Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure

Llywodraeth Cymru
Welsh Government

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East of Magor) Connecting Road) (Amendment) Scheme 201-

The London to Fishguard Trunk Road (East of Magor to Castleton) Order 201-

The M4 Motorway (West of Magor to East of Castleton) and the A48(M) Motorway (West of Castleton to St Mellons)(Variation of Various Schemes) Scheme 201-

The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and The London to Fishguard Trunk Road (east of Magor to Castleton) (Side Roads) Order 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and the M48 Motorway (Junction 23 (East of Magor) Connecting Road) and the London to Fishguard Trunk Road (East of Magor to Castleton)) Compulsory Purchase Order 201-

The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) (Supplementary) Scheme 201-

The Welsh Ministers (The M4 Motorway (Junction 23 (East Of Magor) to West of Junction 29 (Castleton) and Connecting Roads) and The M48 Motorway (Junction 23 (East Of Magor) Connecting Road) and The London to Fishguard Trunk Road (East of Magor to Castleton)) Supplementary Compulsory Purchase Order 201-

Summary Proof of Evidence

Bryan Whittaker, FCIHT

Welsh Government, Traffic

Document Reference: WG 1.2.2

CONTENTS

1 Personal Details

1.1 My name is Bryan Whittaker. I am an Associate Director of Ove Arup and Partners Ltd (Arup), a multi-disciplinary consultancy. I am a Fellow of the Chartered Institution of Highways and Transportation.

1.2 I am a member of the project team which is responsible for the delivery of the Scheme and in particular have led the development of the M4 Corridor around Newport (M4CaN) transport model over the last two and a half year period. In developing the M4CaN model, I have been supported by my team of transport modellers and planners and they have worked to my instructions. I adopt their work as my own and opinions I express on my Proof of Evidence are my own.

2 Scope and Purpose of this Proof of Evidence

2.1 My Proof of Evidence addresses the traffic issues, modelling and forecasting relating to the Scheme. It addresses the existing traffic conditions on the M4 which in my opinion demonstrates the need for the Scheme, the development of the M4CaN model that is used to provide evidence of change to the transport network resulting from the Scheme and the resultant forecasts that are used in the detailed economic, social and environmental appraisals of the Scheme. I will demonstrate that the M4CaN model complies with the Department of Transport WebTAG guidance and acceptance criteria.

2.2 In this Proof of Evidence, I particularise aspects of the modelling that has been undertaken and the assumptions used where they relate to topics raised by objectors such as:

a) the need for the Scheme in terms of traffic demand;
b) that the Scheme would lead to more traffic;
c) about the transport forecasting and its application;

d) that should the Severn Crossing tolls be abolished there would be more traffic demand; and
e) that demand management measures encourage reduced need to travel

3 Existing Conditions on the M4 around Newport

3.1 The M4 around Newport forms part of the Trans European network and is critical to the Welsh economy transporting people and goods to homes, industry and employment. It is therefore a route of significant strategic importance.

3.2 However, the existing M4 between Magor and Castleton does not meet modern motorway design standards and carries a greater volume of traffic than it was originally designed for. The M4 between Junctions 28 and 24 was originally designed as the 'Newport Bypass' in the 1960s. Some sections have alignments (gradients and bends) that are below current motorway standards and in places there is no hard shoulder. In addition to this, there are frequent junctions, resulting in many weaving movements with vehicles accelerating, decelerating and changing lanes over relatively short distances.

3.3 There was sustained traffic growth between 1989 and 2007 on the M4 with the exception of traffic levels through the Brynglas Tunnels in the mid-1990's which was due to completion of the A4042 Malpas Road and Brynglas Tunnels relief scheme. However, following the recession period traffic levels again started to increase and has continued to do so to the present day. At the eastern end of the M4, traffic levels reduced slightly after the opening of the Steelworks Access Road (A4810) in 2013 but has continued to grow since then. It is likely that traffic flows on the M4 will continue to increase as the Welsh Economy grows.

