073	1.051	1.042	1.041
Authority	Monmouthshire	0.977	1.013	1.015	1.053	1.027	1.025	1.029	1.027	1.031	1.050	1.046	1.042
W02000336	Monmouthshire 001	0.980	1.029	1.019	1.071	1.043	1.042	1.046	1.045	1.043	1.058	1.052	1.045
W02000337	Monmouthshire 002	0.993	0.992	1.032	1.030	1.005	1.004	1.007	1.003	1.044	1.027	1.017	1.025
W02000338	Monmouthshire 003	0.977	1.015	1.013	1.055	1.035	1.028	1.032	1.029	1.035	1.049	1.046	1.041
W02000339	Monmouthshire 004	0.984	1.002	1.023	1.042	1.019	1.015	1.019	1.015	1.047	1.043	1.035	1.034
W02000340	Monmouthshire 005	0.981	1.000	1.017	1.039	1.020	1.012	1.017	1.011	1.027	1.044	1.026	1.029
W02000341	Monmouthshire 006	0.967	1.010	1.004	1.051	1.027	1.022	1.028	1.025	1.016	1.055	1.054	1.048
W02000342	Monmouthshire 007	0.976	1.009	1.012	1.048	1.022	1.022	1.025	1.020	1.029	1.050	1.046	1.041
W02000343	Monmouthshire 008	0.979	1.017	1.021	1.058	1.031	1.029	1.033	1.033	1.030	1.049	1.041	1.040
W02000344	Monmouthshire 009	0.975	1.012	1.012	1.055	1.037	1.025	1.034	1.031	1.024	1.077	1.084	1.070

Area Description		Car Driver Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000345	Monmouthshire 010	0.990	1.009	1.031	1.045	1.019	1.022	1.022	1.016	1.042	1.040	1.031	1.033
W02000346	Monmouthshire 011	0.957	1.017	0.996	1.058	1.026	1.030	1.032	1.032	1.005	1.044	1.040	1.041
Authority	Newport	1.024	1.014	1.066	1.056	1.028	1.026	1.030	1.031	1.048	1.054	1.048	1.045
W02000347	Newport 001	1.003	1.026	1.046	1.067	1.040	1.039	1.048	1.042	1.031	1.082	1.093	1.081
W02000348	Newport 002	1.029	1.020	1.073	1.060	1.020	1.033	1.033	1.034	1.048	1.040	1.035	1.037
W02000349	Newport 003	1.055	1.002	1.101	1.040	1.026	1.014	1.021	1.012	1.065	1.047	1.037	1.039
W02000350	Newport 004	0.998	1.003	1.037	1.044	1.033	1.015	1.024	1.018	1.017	1.055	1.053	1.041
W02000351	Newport 005	1.030	1.018	1.074	1.056	1.015	1.031	1.030	1.026	1.053	1.038	1.031	1.035
W02000352	Newport 006	1.034	1.005	1.080	1.048	1.027	1.017	1.021	1.024	1.059	1.055	1.040	1.048
W02000353	Newport 007	1.025	1.001	1.069	1.040	1.008	1.013	1.014	1.013	1.048	1.036	1.023	1.034
W02000354	Newport 008	1.030	1.041	1.074	1.084	1.040	1.054	1.054	1.058	1.051	1.043	1.047	1.040
W02000355	Newport 009	1.008	1.023	1.050	1.063	1.030	1.036	1.038	1.036	1.034	1.058	1.051	1.053
W02000356	Newport 010	1.062	0.996	1.107	1.037	1.020	1.008	1.019	1.010	1.074	1.062	1.070	1.063
W02000357	Newport 011	1.030	1.011	1.075	1.056	1.027	1.024	1.028	1.033	1.053	1.050	1.038	1.042
W02000358	Newport 012	1.016	1.012	1.058	1.053	1.015	1.024	1.024	1.029	1.040	1.047	1.028	1.040
W02000359	Newport 013	1.029	1.011	1.075	1.048	1.032	1.024	1.028	1.020	1.052	1.054	1.044	1.043
W02000360	Newport 014	1.033	1.025	1.082	1.067	1.036	1.038	1.040	1.042	1.062	1.056	1.048	1.041
W02000361	Newport 015	1.039	1.017	1.085	1.058	1.026	1.030	1.032	1.032	1.055	1.045	1.033	1.032
W02000362	Newport 016	1.017	1.020	1.061	1.059	1.013	1.032	1.031	1.033	1.038	1.028	1.022	1.031
W02000363	Newport 017	1.036	1.013	1.080	1.053	1.042	1.026	1.032	1.025	1.059	1.053	1.046	1.045
W02000364	Newport 018	1.053	1.014	1.100	1.057	1.032	1.027	1.032	1.032	1.069	1.057	1.043	1.042
W02000365	Newport 019	1.037	1.009	1.082	1.049	1.023	1.022	1.025	1.022	1.055	1.045	1.034	1.043
W02000366	Newport 020	1.000	1.006	1.039	1.051	1.012	1.019	1.021	1.030	1.038	1.051	1.029	1.040
Authority	RCT	1.004	1.015	1.047	1.056	1.026	1.027	1.030	1.030	1.045	1.046	1.038	1.040
Authority	Glamorgan	0.993	1.019	1.034	1.059	1.033	1.032	1.035	1.033	1.042	1.054	1.049	1.047
Authority	Torfaen	0.984	1.017	1.028	1.058	1.028	1.029	1.032	1.033	1.031	1.046	1.040	1.041
County	South West Wales	0.995	0.996	1.037	1.037	1.017	1.015	1.014	1.014	1.044	1.046	1.035	1.035
Authority	Carmarthenshire	0.993	0.984	1.034	1.025	1.013	1.009	1.005	1.002	1.060	1.051	1.033	1.034
Authority	Neath Port Talbot	0.970	0.995	1.013	1.037	1.021	1.019	1.014	1.015	1.037	1.048	1.037	1.038
Authority	Pembrokeshire	1.013	1.018	1.051	1.056	1.023	1.016	1.032	1.031	1.019	1.028	1.032	1.031
Authority	Swansea	1.002	0.993	1.044	1.035	1.014	1.017	1.012	1.013	1.050	1.051	1.038	1.037
Region	West Midlands	1.014	1.014	1.054	1.054	1.028	1.028	1.030	1.030	1.053	1.053	1.045	1.045
Region	Yorkshire/ Humber	1.032	1.032	1.072	1.072	1.033	1.033	1.044	1.044	1.047	1.047	1.046	1.046

Table A2: NTEM Car Driver Growth, 2014 to 2037, Average Weekday

Area Description		Car Driver Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.100	1.100	1.158	1.158	1.139	1.139	1.124	1.124	1.200	1.200	1.169	1.169
Region	East of England	1.067	1.094	1.124	1.154	1.179	1.182	1.131	1.128	1.270	1.284	1.220	1.223
Region	East Midlands	1.086	1.086	1.142	1.142	1.125	1.125	1.109	1.109	1.188	1.188	1.158	1.158
Region	London	1.183	1.120	1.236	1.180	1.197	1.187	1.156	1.155	1.299	1.274	1.228	1.224
Region	North East	1.118	1.118	1.180	1.180	1.116	1.116	1.130	1.130	1.146	1.146	1.138	1.138
Region	North West	1.107	1.107	1.161	1.161	1.115	1.115	1.120	1.120	1.150	1.150	1.137	1.137
Region	Scotland	1.103	1.103	1.163	1.163	1.115	1.115	1.118	1.118	1.171	1.171	1.147	1.147
Region	South East	1.089	1.102	1.145	1.160	1.154	1.154	1.131	1.129	1.228	1.227	1.186	1.188
Region	South West	1.087	1.087	1.142	1.142	1.126	1.126	1.111	1.111	1.186	1.186	1.158	1.158
Region	Wales	1.080	1.080	1.135	1.135	1.099	1.099	1.099	1.099	1.149	1.149	1.128	1.128
County	Mid Wales	0.996	1.056	1.048	1.110	1.052	1.057	1.072	1.070	1.076	1.098	1.091	1.088
County	North Wales	1.073	1.065	1.131	1.122	1.080	1.079	1.085	1.085	1.127	1.126	1.109	1.109
County	South East Wales	1.099	1.094	1.156	1.149	1.116	1.116	1.113	1.113	1.172	1.169	1.145	1.145
Authority	Blaenau Gwent	1.033	1.097	1.092	1.152	1.122	1.119	1.116	1.115	1.105	1.144	1.141	1.139
Authority	Bridgend	1.065	1.094	1.128	1.150	1.115	1.116	1.114	1.114	1.154	1.169	1.147	1.148
Authority	Caerphilly	1.041	1.095	1.099	1.151	1.112	1.117	1.113	1.114	1.133	1.150	1.137	1.143
Authority	Cardiff	1.273	1.089	1.342	1.145	1.112	1.111	1.105	1.108	1.309	1.189	1.144	1.147
Authority	Merthyr Tydfil	1.115	1.095	1.182	1.152	1.119	1.117	1.114	1.116	1.204	1.168	1.146	1.143
Authority	Monmouthshire	0.946	1.093	0.994	1.148	1.120	1.115	1.115	1.111	1.072	1.162	1.150	1.143
W02000336	Monmouthshire 001	0.943	1.111	0.996	1.167	1.147	1.133	1.135	1.130	1.104	1.183	1.167	1.149
W02000337	Monmouthshire 002	0.990	1.071	1.044	1.123	1.087	1.092	1.089	1.084	1.115	1.124	1.109	1.121
W02000338	Monmouthshire 003	0.941	1.096	0.989	1.150	1.129	1.118	1.117	1.112	1.089	1.155	1.147	1.140
W02000339	Monmouthshire 004	0.960	1.082	1.015	1.136	1.109	1.104	1.103	1.098	1.121	1.151	1.136	1.134
W02000340	Monmouthshire 005	0.936	1.080	0.980	1.133	1.112	1.101	1.102	1.094	1.049	1.157	1.127	1.130
W02000341	Monmouthshire 006	0.922	1.089	0.969	1.144	1.115	1.111	1.113	1.108	1.036	1.164	1.154	1.148
W02000342	Monmouthshire 007	0.941	1.090	0.986	1.142	1.114	1.112	1.112	1.104	1.053	1.161	1.148	1.142
W02000343	Monmouthshire 008	0.965	1.097	1.024	1.154	1.123	1.120	1.117	1.118	1.078	1.161	1.142	1.144
W02000344	Monmouthshire 009	0.934	1.093	0.982	1.151	1.129	1.115	1.120	1.115	1.044	1.193	1.190	1.178
W02000345	Monmouthshire 010	0.980	1.089	1.035	1.139	1.108	1.111	1.105	1.098	1.109	1.146	1.131	1.134
W02000346	Monmouthshire 011	0.913	1.097	0.964	1.152	1.115	1.120	1.116	1.115	1.007	1.146	1.139	1.142
Authority	Newport	1.151	1.094	1.212	1.151	1.119	1.116	1.115	1.115	1.197	1.177	1.151	1.148
W02000347	Newport 001	1.079	1.106	1.139	1.162	1.127	1.128	1.135	1.125	1.134	1.199	1.201	1.187

Area Description		Car Driver Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	1.158	1.102	1.223	1.156	1.109	1.124	1.118	1.118	1.199	1.163	1.137	1.137
W02000349	Newport 003	1.240	1.082	1.314	1.134	1.116	1.104	1.106	1.095	1.259	1.171	1.140	1.138
W02000350	Newport 004	1.069	1.082	1.119	1.138	1.135	1.104	1.112	1.101	1.101	1.175	1.161	1.146
W02000351	Newport 005	1.163	1.099	1.227	1.152	1.103	1.121	1.115	1.110	1.213	1.168	1.130	1.133
W02000352	Newport 006	1.180	1.085	1.254	1.142	1.116	1.106	1.103	1.107	1.231	1.180	1.138	1.152
W02000353	Newport 007	1.154	1.081	1.224	1.134	1.093	1.102	1.097	1.096	1.200	1.153	1.118	1.134
W02000354	Newport 008	1.161	1.124	1.226	1.181	1.136	1.146	1.140	1.145	1.212	1.183	1.159	1.143
W02000355	Newport 009	1.103	1.105	1.158	1.158	1.119	1.127	1.122	1.121	1.147	1.186	1.151	1.155
W02000356	Newport 010	1.262	1.076	1.334	1.131	1.105	1.097	1.103	1.093	1.290	1.180	1.171	1.167
W02000357	Newport 011	1.170	1.092	1.242	1.151	1.119	1.114	1.113	1.117	1.217	1.177	1.142	1.144
W02000358	Newport 012	1.117	1.092	1.175	1.148	1.100	1.114	1.106	1.112	1.170	1.176	1.123	1.140
W02000359	Newport 013	1.174	1.092	1.252	1.143	1.129	1.114	1.114	1.103	1.216	1.178	1.147	1.145
W02000360	Newport 014	1.186	1.107	1.269	1.163	1.135	1.129	1.126	1.127	1.246	1.184	1.159	1.144
W02000361	Newport 015	1.195	1.099	1.266	1.153	1.115	1.121	1.116	1.116	1.228	1.162	1.131	1.134
W02000362	Newport 016	1.122	1.101	1.183	1.155	1.092	1.123	1.114	1.117	1.161	1.142	1.108	1.127
W02000363	Newport 017	1.175	1.094	1.243	1.148	1.137	1.116	1.117	1.108	1.233	1.174	1.148	1.147
W02000364	Newport 018	1.252	1.095	1.334	1.152	1.128	1.117	1.117	1.116	1.280	1.180	1.147	1.146
W02000365	Newport 019	1.193	1.090	1.264	1.143	1.109	1.112	1.109	1.106	1.226	1.158	1.129	1.144
W02000366	Newport 020	1.094	1.086	1.146	1.146	1.097	1.108	1.104	1.114	1.145	1.183	1.126	1.148
Authority	RCT	1.039	1.096	1.097	1.151	1.115	1.118	1.115	1.114	1.124	1.154	1.139	1.141
Authority	Glamorgan	1.031	1.100	1.087	1.155	1.123	1.122	1.120	1.117	1.131	1.170	1.152	1.149
Authority	Torfaen	1.011	1.098	1.070	1.153	1.117	1.120	1.117	1.117	1.103	1.155	1.141	1.142
County	South West Wales	1.072	1.072	1.128	1.128	1.097	1.095	1.094	1.094	1.149	1.150	1.128	1.128
Authority	Carmarthenshire	1.056	1.063	1.112	1.117	1.100	1.094	1.088	1.084	1.166	1.166	1.133	1.133
Authority	Neath Port Talbot	1.012	1.074	1.069	1.130	1.106	1.105	1.097	1.098	1.127	1.155	1.135	1.138
Authority	Pembrokeshire	1.074	1.084	1.127	1.139	1.080	1.072	1.099	1.099	1.086	1.092	1.096	1.095
Authority	Swansea	1.121	1.072	1.179	1.128	1.100	1.103	1.094	1.096	1.185	1.166	1.138	1.137
Region	West Midlands	1.090	1.090	1.145	1.145	1.127	1.127	1.112	1.112	1.184	1.184	1.155	1.155
Region	Yorkshire/ Humber	1.117	1.117	1.173	1.173	1.134	1.134	1.134	1.134	1.178	1.178	1.159	1.159

Table A3: NTEM Car Driver Growth, 2014 to 2051, Average Weekday

Area Description		Car Driver Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.185	1.185	1.265	1.265	1.241	1.241	1.215	1.215	1.320	1.320	1.274	1.274
Region	East of England	1.135	1.174	1.217	1.261	1.290	1.293	1.223	1.219	1.399	1.425	1.338	1.341
Region	East Midlands	1.166	1.166	1.243	1.243	1.226	1.226	1.197	1.197	1.310	1.310	1.264	1.264
Region	London	1.293	1.204	1.371	1.290	1.310	1.299	1.248	1.249	1.461	1.408	1.342	1.338
Region	North East	1.215	1.215	1.303	1.303	1.231	1.231	1.234	1.234	1.284	1.284	1.259	1.259
Region	North West	1.197	1.197	1.272	1.272	1.223	1.223	1.216	1.216	1.277	1.277	1.248	1.248
Region	Scotland	1.195	1.195	1.281	1.281	1.204	1.204	1.212	1.212	1.271	1.271	1.240	1.240
Region	South East	1.164	1.183	1.241	1.263	1.252	1.250	1.218	1.216	1.337	1.339	1.285	1.288
Region	South West	1.164	1.164	1.238	1.238	1.221	1.221	1.194	1.194	1.299	1.299	1.258	1.258
Region	Wales	1.159	1.159	1.233	1.233	1.170	1.170	1.178	1.178	1.221	1.221	1.200	1.200
County	Mid Wales	1.045	1.127	1.112	1.199	1.111	1.116	1.144	1.141	1.110	1.152	1.151	1.147
County	North Wales	1.145	1.135	1.222	1.210	1.139	1.139	1.155	1.156	1.186	1.183	1.168	1.168
County	South East Wales	1.186	1.178	1.264	1.255	1.196	1.196	1.198	1.198	1.257	1.252	1.225	1.225
Authority	Blaenau Gwent	1.074	1.182	1.155	1.257	1.202	1.200	1.203	1.200	1.150	1.215	1.220	1.219
Authority	Bridgend	1.134	1.178	1.222	1.255	1.195	1.196	1.200	1.199	1.224	1.250	1.227	1.228
Authority	Caerphilly	1.099	1.180	1.179	1.256	1.192	1.197	1.200	1.200	1.195	1.227	1.217	1.223
Authority	Cardiff	1.444	1.174	1.542	1.249	1.192	1.191	1.188	1.193	1.472	1.281	1.224	1.227
Authority	Merthyr Tydfil	1.199	1.180	1.297	1.257	1.197	1.197	1.200	1.201	1.295	1.248	1.225	1.223
Authority	Monmouthshire	0.971	1.178	1.032	1.253	1.200	1.195	1.202	1.196	1.095	1.240	1.230	1.223
W02000336	Monmouthshire 001	0.967	1.197	1.035	1.274	1.226	1.215	1.223	1.217	1.132	1.262	1.248	1.229
W02000337	Monmouthshire 002	1.040	1.154	1.114	1.226	1.169	1.171	1.175	1.167	1.170	1.200	1.188	1.199
W02000338	Monmouthshire 003	0.962	1.180	1.024	1.255	1.206	1.198	1.202	1.198	1.105	1.227	1.223	1.217
W02000339	Monmouthshire 004	0.990	1.166	1.064	1.240	1.189	1.183	1.188	1.182	1.160	1.229	1.215	1.213
W02000340	Monmouthshire 005	0.956	1.164	1.009	1.237	1.194	1.181	1.188	1.178	1.058	1.237	1.206	1.210
W02000341	Monmouthshire 006	0.934	1.173	0.990	1.248	1.195	1.191	1.199	1.192	1.041	1.243	1.237	1.227
W02000342	Monmouthshire 007	0.963	1.175	1.017	1.248	1.196	1.192	1.199	1.189	1.064	1.242	1.229	1.222
W02000343	Monmouthshire 008	1.001	1.182	1.081	1.259	1.202	1.200	1.204	1.203	1.119	1.236	1.221	1.224
W02000344	Monmouthshire 009	0.956	1.178	1.014	1.256	1.214	1.196	1.208	1.201	1.055	1.282	1.280	1.265
W02000345	Monmouthshire 010	1.026	1.173	1.101	1.244	1.187	1.191	1.190	1.183	1.154	1.222	1.209	1.213
W02000346	Monmouthshire 011	0.922	1.182	0.982	1.257	1.193	1.200	1.203	1.200	1.014	1.217	1.217	1.221
Authority	Newport	1.263	1.179	1.348	1.256	1.199	1.197	1.201	1.200	1.308	1.262	1.233	1.229
W02000347	Newport 001	1.146	1.190	1.225	1.267	1.212	1.208	1.223	1.210	1.196	1.293	1.293	1.275

