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

Llywodraeth Cymru
Welsh Government

Magor Services objections

Objection Refs OBJ0026 (Roadchef)

File Refs WG/REB/OBJ0026/BWh

Response to Objectors' Evidence: Roadchef – Mike Axon - Traffic Aspects

1. AUTHOR

1.1 I am Bryan Whittaker. I am a Director of WSP, a multi-disciplinary consultancy, with responsibility for strategic modelling and appraisal. I was previously an Associate Director of Ove Arup and Partners Ltd (Arup). My professional qualifications are set out in my main proof of evidence and are not repeated here.

1.2 The evidence which I have prepared and provide in this proof of evidence has been prepared and is given in accordance with the guidance of my professional institution and I confirm that the opinions expressed are my true and professional opinions.

2. SCOPE AND PURPOSE OF THIS PROOF OF EVIDENCE

2.1.1. Mr Mike Axon has submitted a Proof of Evidence dated February 2017 in relation to the draft statutory Orders associated with the Welsh Government's proposals for the M4 Corridor around Newport. On the 30th June 2017, Mr Axon submitted a Supplementary Proof of Evidence. Both of these documents were received via the Programme Officer.

2.1.2. I have considered the Proof of Evidence dated February 2017 and conclude that similar issues contained in that Proof of Evidence are also contained in the 30th June 2017. My rebuttal evidence in response to the Mr Axon's Proof of Evidence is therefore confined to responding to the Supplementary Proof and it should, of course, be read in conjunction with my earlier evidence to the Inquiry. I provide my rebuttal by reference to the relevant Section and Paragraph Number within Mr Axon's Supplementary Proof of Evidence.

2.1.3. My evidence is presented in the following structure, with a detailed contents provided at the start of the document.

1. Author
2. Scope and Purpose of this Proof of evidence
3. Scheme Rebuttal
4. Roadchef Alternatives

3. SCHEME REBUTTAL

3.1. Introduction

3.1.1. Para 14/15: It is incorrect to say that the Welsh Government has advised that the output from the model shows that a substantial proportion of traffic entering the services travel back in the same direction, this was an assertion made by Roadchef. At the meeting held on the 10th April 2017 (referred to in Paragraph 7 of the Supplementary Proof), it was stated by myself in response that whilst the inbound and outbound flows in the modelled time period were of a similar magnitude (see table below), it could and should not be assumed that those turning movements related to the same trips. It should be noted that in both peaks, traffic is quite evenly balanced between entry and exit volumes, and also between entry/exit from the west and east. Further clarification was provided in a Welsh Government letter to Mr Michael Dempsey of 9th June 2017 regarding the directional splits of traffic entering Magor Services compared to those exiting the services; it stated: 'Whilst in reality, the great majority of trips entering and leaving the services are likely to be linked, it is a misconception that these linkages can be replicated in the traffic model. Trip representation in the model cannot link the destination end of one trip to the origin end of another. It is not the case, therefore, that a significant proportion of traffic entering the services travels back in the direction it had had entered from as there is no connection between entry and exit in the model.

		Out	In
AM Peak	M4 West M4 East	124 125	138 141
PM Peak	M4 West M4 East	86 101	107 96

3.1.2. It should be noted that the M4CaN is a strategic model, in which model validation is primarily undertaken against link volumes and not junction turning movements owing to the extent and complexity of the network covered by the model. Consequently, while the base model

will give a reasonably accurate representation of the turning movements at the junction, it is less likely that they will be as good as the validation on the links. The M4CaN model is validated for an average weekday in May 2014 as recommended in WebTAG against average observed link flows collected over the whole month. The turning counts are carried out on a single day in May and cannot be adjusted to represent an average day within the month. Therefore as stated above, we cannot expect that the quality of the reported validation of turning counts can be as good as that for links.

3.1.3. Paragraph 17. Technically, I would have referred to least generalised cost route based on a combination of the time and distances of alternative routes. It is correct that in the absence of the eastbound off-slip, trips making a stop at Magor Services are routed via the existing M4 based on generalised cost in the model.