3.4 As a result of the high level on flow on a motorway that does not meet modern design standards (the section of the M4 between

Junctions 29 and 28 carries the highest flow on the motorway, with an average 114,508 vehicles per day in 2015) congestion, with frequent incidents, is a very common occurrence on the existing M4 between Junctions 23 and 29. 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. The restricted capacity of the Brynglas 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.

3.5 Distinctive peak periods occur in the morning and evening on weekdays. Traffic volumes at the weekend are lower during the morning and evening peaks than during weekdays. However, flows in the middle of the day at weekends are higher than during weekdays. On Sundays, the highest flow is the late morning/early afternoon in the eastbound direction and is almost as high as the Monday – Thursday weekday.

3.6 In addition to day-to-day congestion, the M4 corridor has experienced a high number of incidents (unexpected events) and the lack of network resilience means that the time before the M4 can return to normal operating condition following an incident can be significant.

3.7 In the future without the Scheme, congestion will become more prevalent and traffic growth and the impact of incidents will have significant consequences. Journey times will become longer causing increasing frustration to the travelling public and have a negative impact on the Welsh economy.

3.8 The M4 motorway has a number of two lane and three lane sections, and several grade separated sections via over or under passes. Some sections of the main carriageway have non-standard

gradients, existing advisory speed limits and reduced visibility. Between Junction 23A and Junction 29, there was a total of 665 reported personal injury collisions on the M4 between January 2003 and December 2015, comprising 11 fatal, 43 Serious and 611 slight personal injury collisions. Of the 665 collisions 328 occurred in the eastbound direction, and 337 occurred in the westbound direction.

3.9 In the period between July 2011 and December 2015, following the introduction of the Variable Speed Limit, the link only collision rate on every section was reduced compared to the pre-VSL period. The level of reduction, however, was particularly large on those sections where VSL has been implemented (Junction 24 to Junctions 28). During the period from July 2011 to December 2015 there were 153 reported personal injury collisions. The default WebTAG average link and junction collision rate (per million vehicle km) in the period 2011 to 2015 is 0.0561. There are two key sections either side of the tunnels where observed rates remain higher than the WebTAG average collision rate and one key section where the observed accident rate is close to the WebTAG average collision rate.

4 M4CaN Transport Model

4.1 In this section I will explain the transport model developed and applied as part of the assessment of the likely impacts of the Scheme on transport conditions. In doing so, I will highlight the key issues, which will serve to address the objections received to the Draft Orders that express concerns about traffic forecasting and the methods adopted, as well as concerns expressed that the Scheme will lead to more traffic.

4.2 The Department for Transport publishes guidance (known as 'WebTAG') on good practice for modelling and appraisal of highway schemes. The M4CaN model has been developed in

accordance with that guidance and meets the required criteria stated within the guidance. In my professional opinion, the M4CaN Transport Model produces robust and defensible traffic forecasts in both in the Do-Minimum (without the Scheme) and the Do-Something (with the Scheme) that support the Scheme design and which are used in the detailed economic, social and environmental appraisal.

4.3 The M4CaN Transport Model represents typical operating conditions on the highway network in terms of average flows and speeds on a normal day of operation. In the base year highway model, validation was carried out on the mainline motorway links between Junction 23a and 29, together with a screenline of links crossing the Usk River in the Newport area, by comparing modelled and observed flows in the AM, Inter-Peak and PM modelled time periods. The results show that, in the PM peak and Inter-Peak hours, the validation of flows on the motorway links between Junction 23a and Junction 29 passed the WebTAG criteria in all but one case. The M4CaN model thus provides an accurate representation of existing traffic volumes on the M4 around Newport.

4.4 Journey time surveys were carried out on 12 key routes through the Area of Detailed Modelling. The results show that the validation of journey times in each of the modelled time periods meets the WebTAG guidance on all of the surveyed routes, indicating a robust representation of the network operation in the Area of Detailed Modelling.

4.5 The level of validation achieved both in terms of modelled flow and in journey times demonstrates that the base year transport model, for a robust basis for the purpose of forecasting.

4.6 Given the major change in the network in terms of providing additional highway capacity resulting from the Scheme and the re-classification of the existing M4, the M4CaN transport model has

been developed in such a way that it can capture a range of behavioural responses to these changes, which are generally summarised as 'induced traffic'. These responses include reassignment, the switching of trips between highways and public transport and changes in trip destination.