Area Description		Car Driver Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	1.272	1.187	1.367	1.262	1.190	1.205	1.205	1.204	1.305	1.252	1.217	1.217
W02000349	Newport 003	1.412	1.166	1.527	1.238	1.199	1.183	1.192	1.180	1.421	1.262	1.220	1.217
W02000350	Newport 004	1.127	1.166	1.190	1.242	1.212	1.183	1.197	1.185	1.147	1.254	1.241	1.227
W02000351	Newport 005	1.280	1.184	1.372	1.257	1.184	1.202	1.202	1.195	1.334	1.262	1.206	1.210
W02000352	Newport 006	1.309	1.168	1.420	1.246	1.195	1.186	1.187	1.193	1.369	1.267	1.217	1.232
W02000353	Newport 007	1.268	1.164	1.372	1.238	1.173	1.182	1.183	1.180	1.317	1.239	1.197	1.213
W02000354	Newport 008	1.280	1.211	1.373	1.289	1.215	1.229	1.227	1.233	1.322	1.280	1.238	1.223
W02000355	Newport 009	1.184	1.190	1.254	1.264	1.198	1.208	1.209	1.207	1.217	1.278	1.231	1.235
W02000356	Newport 010	1.452	1.159	1.571	1.235	1.190	1.177	1.189	1.177	1.471	1.274	1.260	1.251
W02000357	Newport 011	1.296	1.176	1.404	1.257	1.199	1.194	1.199	1.203	1.350	1.264	1.221	1.224
W02000358	Newport 012	1.202	1.177	1.279	1.253	1.179	1.194	1.192	1.198	1.243	1.266	1.202	1.219
W02000359	Newport 013	1.300	1.176	1.419	1.247	1.208	1.194	1.200	1.188	1.351	1.264	1.225	1.224
W02000360	Newport 014	1.320	1.192	1.445	1.270	1.214	1.210	1.212	1.214	1.396	1.265	1.238	1.224
W02000361	Newport 015	1.335	1.183	1.439	1.259	1.195	1.201	1.203	1.202	1.366	1.244	1.210	1.213
W02000362	Newport 016	1.208	1.187	1.290	1.261	1.175	1.204	1.202	1.203	1.239	1.236	1.191	1.209
W02000363	Newport 017	1.303	1.179	1.403	1.253	1.217	1.197	1.200	1.194	1.358	1.259	1.225	1.227
W02000364	Newport 018	1.437	1.180	1.568	1.257	1.206	1.197	1.203	1.202	1.467	1.260	1.226	1.226
W02000365	Newport 019	1.329	1.174	1.435	1.248	1.191	1.192	1.195	1.191	1.363	1.243	1.209	1.225
W02000366	Newport 020	1.171	1.170	1.237	1.251	1.176	1.188	1.190	1.200	1.215	1.273	1.207	1.232
Authority	RCT	1.094	1.180	1.175	1.256	1.195	1.198	1.201	1.200	1.186	1.231	1.219	1.221
Authority	Glamorgan	1.087	1.185	1.160	1.260	1.205	1.203	1.207	1.203	1.185	1.251	1.233	1.230
Authority	Torfaen	1.061	1.183	1.140	1.259	1.198	1.200	1.203	1.202	1.156	1.232	1.221	1.223
County	South West Wales	1.150	1.151	1.224	1.225	1.168	1.166	1.173	1.172	1.219	1.220	1.198	1.198
Authority	Carmarthenshire	1.129	1.143	1.203	1.216	1.175	1.168	1.169	1.164	1.236	1.244	1.209	1.209
Authority	Neath Port Talbot	1.071	1.155	1.148	1.230	1.182	1.181	1.178	1.179	1.190	1.228	1.211	1.214
Authority	Pembrokeshire	1.137	1.154	1.208	1.227	1.132	1.123	1.168	1.168	1.120	1.131	1.143	1.142
Authority	Swansea	1.222	1.152	1.300	1.227	1.175	1.179	1.174	1.177	1.279	1.245	1.213	1.212
Region	West Midlands	1.174	1.174	1.248	1.248	1.231	1.231	1.202	1.202	1.310	1.310	1.264	1.264
Region	Yorkshire/ Humber	1.209	1.209	1.287	1.287	1.244	1.244	1.232	1.232	1.309	1.309	1.273	1.273

A2 Rail

Table A4: NTEM Rail Passenger Growth, 2014 to 2022, Average Weekday

Level		Rail Passenger Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
		Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.023	1.023	1.041	1.041	1.019	1.019	1.023	1.023	1.002	1.002	1.026	1.026
Region	East of England	0.985	1.012	1.029	1.036	1.056	1.046	1.030	1.033	1.022	1.040	1.061	1.057
Region	East Midlands	0.987	0.987	1.007	1.007	1.013	1.013	1.000	1.000	0.987	0.987	1.015	1.015
Region	London	1.053	1.045	1.099	1.088	1.037	1.043	1.058	1.056	1.030	1.027	1.049	1.052
Region	North East	0.976	0.976	0.988	0.988	0.982	0.982	0.988	0.988	0.943	0.943	0.982	0.982
Region	North West	0.982	0.982	0.998	0.998	0.991	0.991	0.996	0.996	0.956	0.956	0.993	0.993
Region	Scotland	0.969	0.969	0.979	0.979	0.990	0.990	0.980	0.980	0.958	0.958	0.990	0.990
Region	South East	0.996	1.007	1.036	1.046	1.030	1.029	1.030	1.027	1.004	1.007	1.038	1.028
Region	South West	0.990	0.990	1.016	1.016	1.018	1.018	1.008	1.008	0.991	0.991	1.020	1.020
Region	Wales	0.965	0.965	0.991	0.991	0.998	0.998	0.989	0.989	0.969	0.969	0.998	0.998
County	Mid Wales	0.943	0.945	0.975	0.977	0.967	0.970	0.974	0.977	0.941	0.927	0.972	0.958
County	North Wales	0.952	0.952	0.986	0.986	0.991	0.991	0.983	0.983	0.952	0.955	0.991	0.993
County	South East Wales	0.976	0.975	0.998	0.997	1.005	1.004	0.995	0.994	0.978	0.978	1.006	1.006
Authority	Blaenau Gwent	0.944	0.986	0.966	1.008	1.018	1.016	1.009	1.005	0.926	0.965	1.005	0.991
Authority	Bridgend	0.960	0.978	0.994	1.001	1.014	1.008	1.006	0.997	0.958	0.988	1.020	1.017
Authority	Caerphilly	0.951	0.981	0.978	1.004	1.009	1.011	1.003	1.002	0.963	0.971	1.006	1.006
Authority	Cardiff	1.021	0.973	1.033	0.996	0.994	1.003	0.986	0.994	1.004	0.977	0.998	1.005
Authority	Merthyr Tydfil	0.963	0.979	0.992	1.003	1.009	1.009	0.999	1.000	0.966	0.977	1.001	0.995
Authority	Monmouthshire	0.944	0.981	0.981	1.004	1.020	1.012	1.011	1.001	0.963	0.988	1.018	1.008
W02000336	Monmouthshire 001	0.938	0.996	0.975	1.019	1.024	1.027	1.024	1.017	0.967	0.988	1.017	1.011
W02000337	Monmouthshire 002	0.931	0.960	0.963	0.981	0.995	0.990	0.989	0.976	0.933	0.949	0.982	0.970
W02000338	Monmouthshire 003	0.942	0.983	0.978	1.005	1.024	1.014	1.013	1.001	0.965	0.977	1.012	0.998
W02000339	Monmouthshire 004	0.949	0.971	0.981	0.992	1.009	1.001	0.996	0.988	0.962	0.976	1.005	0.992
W02000340	Monmouthshire 005	0.964	0.968	1.003	0.989	1.004	0.998	0.999	0.984	0.997	0.953	0.969	0.954
W02000341	Monmouthshire 006	0.942	0.978	0.980	1.000	1.033	1.008	1.020	0.997	0.966	1.008	1.036	1.022
W02000342	Monmouthshire 007	0.959	0.977	1.001	0.997	1.021	1.007	1.015	0.992	0.999	0.990	1.016	1.003
W02000343	Monmouthshire 008	0.926	0.984	0.958	1.008	1.015	1.015	1.007	1.006	0.931	0.977	1.007	1.009
W02000344	Monmouthshire 009	0.957	0.980	0.998	1.005	1.058	1.011	1.027	1.003	0.991	1.035	1.066	1.050
W02000345	Monmouthshire 010	0.936	0.977	0.971	0.995	1.002	1.007	0.993	0.988	0.943	0.959	0.986	0.970

		Rail Passenger Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000346	Monmouthshire 011	0.938	0.985	0.977	1.007	1.018	1.015	1.012	1.004	0.955	0.963	1.011	1.004
Authority	Newport	0.980	0.984	1.003	1.009	1.016	1.015	1.003	1.008	0.991	0.998	1.025	1.027
W02000347	Newport 001	0.964	0.994	1.006	1.016	1.047	1.024	1.042	1.014	0.980	1.046	1.070	1.061
W02000348	Newport 002	0.983	0.988	1.009	1.010	0.999	1.019	1.002	1.006	0.997	0.958	0.989	0.983
W02000349	Newport 003	0.992	0.970	0.996	0.990	1.009	1.000	0.993	0.985	0.986	0.969	0.994	0.985
W02000350	Newport 004	0.971	0.971	1.011	0.994	1.032	1.001	1.011	0.991	0.975	1.014	1.046	1.057
W02000351	Newport 005	0.979	0.986	1.001	1.006	0.992	1.016	1.000	0.998	0.994	0.954	0.981	0.971
W02000352	Newport 006	0.977	0.973	0.997	0.997	1.012	1.003	0.988	0.996	0.991	0.980	1.000	1.016
W02000353	Newport 007	0.977	0.969	1.003	0.990	0.990	0.999	0.988	0.986	0.992	0.955	0.979	0.981
W02000354	Newport 008	0.982	1.008	1.007	1.032	1.003	1.039	1.004	1.030	0.995	0.954	0.986	0.999
W02000355	Newport 009	0.978	0.991	1.022	1.012	1.019	1.022	1.005	1.008	1.004	0.996	1.020	1.021
W02000356	Newport 010	0.994	0.964	0.998	0.987	1.030	0.995	1.010	0.983	0.994	1.035	1.066	1.057
W02000357	Newport 011	0.977	0.979	0.993	1.006	1.009	1.010	0.997	1.005	0.988	0.969	0.991	0.989
W02000358	Newport 012	0.980	0.980	1.021	1.003	0.995	1.010	0.995	1.001	1.003	0.969	0.985	0.990
W02000359	Newport 013	0.977	0.979	0.995	0.998	1.015	1.010	0.996	0.993	0.987	0.979	0.997	0.991
W02000360	Newport 014	0.969	0.993	0.983	1.016	1.005	1.023	1.000	1.014	0.985	0.984	0.999	1.001
W02000361	Newport 015	0.984	0.985	0.993	1.008	1.012	1.016	1.004	1.004	0.982	0.965	0.990	0.971
W02000362	Newport 016	0.981	0.987	1.022	1.009	1.000	1.018	1.009	1.005	0.998	0.948	0.996	0.988
W02000363	Newport 017	0.980	0.981	1.001	1.002	1.017	1.012	0.990	0.997	0.995	0.970	0.993	0.997
W02000364	Newport 018	0.984	0.982	0.984	1.006	1.016	1.013	1.001	1.004	0.978	0.983	0.999	1.001
W02000365	Newport 019	0.983	0.977	1.004	0.999	1.007	1.008	0.999	0.995	0.995	0.962	0.992	0.990
W02000366	Newport 020	0.983	0.974	1.024	1.001	1.002	1.005	0.995	1.002	1.020	0.995	1.006	1.021
Authority	RCT	0.951	0.979	0.978	1.000	1.003	1.009	1.001	0.996	0.961	0.963	0.994	0.993
Authority	Glamorgan	0.958	0.987	0.992	1.008	1.017	1.017	1.009	1.003	0.983	0.985	1.019	1.011
Authority	Torfaen	0.943	0.984	0.974	1.006	1.014	1.014	1.007	1.003	0.967	0.974	1.007	1.005
County	South West Wales	0.954	0.954	0.986	0.986	1.000	0.998	0.984	0.983	0.972	0.974	0.998	0.998
Authority	Carmarthenshire	0.949	0.949	0.989	0.979	1.003	0.996	0.981	0.974	0.986	0.980	0.995	0.993
Authority	Neath Port Talbot	0.929	0.957	0.961	0.988	1.011	1.005	0.986	0.983	0.960	0.985	1.005	1.003
Authority	Pembrokeshire	0.954	0.961	0.987	0.992	0.993	0.982	0.997	0.993	0.916	0.935	0.988	0.988
Authority	Swansea	0.970	0.954	0.997	0.985	0.998	1.002	0.980	0.982	0.990	0.982	1.002	1.003
Region	West Midlands	0.976	0.976	1.004	1.004	1.008	1.008	0.999	0.999	0.984	0.984	1.009	1.009
Region	Yorkshire/ Humber	0.987	0.987	1.008	1.008	1.001	1.001	1.006	1.006	0.969	0.969	1.003	1.003

Table A5: NTEM Rail Passenger Growth, 2014 to 2037, Average Weekday

Area Description		Rail Passenger Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.062	1.062	1.077	1.077	1.089	1.089	1.064	1.064	1.073	1.073	1.078	1.078
Region	East of England	0.977	1.052	1.050	1.085	1.182	1.159	1.090	1.092	1.115	1.159	1.164	1.150
Region	East Midlands	1.010	1.010	1.024	1.024	1.076	1.076	1.032	1.032	1.017	1.017	1.052	1.052
Region	London	1.119	1.101	1.190	1.162	1.138	1.152	1.121	1.119	1.167	1.161	1.134	1.141
Region	North East	0.970	0.970	0.967	0.967	0.997	0.997	0.995	0.995	0.903	0.903	0.968	0.968
Region	North West	0.983	0.983	0.991	0.991	1.018	1.018	1.010	1.010	0.941	0.941	0.995	0.995
Region	Scotland	0.962	0.962	0.960	0.960	1.013	1.013	0.989	0.989	0.917	0.917	0.983	0.983
Region	South East	1.004	1.037	1.060	1.087	1.119	1.118	1.076	1.071	1.078	1.091	1.106	1.085
Region	South West	1.015	1.015	1.042	1.042	1.090	1.090	1.045	1.045	1.039	1.039	1.068	1.068
Region	Wales	0.974	0.974	0.989	0.989	1.022	1.022	1.007	1.007	0.947	0.947	0.998	0.998
County	Mid Wales	0.903	0.932	0.941	0.968	0.979	0.965	0.993	0.985	0.862	0.871	0.964	0.942
County	North Wales	0.950	0.947	0.986	0.982	1.005	1.005	0.998	0.999	0.911	0.915	0.982	0.985
County	South East Wales	0.995	0.992	1.000	0.997	1.037	1.037	1.015	1.015	0.973	0.973	1.014	1.014
Authority	Blaenau Gwent	0.871	1.003	0.886	1.007	1.060	1.049	1.050	1.026	0.834	0.939	1.018	0.996
Authority	Bridgend	0.938	0.995	0.973	1.000	1.055	1.041	1.045	1.018	0.913	0.978	1.032	1.027
Authority	Caerphilly	0.913	0.998	0.929	1.003	1.045	1.044	1.038	1.023	0.914	0.957	1.016	1.014
Authority	Cardiff	1.155	0.990	1.138	0.996	1.015	1.035	0.994	1.015	1.078	0.979	1.002	1.012
Authority	Merthyr Tydfil	0.939	0.996	0.954	1.002	1.047	1.042	1.029	1.021	0.899	0.968	1.008	1.001
Authority	Monmouthshire	0.867	0.998	0.914	1.003	1.066	1.044	1.059	1.022	0.898	0.971	1.032	1.020
W02000336	Monmouthshire 001	0.847	1.014	0.894	1.019	1.083	1.061	1.077	1.038	0.910	0.975	1.037	1.026
W02000337	Monmouthshire 002	0.827	0.977	0.867	0.980	1.028	1.022	1.033	0.996	0.822	0.931	0.992	0.972
W02000338	Monmouthshire 003	0.858	1.000	0.904	1.004	1.072	1.046	1.061	1.022	0.912	0.951	1.018	1.001
W02000339	Monmouthshire 004	0.870	0.987	0.911	0.992	1.047	1.033	1.035	1.009	0.906	0.961	1.018	0.999
W02000340	Monmouthshire 005	0.906	0.985	0.954	0.989	1.055	1.031	1.056	1.005	0.968	0.939	0.981	0.963
W02000341	Monmouthshire 006	0.871	0.994	0.917	0.999	1.081	1.040	1.081	1.018	0.911	0.991	1.050	1.036
W02000342	Monmouthshire 007	0.912	0.995	0.963	0.997	1.069	1.041	1.076	1.014	0.972	0.968	1.025	1.012
W02000343	Monmouthshire 008	0.827	1.002	0.871	1.007	1.059	1.048	1.045	1.027	0.828	0.959	1.019	1.017
W02000344	Monmouthshire 009	0.899	0.998	0.951	1.005	1.105	1.044	1.079	1.024	0.952	1.023	1.082	1.068
W02000345	Monmouthshire 010	0.841	0.994	0.885	0.995	1.037	1.040	1.026	1.009	0.853	0.945	0.997	0.975
W02000346	Monmouthshire 011	0.874	1.002	0.924	1.006	1.067	1.048	1.062	1.025	0.886	0.928	1.025	1.011
Authority	Newport	1.013	1.001	1.022	1.008	1.055	1.048	1.035	1.029	1.027	0.993	1.034	1.040
W02000347	Newport 001	0.996	1.010	1.044	1.014	1.082	1.056	1.092	1.034	1.005	1.034	1.084	1.081