4.7 Two broad mechanisms are used in the M4CaN model, consistent with the general case in all transport models. The first mechanism is the modelling of the transport network for highway and public transport conditions which affects the choice of routes that people undertake to get from their origin or start of trip to their destination or end of trip and how individuals choose routes to minimise the 'generalised cost' of travel (i.e. time and money costs). The second mechanism is that of the modelling of the changes in demand for travel arising from the change in the travel choices of individuals as a result of changes in generalised cost from the changed transport network conditions.

4.8 In addition to the M4CaN Transport Model, a VISSIM micro-simulation model has also been developed for the purpose of undertaking carbon assessments. The VISSIM micro-simulation model provides the required inputs into the PHEM 'instantaneous' emission model, in which emissions are related to vehicle operation on a second-by-second in accordance with guidance set out in DMRB.

4.9 WebTAG requires that 'Reference Case' future year forecasts are based on NTEM growth in demand. Future year forecasts have been based on NTEM 7.1 Interim for Wales released in December 2016 which assumes a decline in trip rates between its base year of 2011 and 2016 and constant trip rates thereafter. The decline in trip rates is reflective of the data contained in the 'National Travel Survey'. The two most common trip purposes that have declined (shopping and commuting) would seem to reflect increased participation in 'online shopping' and 'working from home'. NTEM

7.1 Interim for Wales constitutes the latest available estimate of traffic growth in Wales and have formed the starting point for forecasting in the M4CaN model.

4.10 The future year forecasts derived from the M4CaN model assume a halving of current tolls based on successive 2015 and 2016 budget announcements. The M4CaN model is not able on its own to fully model the full effect of the impacts arising from a toll change since it does not include in sufficient detail the area to the east of the Crossings that would allow for the full induced demand effects that will result from a reduction in toll charges. 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 is referred to in my evidence as the 'DfT Severn Toll Model'. That study was based on a more refined variable demand modelling approach (similar to that employed for the M4CaN model) which covered a wider geographic area and incorporated updated user delay assumptions representing the time lost at the toll booths. The M4CaN model takes the changes in demand resulting from changes in toll that are in turn derived from the 'DfT Severn Toll Model'.

5 M4CaN Model Forecasts

5.1 The projected economic and environmental impacts of the M4 Scheme are based on future year forecast runs of the traffic model. The traffic impact is the difference between two forecasts, the Do-Minimum (without-Scheme) and the Do-Something (with-Scheme). The 'Do-Minimum' consists of the future year traffic conditions in the absence of the proposed new section of motorway south of Newport, and the 'Do-Something' includes the proposed new section of motorway south of Newport together with reclassification and associated changes to the existing M4 north of Newport. These forecasts were generated for the projected Scheme opening

year of 2022 and the design year of 2037 and 2051 being the final year for which growth forecasts are available.

5.2 There is an increase in the number of trips between the base year and forecast Do-Minimum years largely as a result of traffic growth, together with an increase arising from redistribution effects that result from the reduction in the toll charge across the Severn Crossings. Slightly counteracting this is a modal shift response from private to public transport as people respond to changes in highway network congestion. The difference in highway trips between the Do-Minimum and Do-Something in the forecast years captures the modal shift response that is to result directly from the introduction of the Scheme, but is negligible.

5.3 The increase in vehicle-kilometres between the base year and forecast Do-Minimum in the forecast years is predicted to be slightly higher than the growth in the number of trips as a result of average trip lengths increasing slightly over time, partly as a result of the change in tolls. 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. 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. There are a number of trips experiencing shorter journeys on the motorway around Newport as a result of reassignment, however a significant number of trips experience an increase in vehicle-kilometres that occurs as a result of redistribution as travellers take advantage of the reduced levels of congestion in the Do Something scenario leading to a neutral effect in terms of the increase in vehicle-kilometres. In some time periods and years vehicle-kilometre savings are achieved despite the number of trips increasing slightly and trips lengthening in response to the Scheme.