Area Description		Rail Passenger Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	1.022	1.006	1.040	1.009	1.025	1.052	1.034	1.027	1.048	0.958	0.992	0.988
W02000349	Newport 003	1.032	0.987	0.996	0.990	1.036	1.033	1.024	1.006	1.019	0.979	1.000	0.988
W02000350	Newport 004	1.005	0.988	1.056	0.993	1.090	1.033	1.065	1.012	0.983	1.000	1.062	1.076
W02000351	Newport 005	1.008	1.003	1.011	1.006	1.020	1.050	1.036	1.020	1.030	0.950	0.977	0.962
W02000352	Newport 006	0.999	0.990	1.000	0.997	1.045	1.036	1.011	1.018	1.024	0.974	1.001	1.024
W02000353	Newport 007	1.004	0.986	1.018	0.990	1.020	1.032	1.025	1.007	1.031	0.951	0.982	0.984
W02000354	Newport 008	1.018	1.026	1.029	1.032	1.033	1.073	1.006	1.052	1.048	0.960	0.978	1.008
W02000355	Newport 009	1.024	1.008	1.078	1.011	1.056	1.055	1.031	1.030	1.064	0.995	1.024	1.029
W02000356	Newport 010	1.034	0.982	0.992	0.987	1.063	1.027	1.055	1.004	1.025	1.030	1.079	1.075
W02000357	Newport 011	1.002	0.996	0.995	1.005	1.044	1.043	1.028	1.026	1.018	0.971	0.996	0.992
W02000358	Newport 012	1.024	0.997	1.074	1.002	1.030	1.043	1.027	1.022	1.065	0.972	0.990	0.992
W02000359	Newport 013	1.001	0.996	0.998	0.998	1.057	1.042	1.027	1.014	1.011	0.980	1.002	0.995
W02000360	Newport 014	0.982	1.010	0.973	1.016	1.040	1.057	1.014	1.036	1.012	0.982	1.003	1.009
W02000361	Newport 015	1.020	1.003	0.992	1.007	1.061	1.049	1.042	1.026	1.015	0.964	1.002	0.975
W02000362	Newport 016	1.020	1.005	1.071	1.009	1.036	1.051	1.056	1.027	1.053	0.952	1.008	0.997
W02000363	Newport 017	1.011	0.998	1.014	1.002	1.038	1.045	1.000	1.018	1.043	0.962	0.985	0.998
W02000364	Newport 018	1.018	0.999	0.970	1.006	1.064	1.046	1.035	1.026	1.002	0.978	1.008	1.008
W02000365	Newport 019	1.015	0.995	1.011	0.998	1.041	1.041	1.037	1.016	1.021	0.956	0.995	0.995
W02000366	Newport 020	1.052	0.991	1.109	1.000	1.048	1.037	1.031	1.024	1.079	0.995	1.018	1.040
Authority	RCT	0.901	0.996	0.919	1.000	1.037	1.041	1.030	1.017	0.895	0.952	1.003	0.998
Authority	Glamorgan	0.933	1.004	0.969	1.007	1.055	1.050	1.043	1.025	0.969	0.976	1.029	1.020
Authority	Torfaen	0.898	1.001	0.921	1.006	1.055	1.047	1.048	1.024	0.930	0.956	1.018	1.014
County	South West Wales	0.962	0.962	0.984	0.983	1.019	1.018	1.001	1.000	0.945	0.942	0.992	0.993
Authority	Carmarthenshire	0.935	0.959	0.981	0.976	1.032	1.020	1.009	0.992	0.955	0.957	0.997	0.993
Authority	Neath Port Talbot	0.898	0.968	0.920	0.986	1.036	1.029	1.007	1.001	0.902	0.959	1.005	1.002
Authority	Pembrokeshire	0.938	0.947	0.979	0.985	0.988	0.976	1.008	1.003	0.853	0.855	0.959	0.960
Authority	Swansea	1.021	0.965	1.024	0.983	1.017	1.026	0.992	1.001	0.993	0.960	0.997	1.001
Region	West Midlands	0.984	0.984	1.014	1.014	1.061	1.061	1.025	1.025	1.006	1.006	1.038	1.038
Region	Yorkshire/ Humber	0.988	0.988	1.004	1.004	1.044	1.044	1.025	1.025	0.974	0.974	1.019	1.019

Table A6: NTEM 7LDP Rail Passenger Growth, 2014 to 2051, Average Weekday

Area Description		Rail Passenger Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	1.087	1.087	1.116	1.116	1.141	1.141	1.099	1.099	1.101	1.101	1.111	1.111
Region	East of England	0.981	1.075	1.083	1.125	1.262	1.219	1.139	1.134	1.136	1.197	1.220	1.199
Region	East Midlands	1.030	1.030	1.052	1.052	1.138	1.138	1.068	1.068	1.043	1.043	1.088	1.088
Region	London	1.156	1.134	1.258	1.223	1.185	1.207	1.162	1.163	1.218	1.209	1.175	1.186
Region	North East	0.971	0.971	0.977	0.977	1.050	1.050	1.020	1.020	0.911	0.911	0.991	0.991
Region	North West	0.988	0.988	1.008	1.008	1.072	1.072	1.039	1.039	0.956	0.956	1.023	1.023
Region	Scotland	0.954	0.954	0.958	0.958	1.032	1.032	1.002	1.002	0.881	0.881	0.975	0.975
Region	South East	1.018	1.057	1.096	1.132	1.176	1.167	1.118	1.107	1.095	1.116	1.144	1.115
Region	South West	1.040	1.040	1.077	1.077	1.154	1.154	1.085	1.085	1.069	1.069	1.109	1.109
Region	Wales	0.983	0.983	0.997	0.997	1.039	1.039	1.027	1.027	0.917	0.917	0.994	0.994
County	Mid Wales	0.899	0.933	0.948	0.980	0.991	0.964	1.019	1.004	0.802	0.822	0.957	0.931
County	North Wales	0.953	0.949	0.997	0.994	1.017	1.017	1.018	1.019	0.869	0.874	0.976	0.979
County	South East Wales	1.006	1.002	1.006	1.003	1.059	1.059	1.034	1.035	0.951	0.951	1.012	1.012
Authority	Blaenau Gwent	0.822	1.013	0.838	1.013	1.091	1.071	1.090	1.046	0.756	0.902	1.020	0.994
Authority	Bridgend	0.926	1.006	0.972	1.006	1.085	1.063	1.083	1.038	0.864	0.950	1.035	1.028
Authority	Caerphilly	0.890	1.008	0.910	1.009	1.073	1.066	1.072	1.043	0.864	0.927	1.016	1.014
Authority	Cardiff	1.230	1.000	1.193	1.001	1.028	1.057	1.001	1.035	1.105	0.963	0.998	1.009
Authority	Merthyr Tydfil	0.910	1.006	0.929	1.008	1.070	1.063	1.055	1.041	0.834	0.939	1.003	0.998
Authority	Monmouthshire	0.848	1.009	0.908	1.009	1.099	1.066	1.105	1.042	0.848	0.940	1.035	1.024
W02000336	Monmouthshire 001	0.818	1.025	0.879	1.025	1.109	1.083	1.123	1.058	0.848	0.941	1.038	1.031
W02000337	Monmouthshire 002	0.781	0.988	0.829	0.986	1.064	1.044	1.080	1.016	0.729	0.900	1.001	0.968
W02000338	Monmouthshire 003	0.835	1.010	0.894	1.010	1.101	1.068	1.104	1.042	0.856	0.912	1.014	0.994
W02000339	Monmouthshire 004	0.848	0.998	0.900	0.998	1.079	1.055	1.074	1.028	0.863	0.930	1.022	1.000
W02000340	Monmouthshire 005	0.913	0.996	0.969	0.995	1.090	1.053	1.109	1.025	0.947	0.911	0.984	0.964
W02000341	Monmouthshire 006	0.858	1.004	0.913	1.005	1.120	1.061	1.139	1.037	0.870	0.961	1.055	1.042
W02000342	Monmouthshire 007	0.922	1.006	0.982	1.004	1.104	1.063	1.134	1.035	0.956	0.933	1.023	1.013
W02000343	Monmouthshire 008	0.785	1.012	0.848	1.013	1.086	1.070	1.081	1.047	0.755	0.926	1.018	1.016
W02000344	Monmouthshire 009	0.904	1.009	0.966	1.011	1.143	1.066	1.128	1.045	0.930	0.999	1.088	1.078
W02000345	Monmouthshire 010	0.803	1.005	0.859	1.001	1.066	1.062	1.058	1.029	0.771	0.916	1.000	0.973
W02000346	Monmouthshire 011	0.862	1.012	0.925	1.012	1.103	1.069	1.111	1.044	0.850	0.883	1.029	1.013
Authority	Newport	1.028	1.012	1.034	1.014	1.079	1.070	1.063	1.049	1.032	0.967	1.031	1.044
W02000347	Newport 001	1.019	1.019	1.079	1.019	1.113	1.077	1.137	1.053	1.007	1.009	1.089	1.093

Area Description		Rail Passenger Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	1.042	1.017	1.063	1.015	1.047	1.074	1.064	1.047	1.054	0.929	0.987	0.992
W02000349	Newport 003	1.047	0.998	0.981	0.996	1.059	1.055	1.054	1.026	1.014	0.961	0.996	0.984
W02000350	Newport 004	1.036	0.998	1.101	0.999	1.124	1.055	1.112	1.031	0.979	0.970	1.064	1.086
W02000351	Newport 005	1.020	1.014	1.016	1.012	1.040	1.072	1.069	1.040	1.031	0.919	0.962	0.948
W02000352	Newport 006	1.002	1.000	0.998	1.003	1.065	1.057	1.030	1.037	1.025	0.946	0.991	1.023
W02000353	Newport 007	1.012	0.997	1.028	0.996	1.048	1.053	1.061	1.027	1.040	0.927	0.980	0.983
W02000354	Newport 008	1.039	1.037	1.049	1.038	1.036	1.096	1.000	1.072	1.051	0.932	0.947	1.014
W02000355	Newport 009	1.058	1.019	1.127	1.017	1.079	1.077	1.053	1.050	1.090	0.972	1.016	1.028
W02000356	Newport 010	1.048	0.992	0.970	0.993	1.097	1.049	1.098	1.024	1.016	1.008	1.085	1.085
W02000357	Newport 011	1.005	1.007	0.987	1.011	1.065	1.065	1.055	1.046	1.019	0.947	0.987	0.986
W02000358	Newport 012	1.055	1.007	1.123	1.008	1.049	1.065	1.056	1.042	1.077	0.949	0.982	0.985
W02000359	Newport 013	1.001	1.007	0.995	1.004	1.082	1.064	1.054	1.033	1.013	0.958	0.991	0.989
W02000360	Newport 014	0.975	1.021	0.957	1.022	1.048	1.079	1.022	1.056	1.012	0.954	0.986	1.007
W02000361	Newport 015	1.036	1.013	0.983	1.013	1.096	1.071	1.079	1.046	1.020	0.940	1.003	0.972
W02000362	Newport 016	1.046	1.016	1.115	1.015	1.080	1.074	1.105	1.047	1.067	0.929	1.029	1.007
W02000363	Newport 017	1.024	1.009	1.021	1.008	1.052	1.067	1.004	1.038	1.043	0.933	0.966	0.992
W02000364	Newport 018	1.023	1.010	0.937	1.012	1.089	1.067	1.065	1.046	1.000	0.950	0.999	1.006
W02000365	Newport 019	1.023	1.006	1.009	1.004	1.075	1.063	1.075	1.036	1.021	0.929	0.995	1.000
W02000366	Newport 020	1.108	1.002	1.182	1.006	1.074	1.059	1.065	1.044	1.115	0.974	1.017	1.048
Authority	RCT	0.870	1.006	0.891	1.006	1.060	1.063	1.059	1.037	0.830	0.928	1.003	0.996
Authority	Glamorgan	0.927	1.014	0.974	1.013	1.082	1.072	1.075	1.045	0.947	0.949	1.029	1.020
Authority	Torfaen	0.876	1.012	0.902	1.012	1.085	1.069	1.088	1.044	0.889	0.923	1.018	1.015
County	South West Wales	0.973	0.973	0.992	0.990	1.034	1.033	1.020	1.019	0.915	0.909	0.985	0.987
Authority	Carmarthenshire	0.935	0.971	0.992	0.983	1.055	1.038	1.038	1.010	0.920	0.930	0.996	0.990
Authority	Neath Port Talbot	0.887	0.980	0.906	0.992	1.055	1.047	1.029	1.021	0.850	0.931	1.003	0.998
Authority	Pembrokeshire	0.937	0.948	0.991	0.996	0.987	0.975	1.029	1.023	0.803	0.791	0.942	0.944
Authority	Swansea	1.052	0.977	1.041	0.990	1.033	1.044	1.006	1.020	0.985	0.935	0.991	0.996
Region	West Midlands	0.992	0.992	1.036	1.036	1.118	1.118	1.057	1.057	1.023	1.023	1.070	1.070
Region	Yorkshire/ Humber	0.990	0.990	1.018	1.018	1.099	1.099	1.054	1.054	0.988	0.988	1.046	1.046

A3 Bus

Table A7: NTEM Bus Passenger Growth, 2014 to 2022, Average Weekday

Area Description		Bus Passenger Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
		Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	0.949	0.949	0.972	0.972	0.995	0.995	0.984	0.984	0.977	0.977	0.999	0.999
Region	East of England	0.932	0.970	0.958	1.002	1.040	1.033	1.007	1.009	1.021	1.031	1.049	1.050
Region	East Midlands	0.917	0.917	0.928	0.928	0.990	0.990	0.957	0.957	0.975	0.975	0.995	0.995
Region	London	1.019	1.003	1.049	1.038	1.025	1.033	1.034	1.034	1.020	1.018	1.034	1.036
Region	North East	0.905	0.905	0.908	0.908	0.950	0.950	0.934	0.934	0.926	0.926	0.952	0.952
Region	North West	0.923	0.923	0.925	0.925	0.961	0.961	0.948	0.948	0.936	0.936	0.964	0.964
Region	Scotland	0.894	0.894	0.904	0.904	0.962	0.962	0.930	0.930	0.955	0.955	0.971	0.971
Region	South East	0.939	0.955	0.951	0.972	1.010	1.014	0.993	0.993	0.987	0.988	1.017	1.010
Region	South West	0.926	0.926	0.930	0.930	0.995	0.995	0.965	0.965	0.972	0.972	0.998	0.998
Region	Wales	0.911	0.911	0.921	0.921	0.977	0.977	0.948	0.948	0.960	0.960	0.980	0.980
County	Mid Wales	0.896	0.888	0.908	0.891	0.945	0.947	0.937	0.928	0.940	0.914	0.953	0.942
County	North Wales	0.890	0.890	0.903	0.903	0.967	0.966	0.937	0.938	0.944	0.945	0.970	0.970
County	South East Wales	0.920	0.919	0.928	0.927	0.982	0.982	0.953	0.953	0.967	0.967	0.986	0.986
Authority	Blaenau Gwent	0.886	0.923	0.888	0.930	0.996	0.986	0.966	0.956	0.921	0.965	0.987	0.976
Authority	Bridgend	0.896	0.921	0.909	0.929	0.990	0.984	0.964	0.955	0.957	0.967	0.995	0.992
Authority	Caerphilly	0.898	0.921	0.906	0.929	0.986	0.983	0.958	0.954	0.947	0.964	0.985	0.983
Authority	Cardiff	0.955	0.916	0.963	0.924	0.973	0.978	0.947	0.949	0.998	0.969	0.982	0.987
Authority	Merthyr Tydfil	0.917	0.920	0.926	0.929	0.980	0.983	0.949	0.955	0.963	0.965	0.979	0.980
Authority	Monmouthshire	0.898	0.923	0.917	0.931	0.998	0.987	0.973	0.958	0.953	0.964	0.999	0.991
W02000336	Monmouthshire 001	0.885	0.936	0.898	0.944	0.999	1.000	0.980	0.971	0.956	0.964	0.993	0.988
W02000337	Monmouthshire 002	0.899	0.902	0.918	0.908	0.985	0.964	0.964	0.931	0.942	0.950	0.979	0.963
W02000338	Monmouthshire 003	0.901	0.923	0.918	0.931	1.004	0.986	0.977	0.956	0.955	0.961	0.996	0.986
W02000339	Monmouthshire 004	0.882	0.911	0.905	0.919	0.990	0.974	0.966	0.943	0.938	0.963	0.989	0.973
W02000340	Monmouthshire 005	0.932	0.909	0.959	0.915	0.996	0.971	0.970	0.939	0.977	0.956	0.969	0.955
W02000341	Monmouthshire 006	0.899	0.918	0.918	0.926	1.012	0.981	0.979	0.952	0.950	0.972	1.018	1.005
W02000342	Monmouthshire 007	0.937	0.917	0.971	0.924	0.998	0.980	0.967	0.948	0.982	0.963	0.999	0.988
W02000343	Monmouthshire 008	0.882	0.924	0.903	0.933	0.992	0.988	0.971	0.960	0.938	0.963	0.987	0.990
W02000344	Monmouthshire 009	0.922	0.921	0.949	0.930	1.031	0.984	0.982	0.957	0.969	0.990	1.050	1.032
W02000345	Monmouthshire 010	0.904	0.917	0.920	0.922	0.984	0.980	0.964	0.944	0.949	0.959	0.979	0.965

Area Description		Bus Passenger Growth 2014 to 2022											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000346	Monmouthshire 011	0.880	0.925	0.898	0.933	0.994	0.988	0.977	0.958	0.937	0.958	0.990	0.985
Authority	Newport	0.910	0.925	0.923	0.934	0.982	0.989	0.949	0.962	0.961	0.967	0.989	0.989
W02000347	Newport 001	0.892	0.933	0.906	0.941	1.005	0.997	0.966	0.968	0.951	0.981	1.039	1.036
W02000348	Newport 002	0.914	0.928	0.922	0.935	0.977	0.992	0.954	0.960	0.960	0.960	0.974	0.977
W02000349	Newport 003	0.914	0.911	0.923	0.917	0.987	0.973	0.944	0.941	0.950	0.969	0.982	0.977
W02000350	Newport 004	0.903	0.911	0.911	0.920	0.995	0.974	0.956	0.946	0.977	0.964	1.005	1.009
W02000351	Newport 005	0.906	0.926	0.922	0.931	0.970	0.989	0.951	0.953	0.961	0.950	0.968	0.972
W02000352	Newport 006	0.902	0.913	0.917	0.923	0.981	0.976	0.940	0.951	0.958	0.972	0.979	0.988
W02000353	Newport 007	0.908	0.910	0.920	0.917	0.968	0.972	0.941	0.941	0.961	0.956	0.966	0.972
W02000354	Newport 008	0.912	0.947	0.924	0.956	0.973	1.012	0.958	0.983	0.959	0.955	0.967	0.978
W02000355	Newport 009	0.931	0.931	0.951	0.937	0.974	0.995	0.949	0.963	0.978	0.967	0.988	0.993
W02000356	Newport 010	0.925	0.905	0.939	0.914	0.990	0.968	0.943	0.938	0.963	0.974	1.025	1.026
W02000357	Newport 011	0.901	0.919	0.911	0.931	0.983	0.983	0.949	0.959	0.957	0.967	0.977	0.980
W02000358	Newport 012	0.921	0.920	0.934	0.928	0.964	0.983	0.945	0.955	0.971	0.957	0.966	0.980
W02000359	Newport 013	0.901	0.919	0.913	0.924	0.981	0.982	0.943	0.948	0.957	0.969	0.979	0.980
W02000360	Newport 014	0.890	0.932	0.905	0.941	0.973	0.996	0.949	0.968	0.954	0.962	0.972	0.979
W02000361	Newport 015	0.907	0.925	0.914	0.933	0.985	0.989	0.960	0.959	0.947	0.965	0.974	0.967
W02000362	Newport 016	0.920	0.927	0.937	0.934	0.986	0.991	0.969	0.960	0.966	0.959	0.983	0.977
W02000363	Newport 017	0.907	0.921	0.921	0.928	0.995	0.984	0.942	0.952	0.961	0.983	0.982	0.980
W02000364	Newport 018	0.913	0.922	0.930	0.932	0.982	0.986	0.949	0.959	0.955	0.969	0.976	0.980
W02000365	Newport 019	0.919	0.918	0.937	0.925	0.983	0.981	0.947	0.950	0.961	0.970	0.978	0.981
W02000366	Newport 020	0.941	0.914	0.965	0.926	0.960	0.977	0.940	0.957	1.030	0.956	0.971	0.987
Authority	RCT	0.896	0.922	0.908	0.930	0.987	0.985	0.962	0.956	0.955	0.965	0.982	0.979
Authority	Glamorgan	0.904	0.926	0.922	0.933	0.995	0.989	0.967	0.959	0.972	0.970	0.997	0.993
Authority	Torfaen	0.883	0.923	0.897	0.931	0.989	0.986	0.956	0.956	0.956	0.968	0.984	0.981
County	South West Wales	0.909	0.911	0.922	0.924	0.981	0.979	0.946	0.946	0.964	0.968	0.983	0.982
Authority	Carmarthenshire	0.909	0.906	0.927	0.921	0.986	0.976	0.950	0.939	0.985	0.972	0.986	0.983
Authority	Neath Port Talbot	0.889	0.915	0.900	0.931	0.994	0.986	0.954	0.950	0.959	0.978	0.993	0.988
Authority	Pembrokeshire	0.887	0.905	0.882	0.906	0.976	0.963	0.947	0.946	0.910	0.940	0.964	0.960
Authority	Swansea	0.925	0.912	0.944	0.928	0.976	0.982	0.943	0.947	0.974	0.971	0.984	0.987
Region	West Midlands	0.929	0.929	0.943	0.943	0.983	0.983	0.959	0.959	0.967	0.967	0.987	0.987
Region	Yorkshire/ Humber	0.938	0.938	0.946	0.946	0.974	0.974	0.963	0.963	0.948	0.948	0.975	0.975

Table A8: NTEM Bus Passenger Growth, 2014 to 2037, Average Weekday

Area Description		Bus Passenger Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	0.902	0.902	0.921	0.921	1.025	1.025	0.973	0.973	0.988	0.988	1.024	1.024
Region	East of England	0.864	0.948	0.894	0.987	1.136	1.124	1.028	1.033	1.091	1.127	1.150	1.141
Region	East Midlands	0.842	0.842	0.833	0.833	1.010	1.010	0.924	0.924	0.965	0.965	1.005	1.005
Region	London	1.057	1.019	1.090	1.067	1.106	1.122	1.075	1.074	1.131	1.119	1.127	1.133
Region	North East	0.807	0.807	0.783	0.783	0.913	0.913	0.864	0.864	0.844	0.844	0.898	0.898
Region	North West	0.845	0.845	0.825	0.825	0.940	0.940	0.895	0.895	0.878	0.878	0.931	0.931
Region	Scotland	0.783	0.783	0.765	0.765	0.936	0.936	0.855	0.855	0.885	0.885	0.928	0.928
Region	South East	0.872	0.914	0.873	0.918	1.067	1.077	0.992	0.995	1.023	1.036	1.075	1.056
Region	South West	0.857	0.857	0.843	0.843	1.028	1.028	0.941	0.941	0.981	0.981	1.025	1.025
Region	Wales	0.828	0.828	0.807	0.807	0.957	0.957	0.898	0.898	0.906	0.906	0.950	0.950
County	Mid Wales	0.766	0.785	0.756	0.757	0.923	0.909	0.893	0.865	0.858	0.837	0.919	0.899
County	North Wales	0.792	0.790	0.774	0.772	0.938	0.937	0.880	0.882	0.876	0.877	0.929	0.930
County	South East Wales	0.847	0.845	0.823	0.822	0.970	0.970	0.908	0.908	0.925	0.924	0.964	0.964
Authority	Blaenau Gwent	0.753	0.848	0.725	0.824	0.990	0.974	0.933	0.911	0.804	0.914	0.970	0.953
Authority	Bridgend	0.787	0.846	0.778	0.823	0.988	0.972	0.934	0.910	0.894	0.921	0.979	0.971
Authority	Caerphilly	0.779	0.846	0.757	0.823	0.976	0.972	0.918	0.909	0.864	0.916	0.964	0.960
Authority	Cardiff	0.955	0.841	0.937	0.818	0.952	0.967	0.898	0.905	1.026	0.931	0.955	0.965
Authority	Merthyr Tydfil	0.809	0.845	0.788	0.823	0.968	0.971	0.895	0.910	0.875	0.920	0.955	0.957
Authority	Monmouthshire	0.744	0.848	0.751	0.825	1.006	0.975	0.956	0.913	0.883	0.915	0.988	0.972
W02000336	Monmouthshire 001	0.711	0.860	0.715	0.836	1.015	0.988	0.958	0.925	0.891	0.916	0.985	0.969
W02000337	Monmouthshire 002	0.742	0.829	0.738	0.805	0.977	0.952	0.956	0.888	0.851	0.896	0.967	0.938
W02000338	Monmouthshire 003	0.737	0.848	0.745	0.824	1.016	0.974	0.962	0.911	0.890	0.906	0.980	0.961
W02000339	Monmouthshire 004	0.701	0.837	0.714	0.814	0.986	0.962	0.948	0.899	0.852	0.916	0.975	0.951
W02000340	Monmouthshire 005	0.817	0.836	0.861	0.811	1.018	0.960	0.969	0.895	0.939	0.908	0.964	0.938
W02000341	Monmouthshire 006	0.753	0.843	0.769	0.820	1.029	0.969	0.972	0.907	0.884	0.921	1.010	0.988
W02000342	Monmouthshire 007	0.825	0.843	0.877	0.819	1.012	0.969	0.947	0.904	0.943	0.913	0.988	0.970
W02000343	Monmouthshire 008	0.720	0.849	0.719	0.827	0.994	0.976	0.948	0.915	0.849	0.913	0.969	0.969
W02000344	Monmouthshire 009	0.799	0.846	0.838	0.824	1.056	0.972	0.970	0.913	0.917	0.941	1.045	1.021
W02000345	Monmouthshire 010	0.756	0.843	0.745	0.816	0.976	0.969	0.942	0.899	0.874	0.910	0.962	0.942
W02000346	Monmouthshire 011	0.728	0.850	0.744	0.826	1.000	0.976	0.963	0.913	0.852	0.902	0.974	0.962
Authority	Newport	0.831	0.850	0.821	0.828	0.969	0.977	0.891	0.917	0.933	0.924	0.965	0.969
W02000347	Newport 001	0.805	0.856	0.810	0.833	0.996	0.984	0.909	0.921	0.926	0.936	1.025	1.024

Area Description		Bus Passenger Growth 2014 to 2037											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	0.848	0.853	0.829	0.828	0.958	0.980	0.898	0.915	0.943	0.919	0.947	0.954
W02000349	Newport 003	0.840	0.837	0.830	0.813	0.966	0.962	0.894	0.897	0.913	0.932	0.961	0.954
W02000350	Newport 004	0.846	0.837	0.844	0.815	1.004	0.962	0.924	0.901	0.976	0.917	0.987	0.992
W02000351	Newport 005	0.818	0.851	0.814	0.825	0.953	0.977	0.899	0.909	0.930	0.908	0.939	0.945
W02000352	Newport 006	0.805	0.839	0.802	0.818	0.963	0.964	0.883	0.906	0.921	0.929	0.947	0.965
W02000353	Newport 007	0.821	0.836	0.802	0.812	0.951	0.961	0.894	0.897	0.924	0.915	0.939	0.948
W02000354	Newport 008	0.839	0.870	0.822	0.847	0.945	1.000	0.876	0.937	0.944	0.912	0.929	0.956
W02000355	Newport 009	0.900	0.856	0.898	0.830	0.955	0.983	0.882	0.918	0.987	0.928	0.960	0.971
W02000356	Newport 010	0.859	0.832	0.858	0.810	0.977	0.957	0.894	0.894	0.933	0.935	1.008	1.011
W02000357	Newport 011	0.810	0.845	0.794	0.825	0.969	0.971	0.896	0.914	0.914	0.926	0.953	0.956
W02000358	Newport 012	0.876	0.845	0.863	0.822	0.949	0.971	0.892	0.911	0.985	0.917	0.937	0.956
W02000359	Newport 013	0.807	0.845	0.789	0.819	0.966	0.971	0.884	0.903	0.908	0.928	0.952	0.956
W02000360	Newport 014	0.776	0.857	0.771	0.834	0.954	0.984	0.879	0.923	0.916	0.919	0.942	0.956
W02000361	Newport 015	0.825	0.851	0.798	0.827	0.978	0.977	0.919	0.914	0.899	0.923	0.950	0.943
W02000362	Newport 016	0.872	0.853	0.867	0.828	0.975	0.979	0.939	0.915	0.963	0.920	0.964	0.954
W02000363	Newport 017	0.820	0.847	0.812	0.822	0.968	0.973	0.872	0.907	0.950	0.940	0.947	0.955
W02000364	Newport 018	0.844	0.848	0.845	0.826	0.972	0.974	0.894	0.914	0.920	0.925	0.949	0.957
W02000365	Newport 019	0.828	0.844	0.822	0.819	0.965	0.969	0.894	0.905	0.913	0.928	0.948	0.957
W02000366	Newport 020	0.933	0.841	0.973	0.821	0.948	0.966	0.885	0.912	1.065	0.917	0.946	0.972
Authority	RCT	0.767	0.847	0.754	0.824	0.978	0.973	0.926	0.911	0.866	0.918	0.962	0.956
Authority	Glamorgan	0.786	0.851	0.784	0.827	0.990	0.977	0.934	0.913	0.928	0.925	0.979	0.972
Authority	Torfaen	0.760	0.848	0.748	0.824	0.978	0.974	0.911	0.911	0.881	0.920	0.961	0.959
County	South West Wales	0.820	0.821	0.808	0.809	0.957	0.954	0.893	0.893	0.903	0.907	0.946	0.946
Authority	Carmarthenshire	0.808	0.819	0.804	0.811	0.974	0.955	0.913	0.888	0.936	0.915	0.959	0.952
Authority	Neath Port Talbot	0.775	0.828	0.764	0.820	0.974	0.965	0.909	0.898	0.873	0.918	0.961	0.955
Authority	Pembrokeshire	0.777	0.796	0.746	0.767	0.934	0.921	0.880	0.881	0.820	0.851	0.906	0.902
Authority	Swansea	0.858	0.825	0.853	0.817	0.950	0.961	0.884	0.896	0.930	0.917	0.947	0.953
Region	West Midlands	0.867	0.867	0.869	0.869	0.995	0.995	0.927	0.927	0.954	0.954	0.991	0.991
Region	Yorkshire/ Humber	0.859	0.859	0.849	0.849	0.972	0.972	0.915	0.915	0.919	0.919	0.962	0.962

Table A9: NTEM 7LDP Bus Passenger Growth, 2014 to 2051, Average Weekday

Area Description		Bus Passenger Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
GB	GB	0.838	0.838	0.854	0.854	1.040	1.040	0.948	0.948	0.972	0.972	1.027	1.027
Region	East of England	0.774	0.883	0.796	0.918	1.178	1.157	1.013	1.018	1.073	1.132	1.182	1.167
Region	East Midlands	0.766	0.766	0.745	0.745	1.031	1.031	0.892	0.892	0.950	0.950	1.013	1.013
Region	London	1.037	0.988	1.070	1.039	1.131	1.154	1.076	1.074	1.157	1.135	1.150	1.161
Region	North East	0.724	0.724	0.694	0.694	0.919	0.919	0.817	0.817	0.819	0.819	0.890	0.890
Region	North West	0.771	0.771	0.749	0.749	0.950	0.950	0.857	0.857	0.858	0.858	0.929	0.929
Region	Scotland	0.681	0.681	0.651	0.651	0.909	0.909	0.790	0.790	0.814	0.814	0.882	0.882
Region	South East	0.790	0.846	0.778	0.838	1.089	1.097	0.970	0.973	0.992	1.017	1.086	1.058
Region	South West	0.786	0.786	0.758	0.758	1.055	1.055	0.917	0.917	0.969	0.969	1.038	1.038
Region	Wales	0.737	0.737	0.692	0.692	0.937	0.937	0.845	0.845	0.842	0.842	0.911	0.911
County	Mid Wales	0.680	0.696	0.651	0.646	0.908	0.883	0.859	0.816	0.790	0.766	0.885	0.860
County	North Wales	0.699	0.698	0.661	0.659	0.916	0.916	0.831	0.834	0.809	0.810	0.890	0.890
County	South East Wales	0.756	0.754	0.706	0.704	0.950	0.951	0.852	0.853	0.861	0.860	0.925	0.926
Authority	Blaenau Gwent	0.627	0.757	0.577	0.707	0.978	0.955	0.890	0.856	0.703	0.841	0.936	0.915
Authority	Bridgend	0.684	0.755	0.650	0.706	0.977	0.953	0.895	0.855	0.823	0.851	0.945	0.934
Authority	Caerphilly	0.662	0.755	0.616	0.705	0.960	0.953	0.868	0.854	0.778	0.849	0.927	0.921
Authority	Cardiff	0.898	0.751	0.851	0.702	0.927	0.947	0.839	0.850	0.997	0.875	0.913	0.926
Authority	Merthyr Tydfil	0.685	0.755	0.641	0.706	0.943	0.952	0.829	0.855	0.787	0.852	0.910	0.917
Authority	Monmouthshire	0.650	0.757	0.640	0.708	1.002	0.956	0.930	0.857	0.818	0.838	0.961	0.941
W02000336	Monmouthshire 001	0.600	0.768	0.594	0.717	0.998	0.968	0.919	0.869	0.815	0.830	0.948	0.934
W02000337	Monmouthshire 002	0.632	0.740	0.599	0.690	0.981	0.933	0.946	0.834	0.750	0.830	0.954	0.903
W02000338	Monmouthshire 003	0.633	0.757	0.632	0.706	1.011	0.955	0.937	0.855	0.822	0.824	0.948	0.924
W02000339	Monmouthshire 004	0.587	0.748	0.588	0.698	0.982	0.943	0.924	0.844	0.768	0.846	0.949	0.916
W02000340	Monmouthshire 005	0.763	0.746	0.814	0.696	1.027	0.942	0.960	0.842	0.910	0.832	0.944	0.908
W02000341	Monmouthshire 006	0.674	0.752	0.686	0.703	1.041	0.949	0.957	0.851	0.835	0.848	0.990	0.960
W02000342	Monmouthshire 007	0.774	0.753	0.835	0.702	1.014	0.950	0.917	0.849	0.921	0.842	0.962	0.940
W02000343	Monmouthshire 008	0.618	0.758	0.588	0.709	0.982	0.957	0.916	0.859	0.761	0.833	0.931	0.932
W02000344	Monmouthshire 009	0.737	0.756	0.779	0.707	1.076	0.954	0.949	0.858	0.886	0.871	1.028	0.997
W02000345	Monmouthshire 010	0.654	0.753	0.611	0.700	0.968	0.949	0.912	0.845	0.778	0.838	0.933	0.904
W02000346	Monmouthshire 011	0.657	0.758	0.677	0.708	0.996	0.956	0.940	0.857	0.809	0.821	0.941	0.925
Authority	Newport	0.731	0.759	0.701	0.710	0.943	0.958	0.819	0.861	0.873	0.858	0.921	0.931
W02000347	Newport 001	0.726	0.764	0.717	0.713	0.991	0.963	0.842	0.864	0.884	0.887	1.002	1.000