5.4 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. 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. 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.

5.5 In my evidence, I have provided details of the traffic flow forecasts in the 'Do-Minimum' (without the Scheme) and the 'Do-Something (with the Scheme). In the 'Do-Minimum', the two-way AADT through the Brynglas Tunnels in 2037 is in the order of 89,000 comprising of 52% two-way through traffic travelling between east of Junction 23 and west of Junction 29. With the Scheme in place, the two-way AADT traffic flows through Brynglas Tunnels reduce by 32%. Between Junctions 28 and 29 which carries the highest AADT two-way flow of 136,000 in 2037 sees a reduction in the order of 40% with the Scheme. In 2037 the AADT forecast traffic flow on the proposed Scheme across the River Usk is 69,700.

5.6 Journey times in 2022 along the existing M4 north of Newport decrease at peak times in both directions, with the exception of eastbound in the PM peak by up to 1.5 minutes. A slight increase in journey time occurs during the Inter-Peak up to a maximum of 23 seconds which diminishes in subsequent years as traffic growth occurs. By 2037, the journey time analysis shows that travel times along the existing M4 would decrease in both directions at all times of the day by up to 4.5 minutes.

5.7 Through traffic using the proposed new section of motorway to travel east-west between Magor and Castleton would experience 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.

5.8 The journey time savings for through traffic, as predicted by the traffic model, will be reduced for those trips making an intermediate stop at Magor Services. For traffic stopping at Magor Services, the fastest route would be via the reclassified M4 instead of the Scheme. For these trips, travelling via the reclassified existing M4, the journey time savings during the peak hours could be expected to be, on average between 0 and 0.5 minutes in 2022, increasing to between 2 and 4 minutes in 2037 rising to between 3.5 and 7 minutes in 2051. However, I recognise that in reality some travellers may choose the alternative routes to access Magor Services, and that, in any event, the additional time costs of visiting the Services as opposed to not stopping will be greater under 'Do Something' than under 'Do Minimum'.

5.9 Journey time savings to and from Newport Docks passing a number of locations on the strategic road Network around Newport are provided with the Scheme. In particular journeys to the M48 J2 benefit from a journey time saving of 6 minutes in 2022 and 9 -10 minutes when travelling from Newport Docks to the M48 J2 via the Scheme and Docks Way Junction compared to travelling via the existing A48 Southern Distributor Road and M4 without the Scheme. Journeys to the M4 East (Toll Plaza of Second Severn Crossing) from Newport Docks benefit from a journey time saving of 6.5 minutes in 2022 and 10 minutes in 2037 travelling via the Scheme and Docks Way Junction when compared to travelling via the A48 Southern Distributor Road and M4.

5.10 An assessment of the potential impact of upgrades to public transport on the demand for travel on the M4 and how these changes might affect the case for the Scheme has been undertaken. A public transport scenario has been tested that represents a major upgrade in public transport and an ambitious target in terms of what is likely to be delivered in 2037 both in terms of delivery and required funding. Whilst the mode transfer from the M4 to the public transport scenario represents a significant increase in public transport patronage, many of the components of the scenario facilitate north-south movements rather than east-west. Whilst achieving increased patronage and other benefits, the assessment indicates that only relatively minor reductions in motorway traffic results.

6 Safety Aspects of the Scheme

6.1 An assessment of the safety aspects of the Scheme was undertaken comparing the number of accidents by severity in the Do-Minimum and Do-Something cases using details of link and junction characteristics, relevant accident rates and forecasts traffic volumes by link and junction. The assessment forecast a reduction in the number of accidents with the Scheme in place of around 300 during the 60 year appraisal period. I am, however of the view that reclassification of the M4 when the Scheme is in place would allow changes to be made to the current layout to enable traffic management, safety and revised access arrangements thus reducing the M4 observed accident rates used in the assessment. The new M4 would be designed to current standards of safety with free flow conditions, and I am equally of the opinion that the accident rate will be lower than the accident rate assumed by the default motorway accident rate used in the assessment. I am therefore of the view that the assessment will underestimate the saving in the number of accidents with the Scheme in place.