Area Description		Bus Passenger Growth 2014 to 2051											
		HB Work		HB Employers Business		NHB Work		NHB Employers Business		HB Other		NHB Other	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction	Production	Attraction
W02000348	Newport 002	0.749	0.762	0.705	0.710	0.937	0.961	0.831	0.860	0.878	0.865	0.908	0.915
W02000349	Newport 003	0.728	0.748	0.698	0.697	0.947	0.943	0.833	0.842	0.838	0.876	0.926	0.917
W02000350	Newport 004	0.797	0.747	0.792	0.699	0.989	0.943	0.879	0.846	0.968	0.835	0.946	0.960
W02000351	Newport 005	0.711	0.760	0.687	0.708	0.932	0.958	0.834	0.854	0.860	0.847	0.895	0.904
W02000352	Newport 006	0.691	0.749	0.669	0.701	0.933	0.945	0.815	0.852	0.851	0.859	0.897	0.924
W02000353	Newport 007	0.719	0.747	0.673	0.697	0.936	0.942	0.837	0.843	0.858	0.861	0.902	0.910
W02000354	Newport 008	0.737	0.777	0.696	0.726	0.895	0.980	0.780	0.880	0.875	0.840	0.864	0.914
W02000355	Newport 009	0.859	0.764	0.842	0.712	0.922	0.963	0.802	0.862	0.961	0.861	0.913	0.932
W02000356	Newport 010	0.746	0.743	0.728	0.695	0.972	0.938	0.835	0.841	0.858	0.889	0.984	0.985
W02000357	Newport 011	0.694	0.754	0.653	0.707	0.943	0.952	0.831	0.859	0.841	0.860	0.908	0.916
W02000358	Newport 012	0.819	0.754	0.792	0.705	0.918	0.952	0.827	0.855	0.942	0.850	0.888	0.916
W02000359	Newport 013	0.700	0.754	0.665	0.702	0.936	0.952	0.812	0.848	0.843	0.857	0.902	0.915
W02000360	Newport 014	0.656	0.765	0.630	0.715	0.910	0.965	0.794	0.867	0.846	0.841	0.883	0.915
W02000361	Newport 015	0.720	0.759	0.661	0.709	0.961	0.958	0.867	0.859	0.825	0.855	0.908	0.904
W02000362	Newport 016	0.806	0.761	0.788	0.710	0.977	0.960	0.904	0.860	0.923	0.875	0.951	0.926
W02000363	Newport 017	0.709	0.756	0.677	0.705	0.938	0.954	0.789	0.852	0.877	0.882	0.898	0.911
W02000364	Newport 018	0.740	0.757	0.725	0.708	0.940	0.955	0.826	0.858	0.858	0.847	0.895	0.915
W02000365	Newport 019	0.718	0.753	0.690	0.703	0.950	0.950	0.831	0.851	0.839	0.876	0.910	0.918
W02000366	Newport 020	0.915	0.750	0.972	0.704	0.917	0.947	0.818	0.857	1.093	0.843	0.899	0.939
Authority	RCT	0.646	0.757	0.612	0.707	0.963	0.954	0.880	0.856	0.776	0.851	0.926	0.917
Authority	Glamorgan	0.693	0.760	0.675	0.709	0.977	0.958	0.890	0.858	0.866	0.855	0.945	0.936
Authority	Torfaen	0.650	0.757	0.618	0.707	0.960	0.955	0.854	0.856	0.797	0.853	0.921	0.919
County	South West Wales	0.730	0.732	0.694	0.695	0.935	0.933	0.839	0.839	0.841	0.843	0.905	0.905
Authority	Carmarthenshire	0.709	0.731	0.688	0.698	0.961	0.935	0.874	0.834	0.882	0.848	0.925	0.916
Authority	Neath Port Talbot	0.670	0.739	0.636	0.706	0.956	0.945	0.862	0.844	0.792	0.852	0.922	0.916
Authority	Pembrokeshire	0.679	0.704	0.631	0.654	0.906	0.893	0.829	0.831	0.755	0.781	0.860	0.857
Authority	Swansea	0.781	0.736	0.749	0.703	0.926	0.941	0.822	0.841	0.875	0.858	0.904	0.913
Region	West Midlands	0.798	0.798	0.795	0.795	1.010	1.010	0.894	0.894	0.936	0.936	0.994	0.994
Region	Yorkshire/ Humber	0.781	0.781	0.765	0.765	0.984	0.984	0.874	0.874	0.900	0.900	0.961	0.961

Appendix B – Uncertainty in Forecasting

B1 Uncertainty Log

Table B1: Uncertainty Log for M4CaN Traffic Forecasts

Input	Forecast Year	Description of Model Core Scenario Assumption	Uncertainty Assumption (Alternative Scenario Options)	Comments
National Uncertainty				
Growth in Demand	2022	NTEM	+ or – 7.07% of base demand	Able to apply quantitative range
	2037	NTEM	+ or – 11.99% of base demand	
	2051	NTEM	+ or – 15.00% of base demand	
Local Uncertainty: Factors Affecting Underlying Demand				
Future Land Use and Development Assumptions	2022	As described in Chapter 4	Uncertainty relating to this encapsulated within low and high growth forecasts.	
	2037			
	2051			
Local Uncertainty: Factors Affecting Supply for Transport				
Highway schemes within study area	2022	As described in Chapter 4	All schemes included in the forecast 'Do Minimum' scenario are considered highly likely to happen. No other potential highway schemes within study area are considered significant or likely to happen.	
	2037			
	2051			
Severn Bridge Tolls	2022	As described in Chapter 5	The current concession is likely to end late 2017 early 2018. Based on announcements in the Budget 2015 and Budget 2016 there is strong likelihood of reduced tolls in forecast years. The model toll assumption based on the two announcements is that of a half toll will be in place.	
	2037			
	2051			

Appendix C – Convergence Statistics

C1 Traffic Assignment Convergence

Table C1: Central Growth Assignment Convergence Statistics

AM Peak	2014	2022		2037		2051	
		Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum	Do Something
Number of Assignment / Simulation Loops	14	15	15	25	22	37	27
Wardrop Equilibrium Gap Function (%Gap)	0.045	0.033	0.027	0.023	0.026	0.026	0.034
Percentage of Link Flows changing by <1% - final four iterations	98.0	98.1	98.1	98.5	98.1	98.6	98.5
	98.4	98.3	98.7	98.1	98.8	98.5	98.7
	99.0	98.4	98.8	98.2	98.9	98.4	98.2
	99.0	98.7	99.1	98.2	98.9	98.6	98.2
Inter Peak							
Number of Assignment / Simulation Loops	16	28	18	20	20	23	20
Wardrop Equilibrium Gap Function (%Gap)	0.003	0.001	0.003	0.006	0.002	0.009	0.004
Percentage of Link Flows changing by <1% - final four iterations	98.4	98.3	98.1	98.1	98.8	98.7	98.1
	98.5	98.4	98.4	98.6	98.6	98.2	98.6
	98.8	99.0	98.6	98.8	98.9	98.6	98.3
	99.1	99.1	98.6	98.9	99.4	98.9	98.3
PM Peak							
Number of Assignment / Simulation Loops	15	17	14	20	22	26	21
Wardrop Equilibrium Gap Function (%Gap)	0.022	0.016	0.025	0.027	0.026	0.023	0.057
Percentage of Link Flows changing by <1% - final four iterations	98.3	98.3	98.2	98.3	98.4	98.0	98.1
	98.3	98.2	98.3	98.4	98.2	98.3	98.3
	98.7	98.6	98.5	98.7	98.7	98.2	98.4
	98.9	98.9	98.9	98.8	98.8	98.3	98.3

Appendix D – Low Growth Scenario

D1 Low Growth Traffic Forecasts

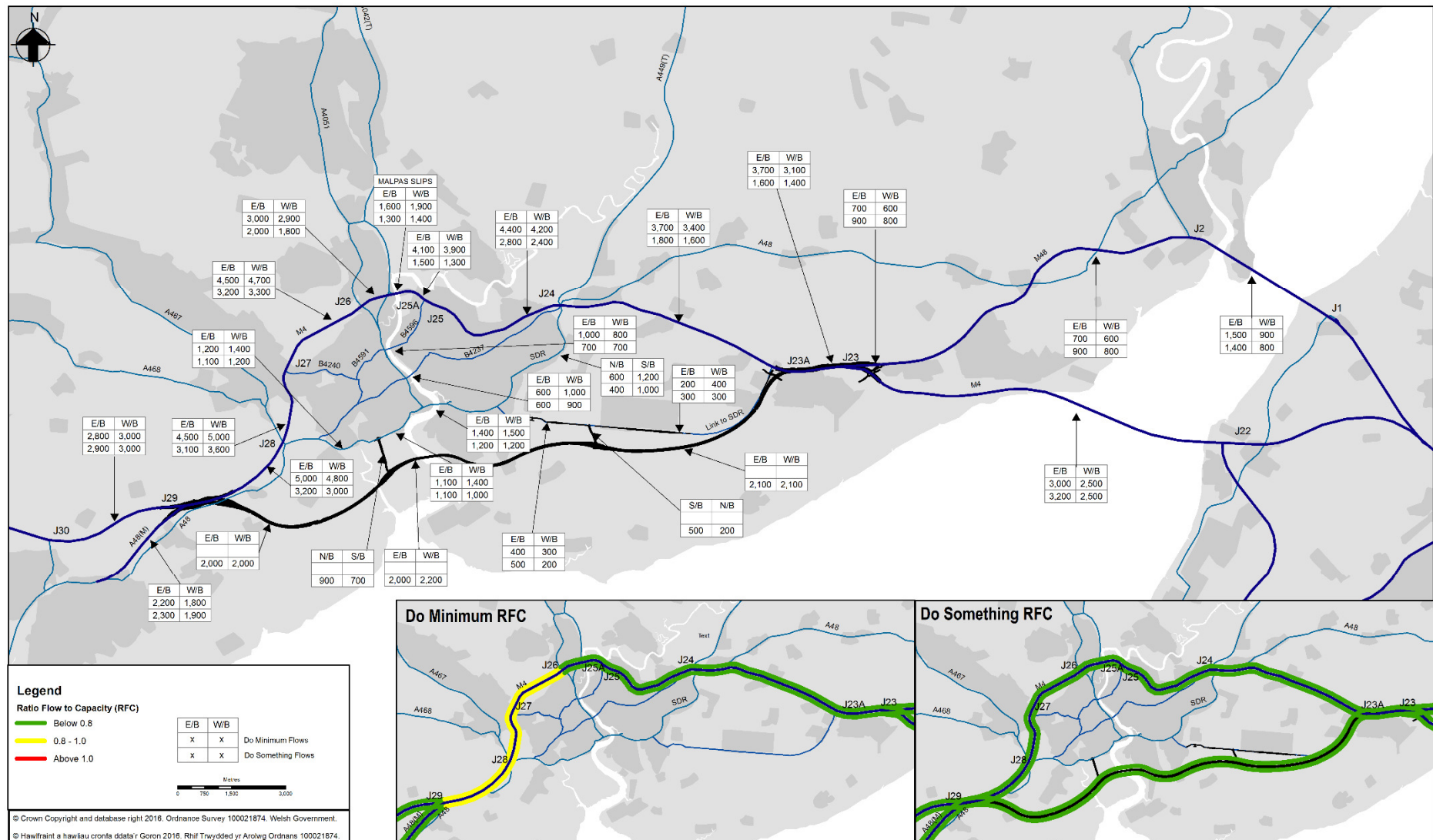


Figure D1: 2022 Forecast AM Peak Hour Traffic Flows, Low Growth



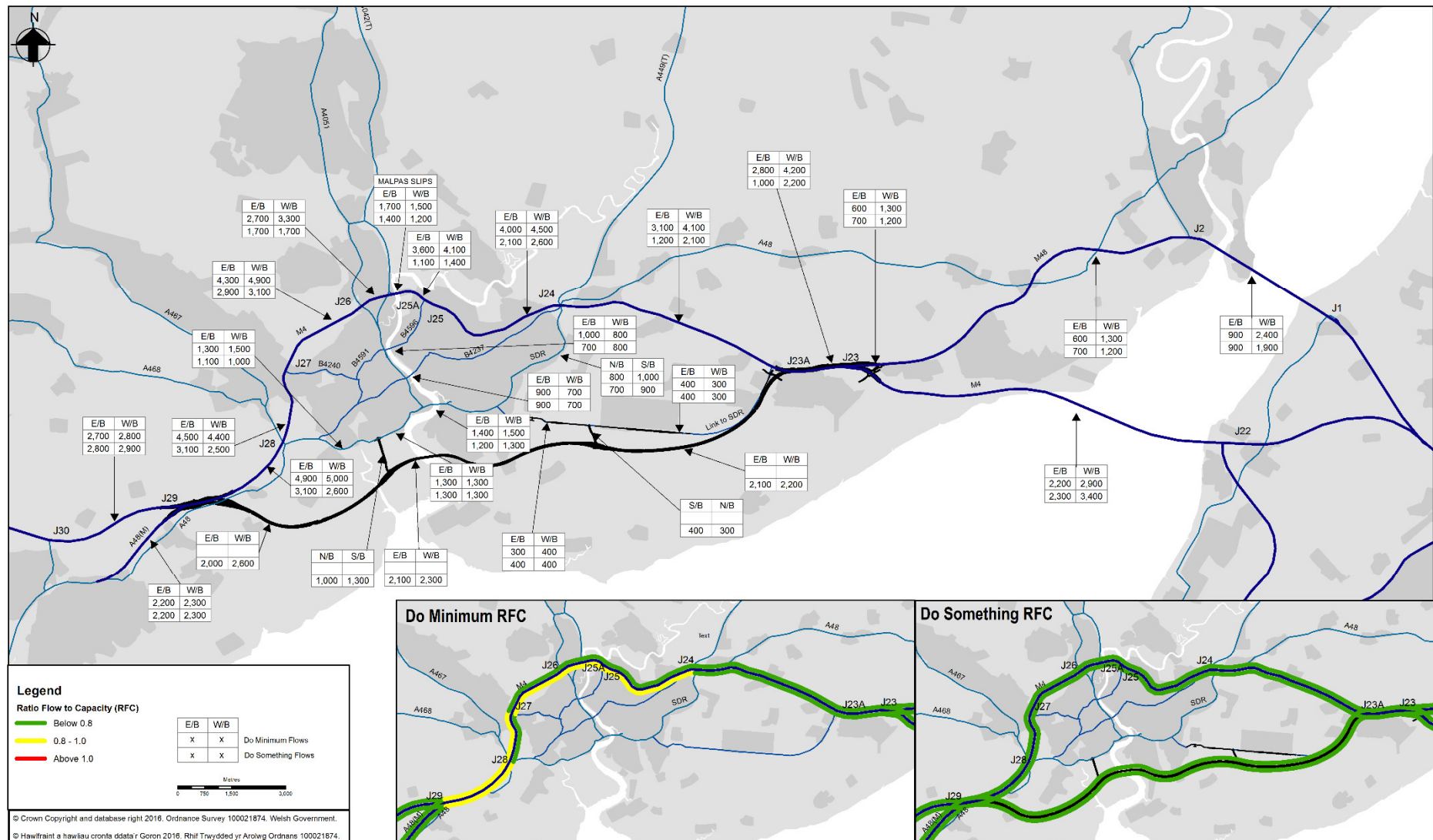


Figure D3: 2022 Forecast PM Peak Hour Traffic Flows, Low Growth

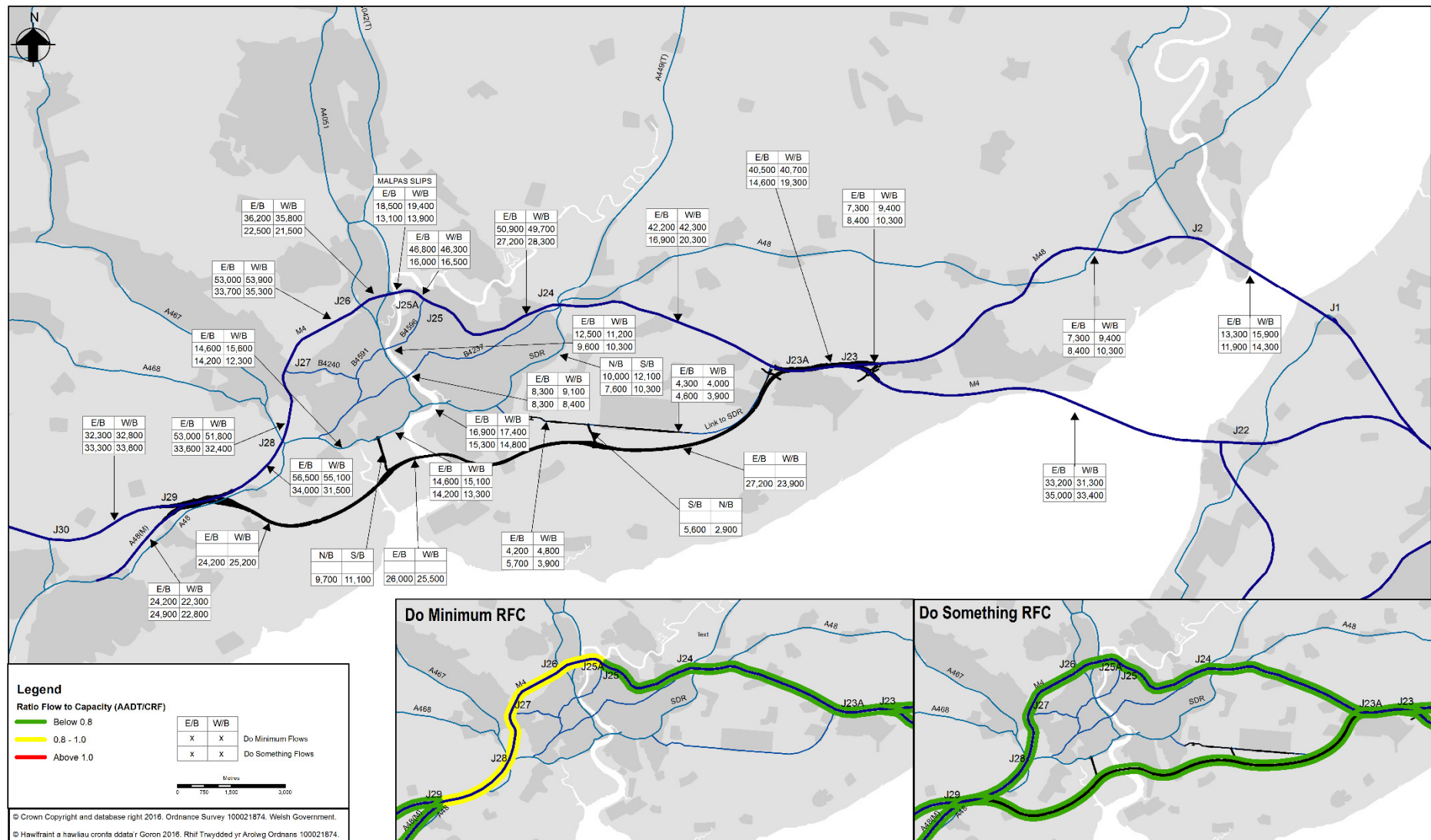


Figure D4: 2022 Forecast Annual Average Daily Traffic Flows, Low Growth

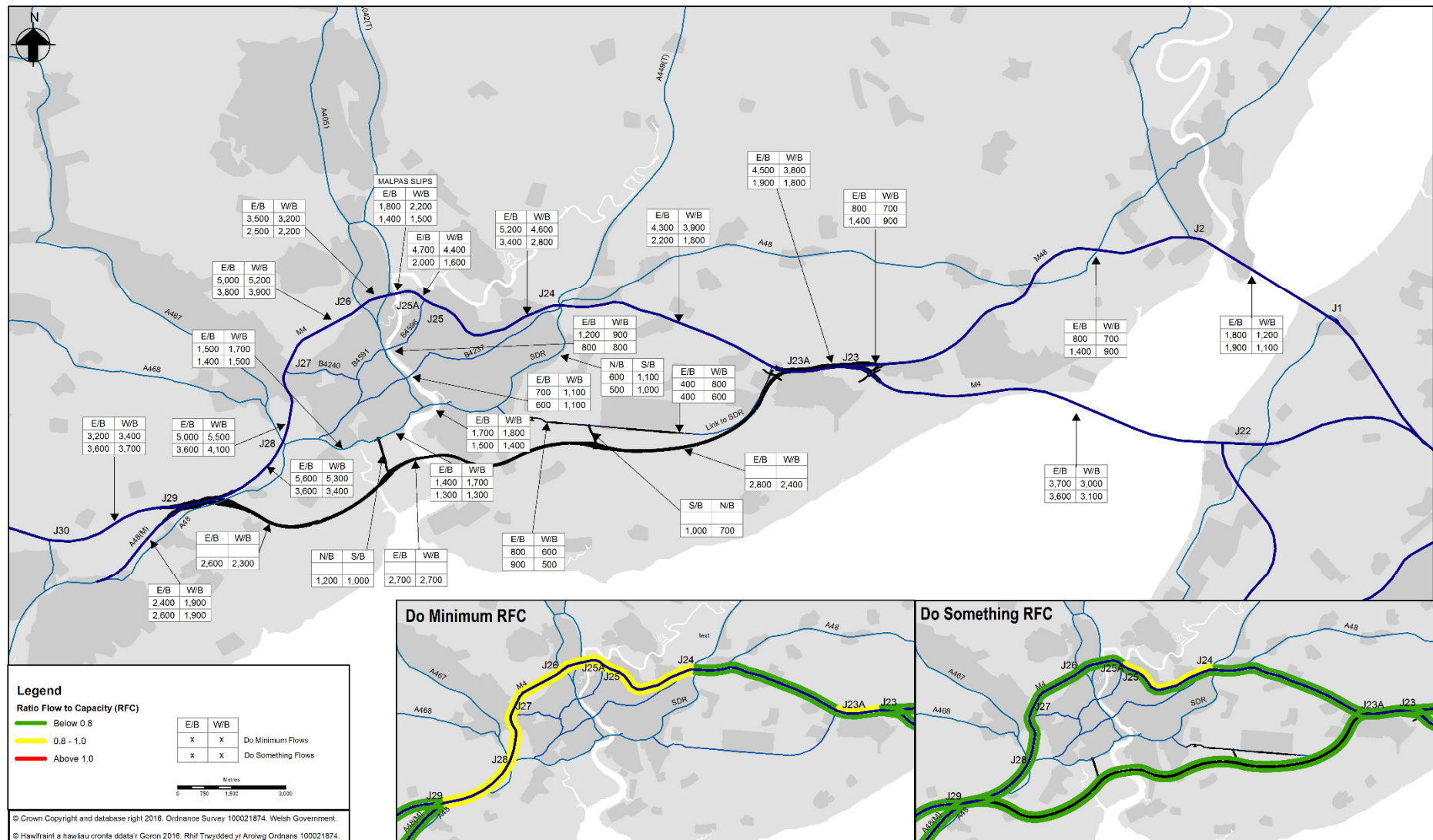


Figure D5: 2037 Forecast AM Peak Hour Traffic Flows, Low Growth

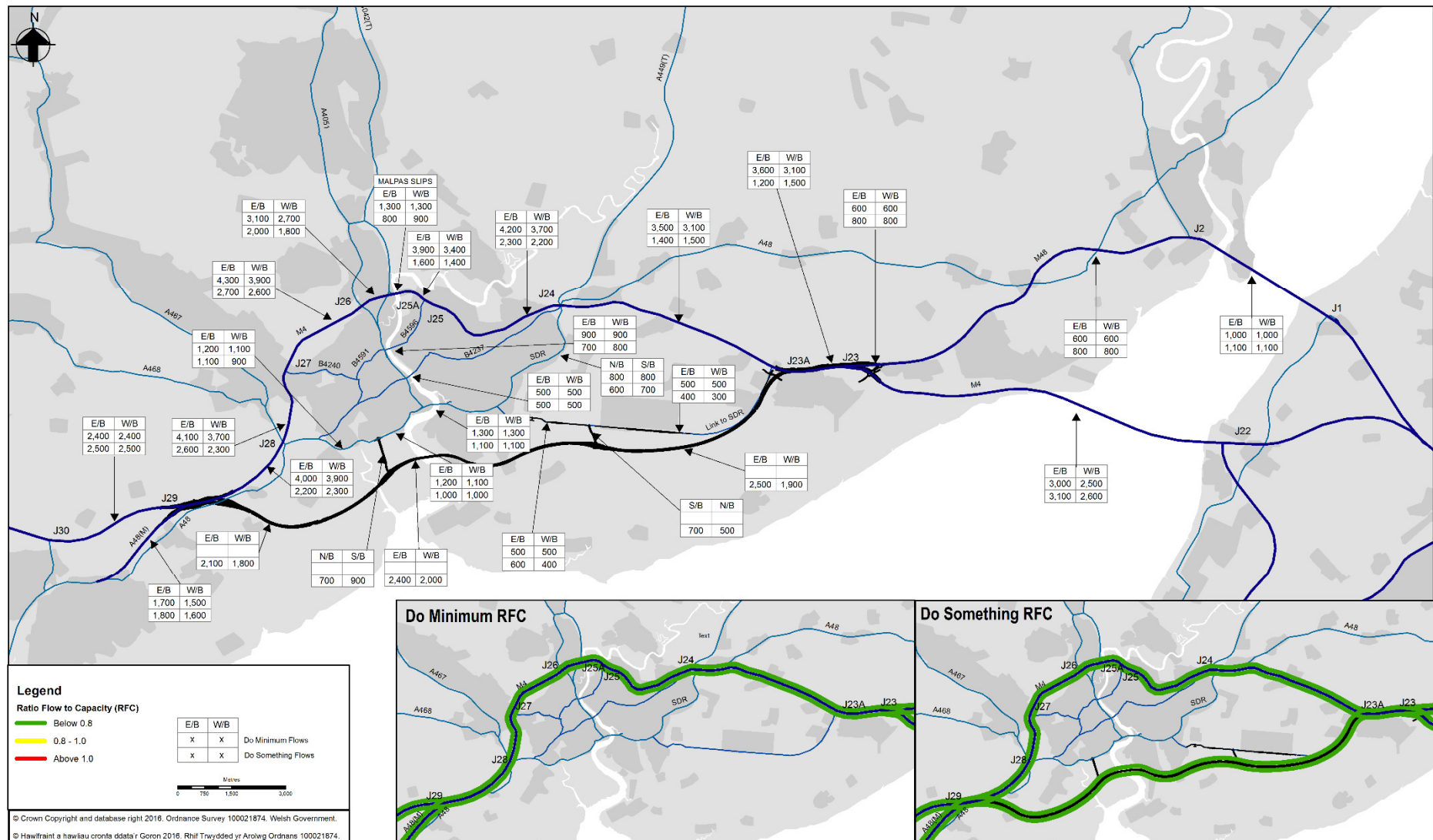


Figure D6: 2037 Forecast Inter Peak Hour Traffic Flows, Low Growth

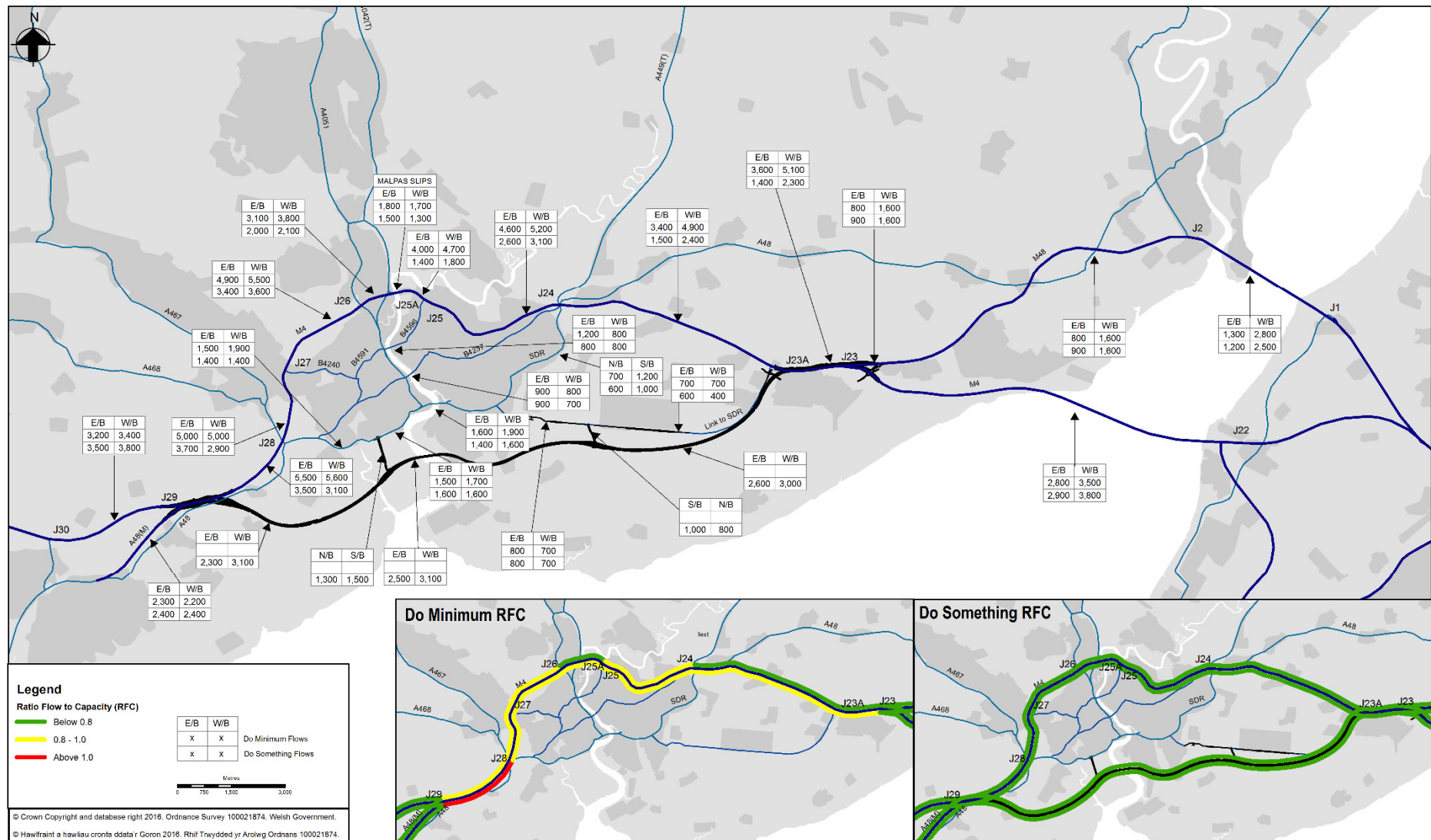


Figure D7: 2037 Forecast PM Peak Hour Traffic Flows, Low Growth

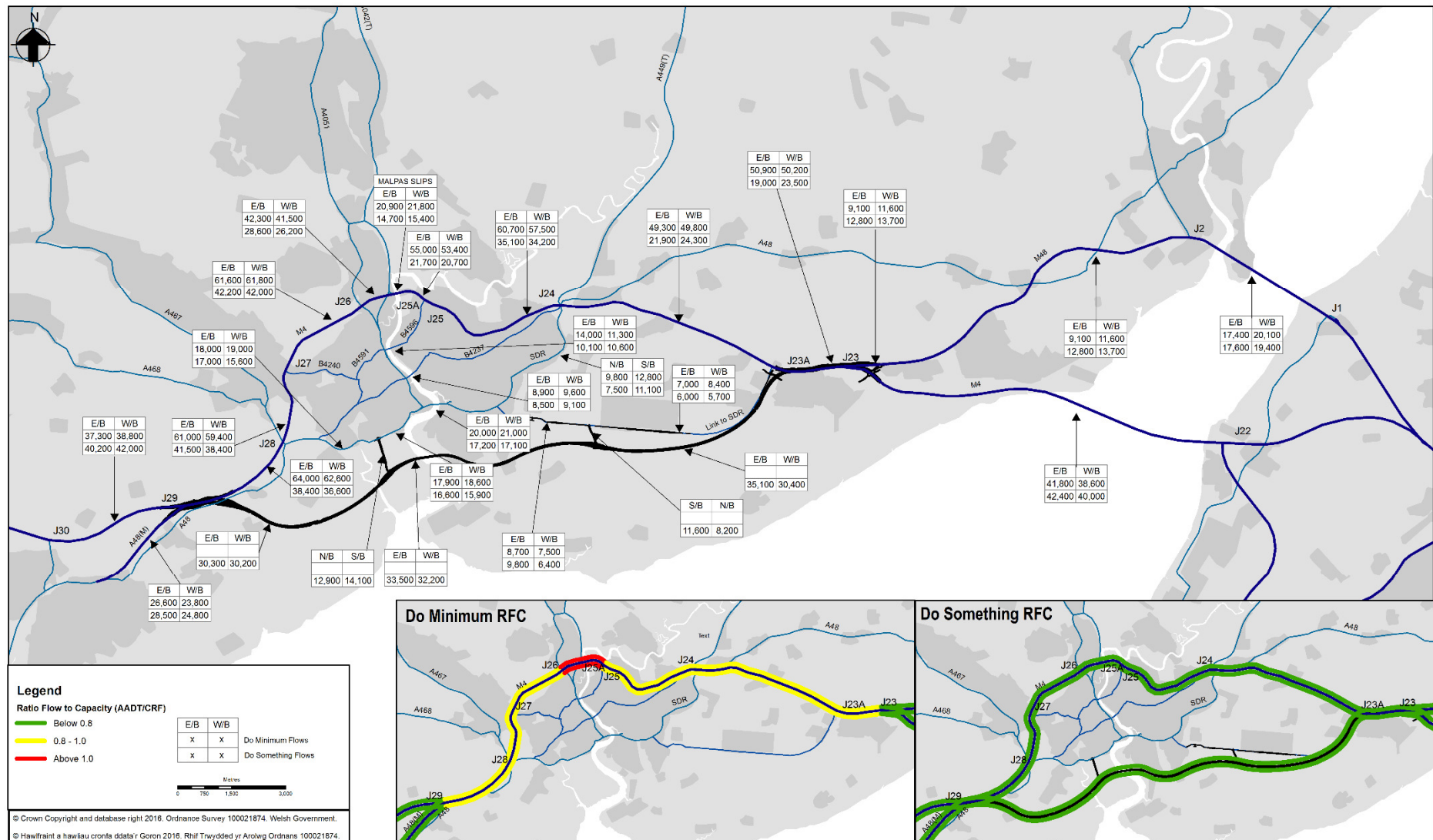


Figure D8: 2037 Forecast Annual Average Daily Traffic Flows, Low Growth



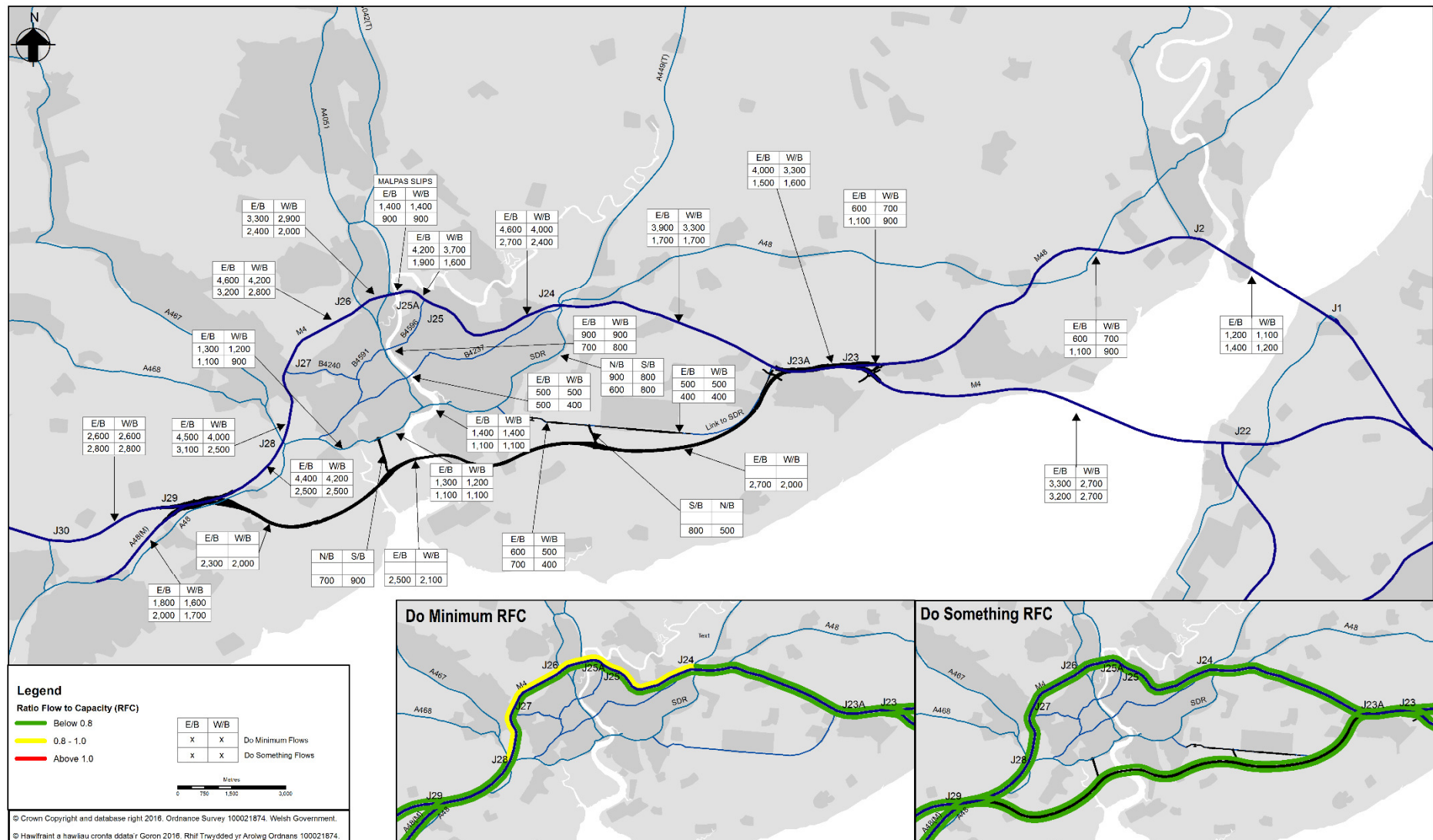


Figure D10: 2051 Forecast Inter Peak Hour Traffic Flows, Low Growth

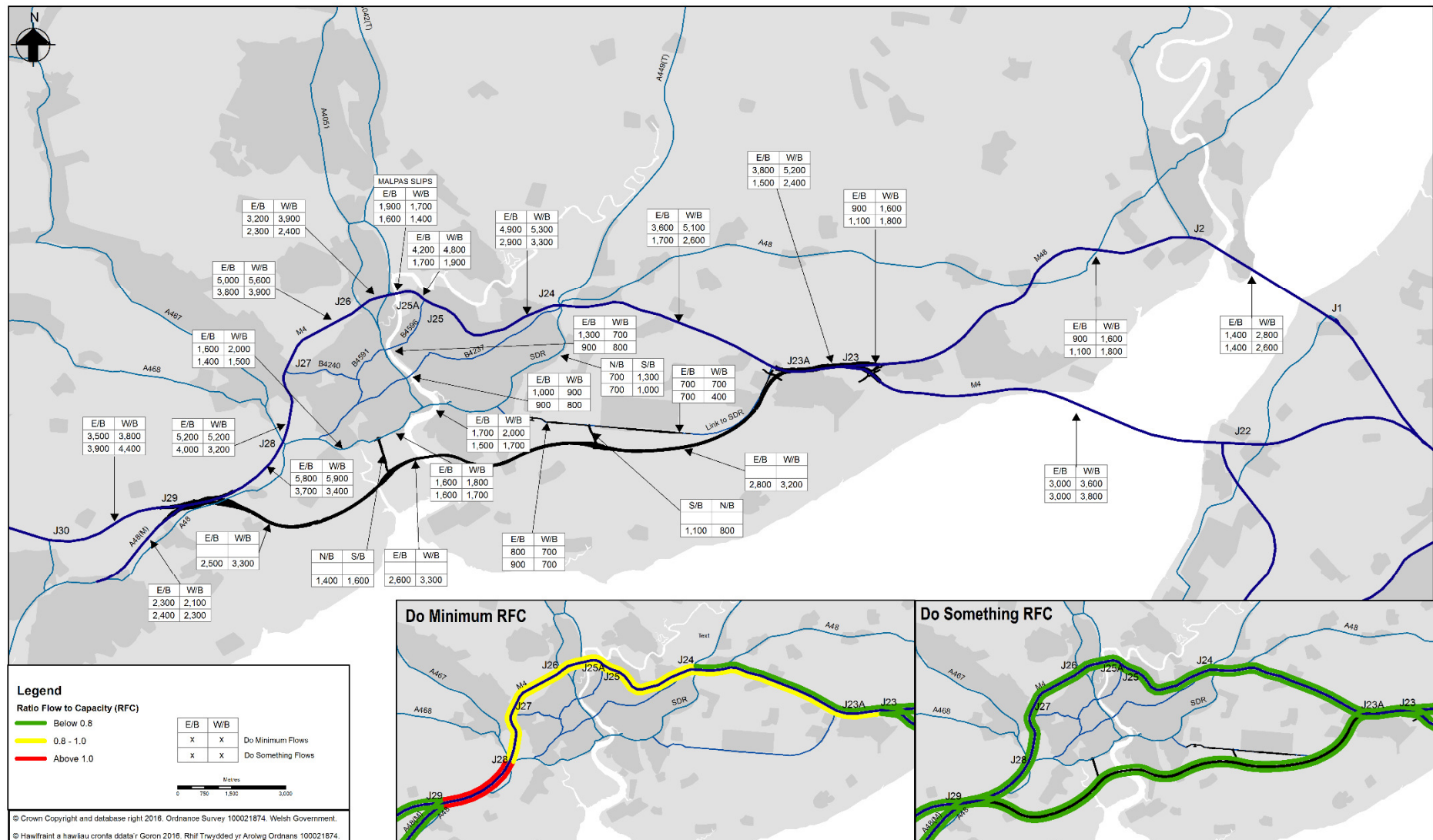


Figure D11: 2051 Forecast PM Peak Hour Traffic Flows, Low Growth

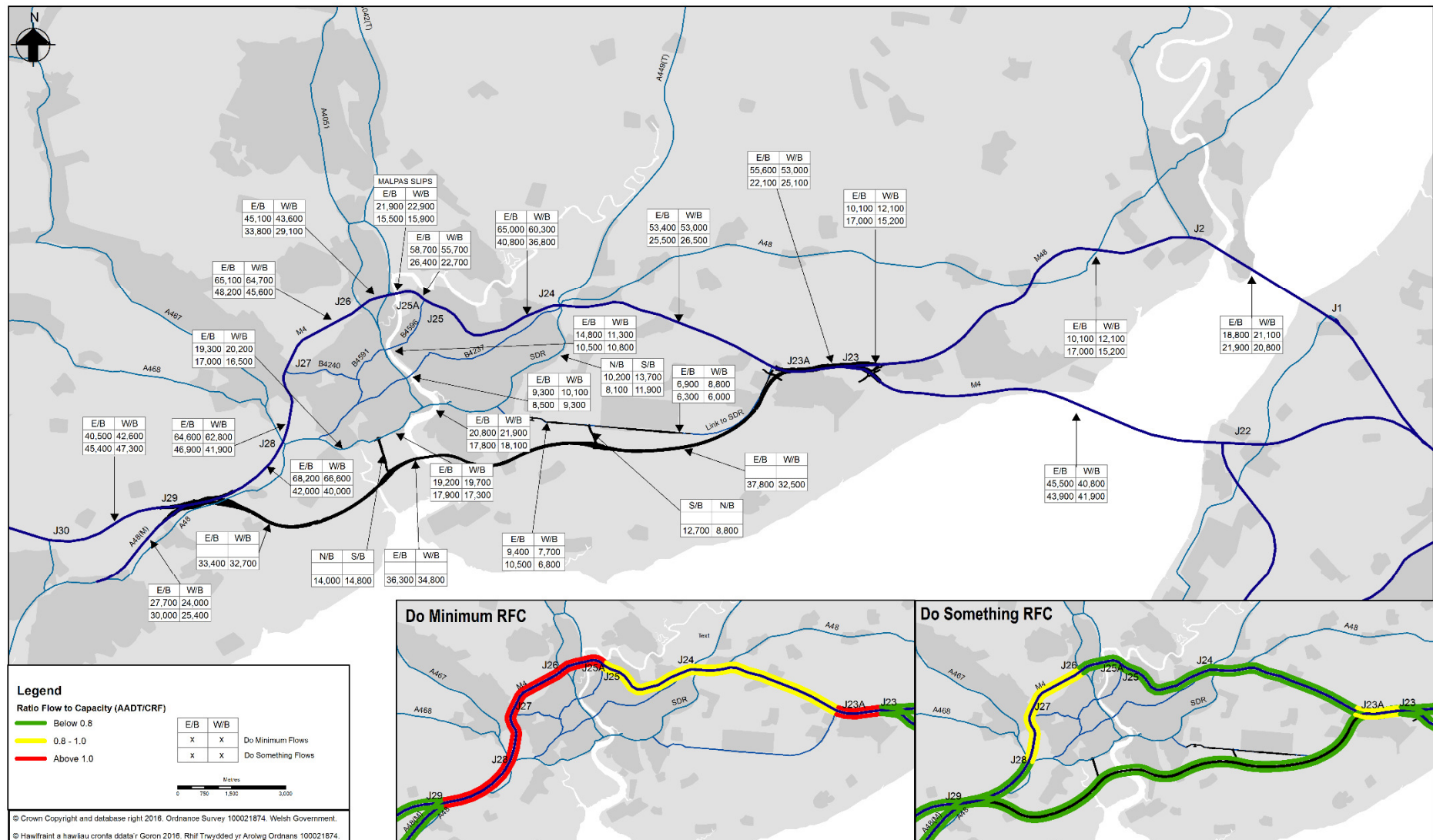


Figure D12: 2051 Forecast Annual Average Daily Traffic Flows, Low Growth

D2 Low Growth Journey Time Analysis

Table D1: Low Growth - Journey Time between Junction 30 and M4 Toll Plaza (min:sec)

Direction	Time	Route	2022 Central Growth		2037 Central Growth		2051 Central Growth	
			Do Min	Do Som	Do Min	Do Som	Do Min	Do Som
East	AM	Via existing M4	18:41	18:42	21:37	19:23	23:29	20:00
	IP	Via existing M4	17:04	17:47	18:30	18:12	19:33	18:27
	PM	Via existing M4	17:27	18:00	19:10	18:34	20:15	18:57
	AM	Via new motorway		14:54		15:40		16:11
	IP	Via new motorway		14:41		15:14		15:27
	PM	Via new motorway		14:43		15:16		15:28
West	AM	Via existing M4	18:53	18:00	20:40	18:57	21:40	19:45
	IP	Via existing M4	16:59	17:00	17:38	17:27	17:59	17:45
	PM	Via existing M4	18:44	18:10	21:29	19:21	23:23	20:14
	AM	Via new motorway		15:20		15:57		16:23
	IP	Via new motorway		14:33		14:57		15:07
	PM	Via new motorway		15:17		16:17		16:48

Appendix E – High Growth Scenario

E1 High Growth Traffic Forecasts



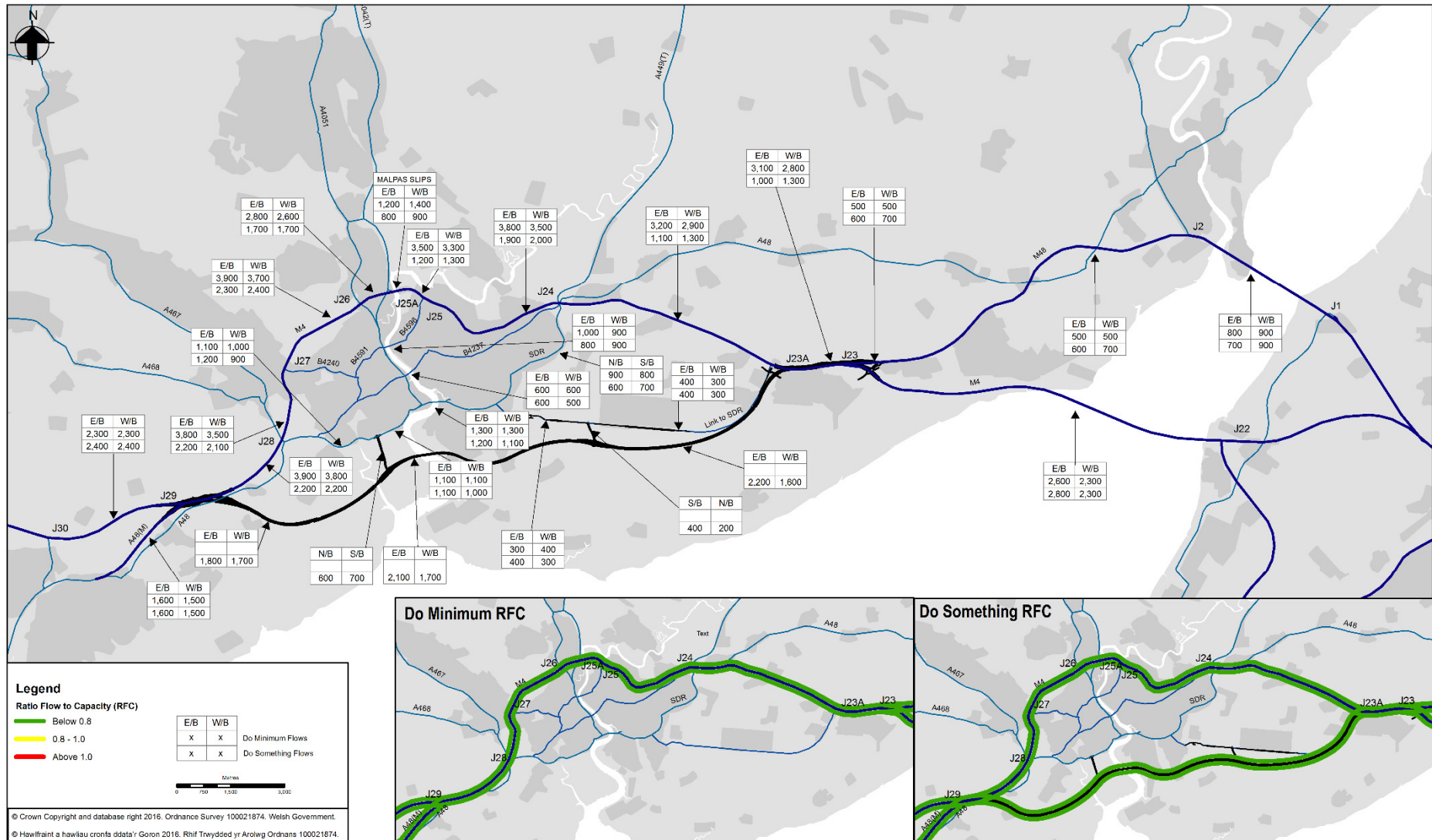


Figure E2: 2022 Forecast Inter Peak Hour Traffic Flows, High Growth





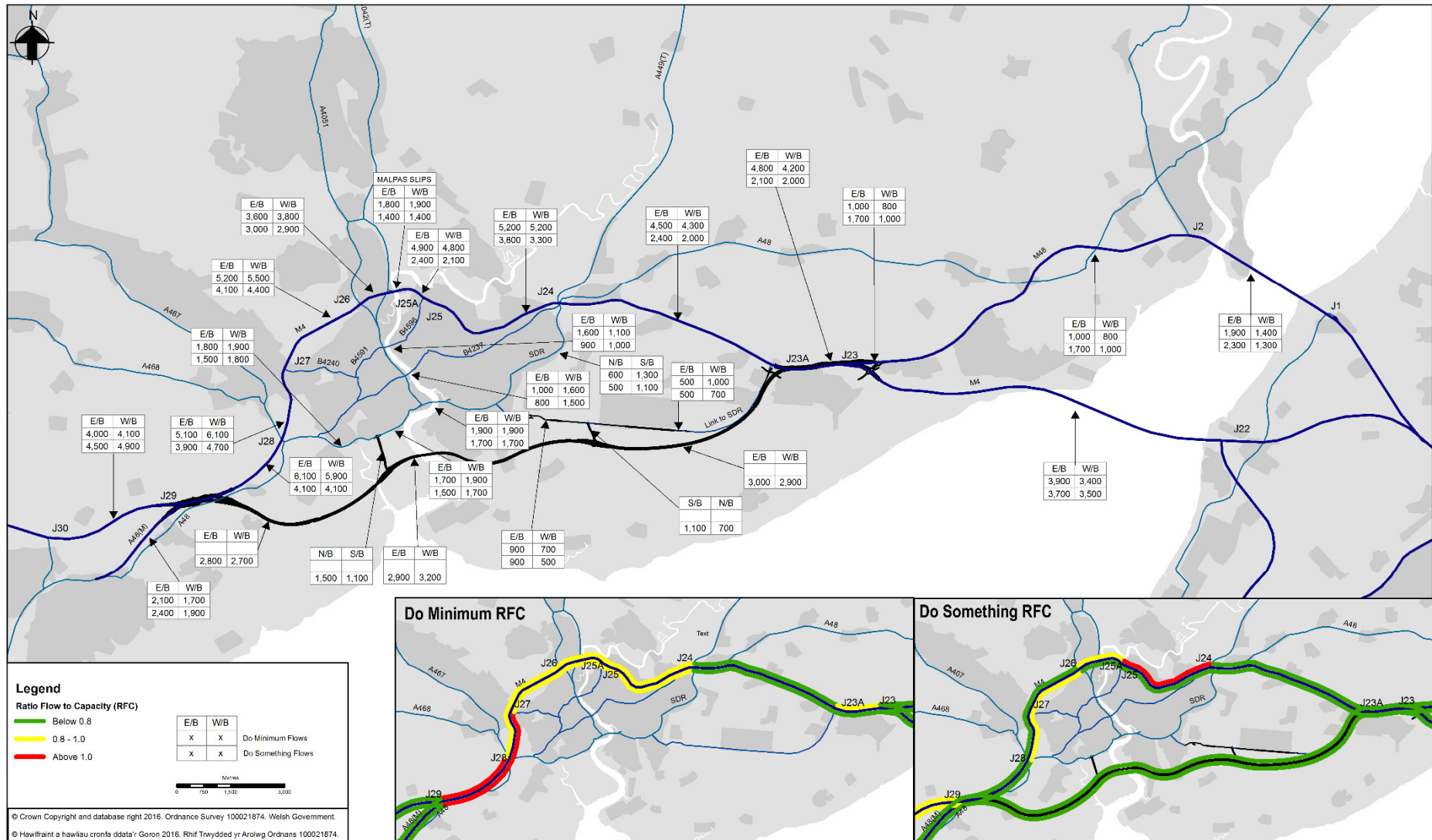


Figure E5: 2037 Forecast AM Peak Hour Traffic Flows, High Growth

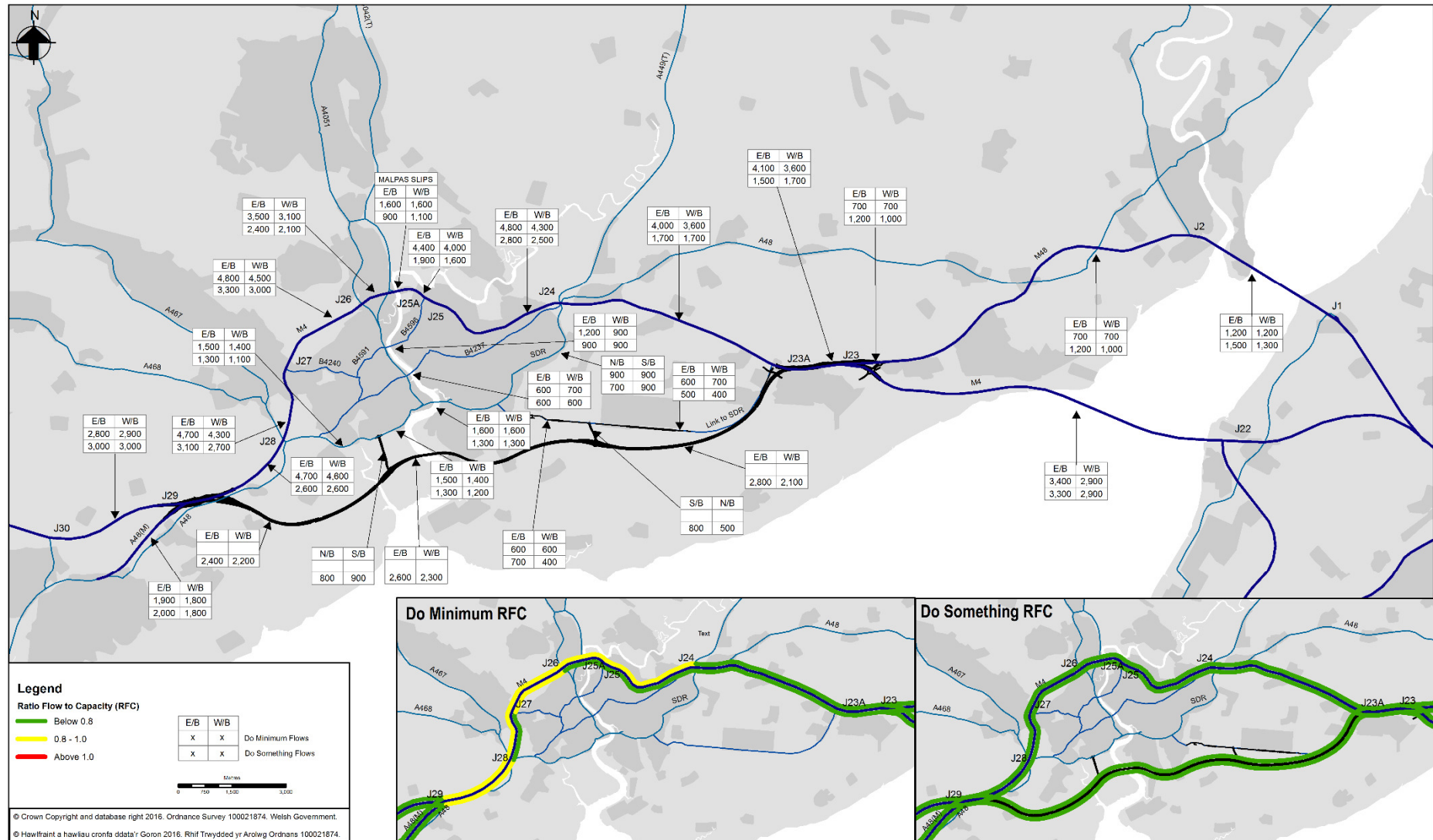


Figure E6: 2037 Forecast Inter Peak Hour Traffic Flows, High Growth



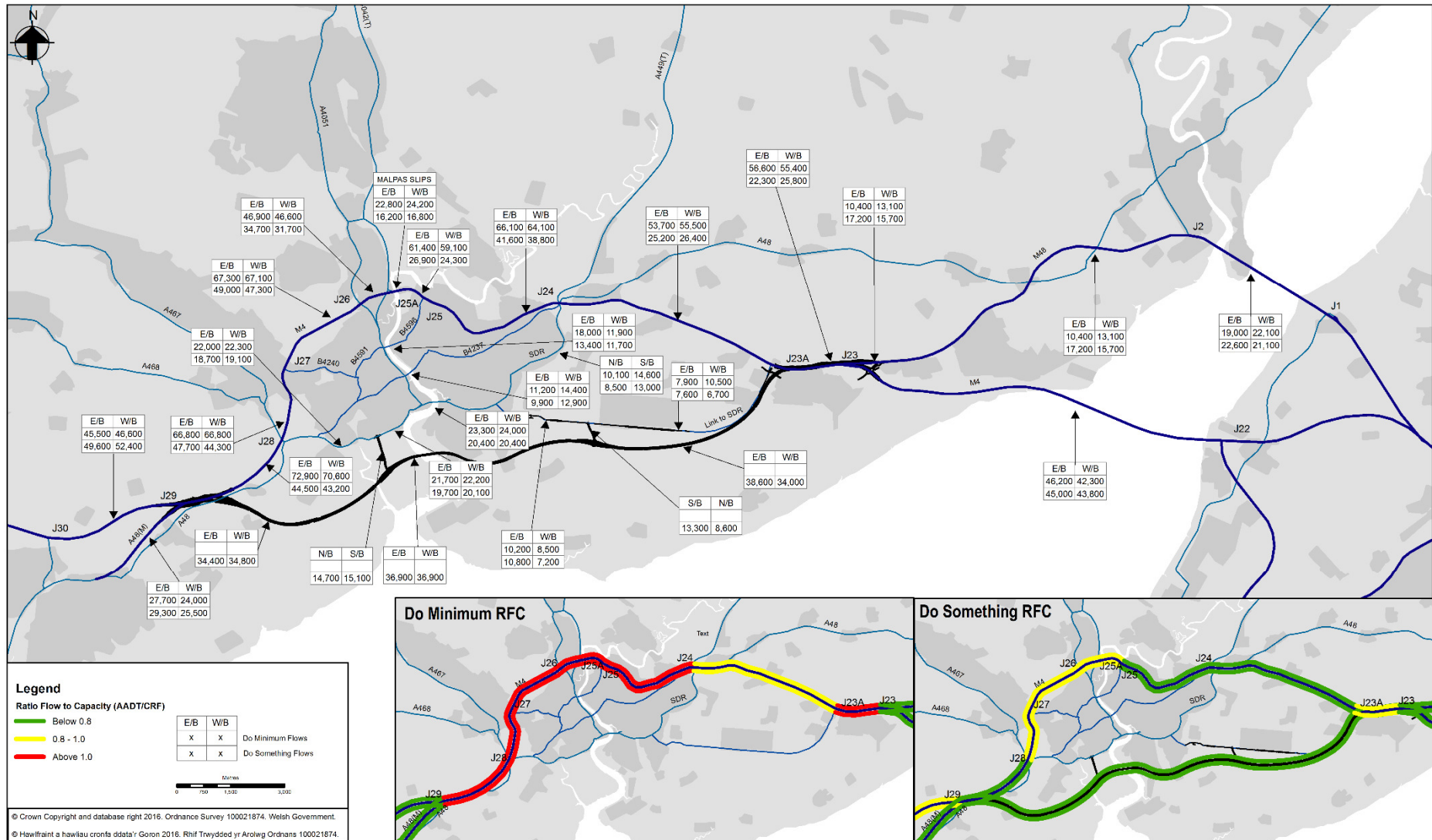


Figure E8: 2037 Forecast Annual Average Daily Traffic Flows, High Growth

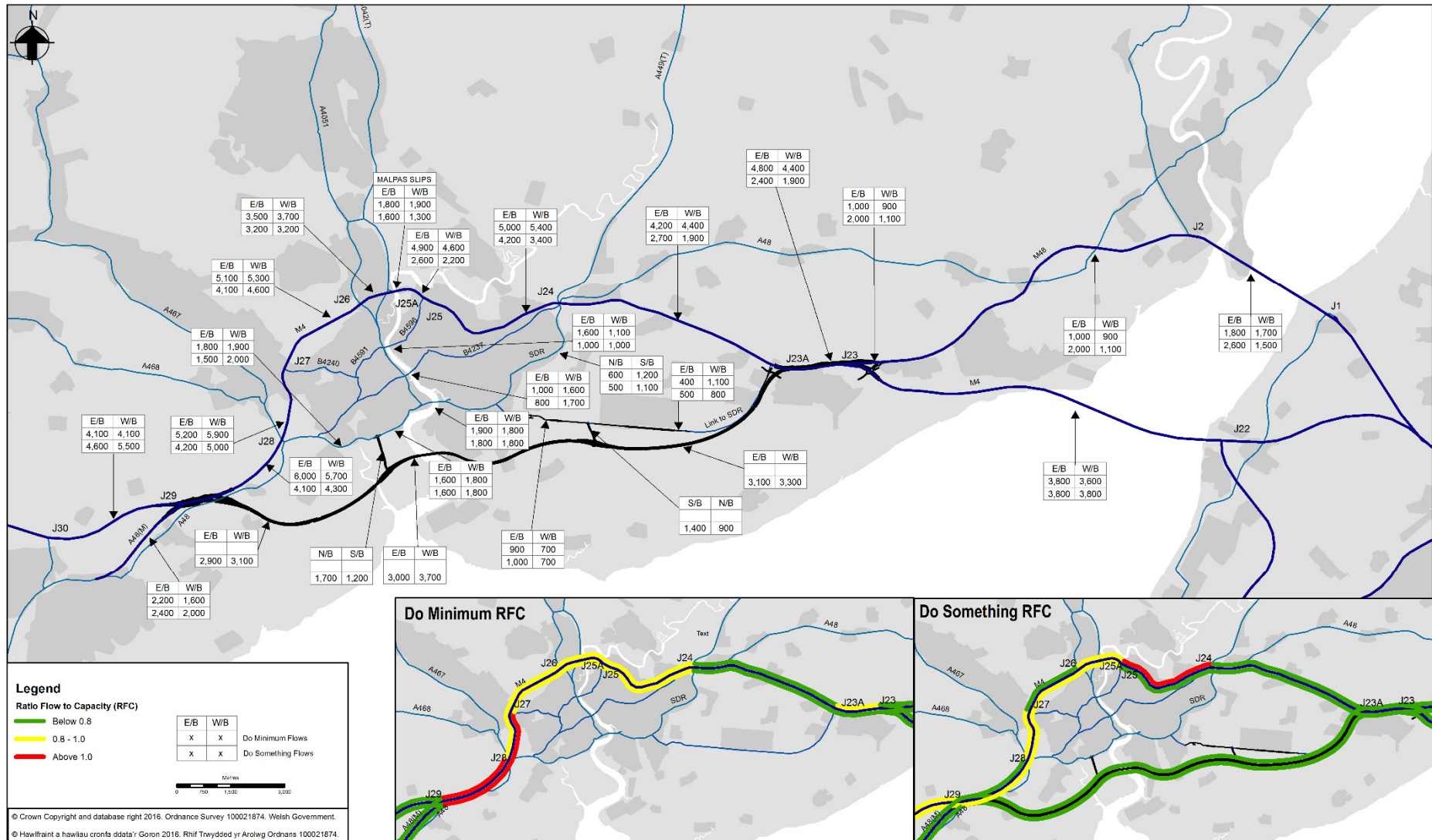


Figure E9: 2051 Forecast AM Peak Hour Traffic Flows, High Growth





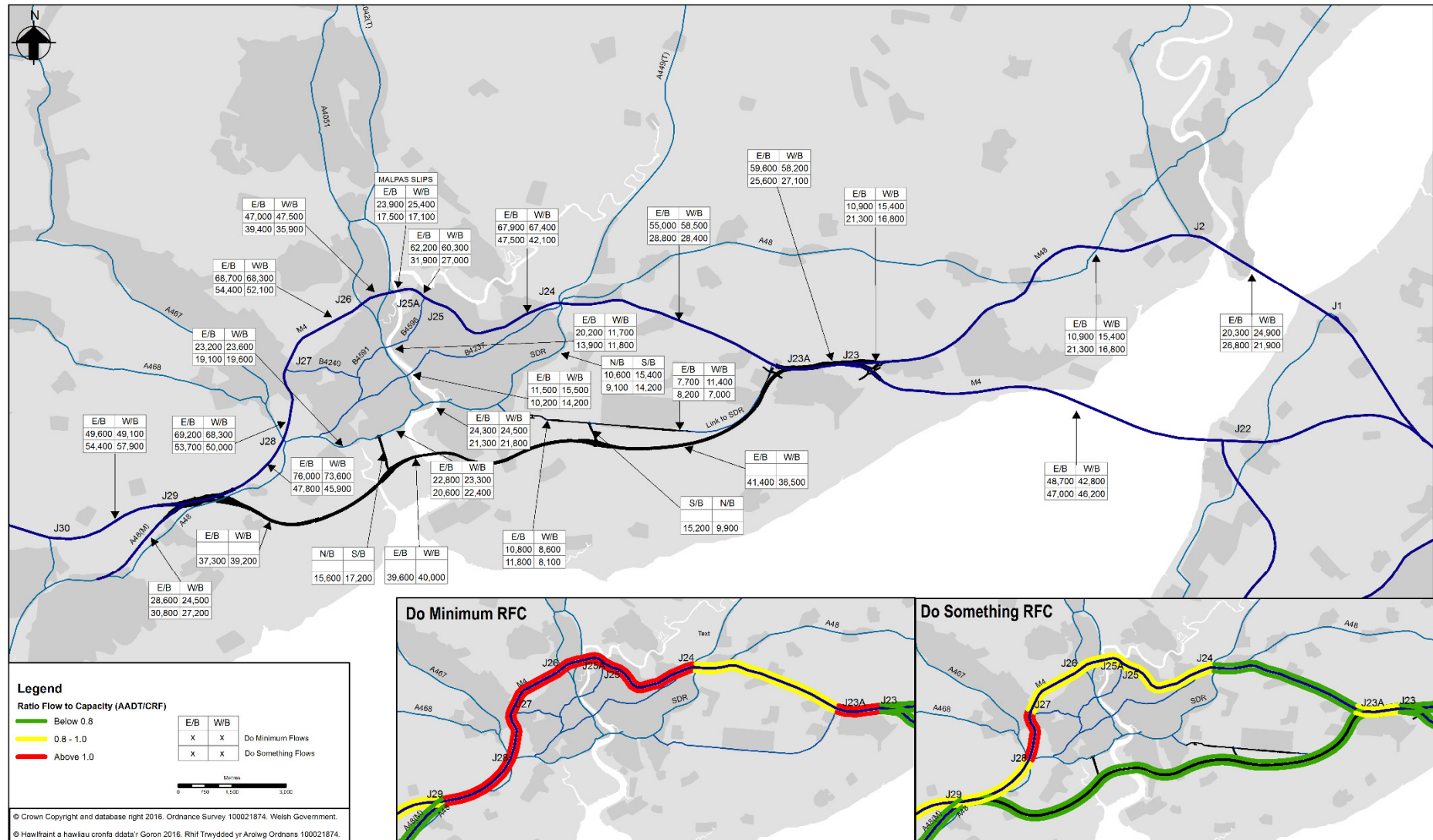


Figure E12: 2051 Forecast Annual Average Daily Traffic Flows, High Growth

E2 High Growth Journey Time Analysis

Table E1: High Growth - Journey Time between Junction 30 and M4 Toll Plaza (min:sec)

Direction	Time	Route	2022 Central Growth		2037 Central Growth		2051 Central Growth	
			Do Min	Do Som	Do Min	Do Som	Do Min	Do Som
East	AM	Via existing M4	20:47	19:15	27:57	20:32	31:14	21:34
	IP	Via existing M4	18:00	18:00	21:53	18:41	25:45	19:14
	PM	Via existing M4	19:03	18:22	23:30	19:19	27:12	20:15
	AM	Via new motorway		15:14		16:18		16:30
	IP	Via new motorway		14:59		15:45		16:11
	PM	Via new motorway		15:01		15:52		16:19
West	AM	Via existing M4	20:59	18:51	27:10	21:49	33:53	24:03
	IP	Via existing M4	17:27	17:17	18:55	18:04	20:33	18:45
	PM	Via existing M4	20:30	18:47	27:40	20:38	32:01	22:45
	AM	Via new motorway		15:53		17:37		18:53
	IP	Via new motorway		14:48		15:28		15:53
	PM	Via new motorway		15:46		17:10		17:56