3.1.4. Paragraph 18. The addition of the eastbound off-slip improves accessibility into Magor, Magor Services, the Wales 1 Business Park, Magor Brewery and the surrounding areas. This leads to a reduction in eastbound traffic volumes on the reclassified M4 and a corresponding increase in traffic on the proposed motorway. The increase in eastbound traffic is highest on the eastern section of the proposed motorway (4,400 AADT in 2037), where in addition to the above, some traffic which would have previously used the Glan Llyn junction and travelled eastbound along the A4810 Steelworks Access Road will be able to continue along the proposed motorway and exit onto the local road network using the eastbound off-slip at Magor instead. Roadchef currently attracts some 1.7 million vehicles per year and assuming a 50:50 spilt then that implies 850,000 eastbound a year which is 2328 vehicles a day. With the addition of the eastbound off-slip, trips making a stop at Magor Services are routed via the new M4 and the eastbound off-slip. Given that the aim of the assignment model is to reach equilibrium, such that costs and traffic flows are in balance under the assumption that individual users will

seek to minimise their own costs of travel through the networks, both results are sensible.

3.1.5. Paragraph 20. Table 11.2 of my Revised Proof of Evidence WG 1.2.1 Rev A shows that in all time periods, eastbound traffic making a stop at Magor Services switch from the reclassified M4 to the new M4 with the inclusion of the eastbound on-slip.

3.2. Driver Behavior

3.2.1. The statement made in the meeting on the 10th April (referred to by Mr Axon at 1.2 (4) in his Proof of Evidence) is correct in that the M4CaN assignment procedure is that of the well-established and WebTAG compliant basis of 'generalised cost'. I would also add that no manual intervention manual adjustments have been made within the model to represent any additional effect of perceived driver behaviour.

3.2.2. Mr Axon asserts that in respect of driver behaviour, individuals do not make decisions on a mathematical basis of time and costs.

3.2.3. Investment in transport can bring about a range of economic, social and environmental benefits. Building new transport links has the potential to make it easier for people to move around or address the problems of road congestion. However, with limited financial resources and a variety of options, how can we tell which transport improvements are the best to invest in? We need to predict the impact of each proposal on people's travel decisions and the resulting crowding and congestion impacts against a backdrop of changes in population, employment and other economic factors. Transport models are tools which help to provide a robust and consistent evidence base for data and analysis when carrying out these predictions.

3.2.4. Individuals make a number of decisions when considering travel options which can be summarised as follows; do I need to own a car,

where shall I travel to, shall I travel at all, what time of day shall I travel, which mode of transport shall I use, which route shall I take, should I live in a place with better transport connections.

3.2.5. The M4CaN model addresses all of the choices represented above. It is a strategic model that represents the different decisions that an individual makes and is developed to be used for understanding the long-terms impacts of schemes over wide areas.

3.2.6. Each and every individual exhibits different behaviours with respect to those choices. Transport Models do not and cannot model every individual's behaviour at disaggregated level of response. Transport models, as in any other model consider those choice decisions at an aggregated level.

3.2.7. I would offer the observation that the base year transport model was developed (from which future year traffic flows with and without the proposed scheme are produced) directly using observed data. The observed data incorporates the aggregation of a number of individual behaviours that are implicit in the data collected, in terms of travel demand and the distribution of such demand, through the modelled network at the time of data collection. In the M4CaN transport model assignment and as recommended by WebTAG, the way in which these behaviours are represented is in the form of generalised cost defined as Generalised Cost = Time + (vehicle operating cost per km x distance / value of time) + (road user charges / value of time). WebTAG also provides that this formula should be held constant in forecasting. The base year model assigns traffic onto the network and the resultant modelled traffic flows on all links have been validated against observed traffic flows thereby providing some evidence that the behaviours of the travelling public are captured within the simplified principle of generalised cost.

3.2.8. Mr Axon states that people make decisions on the basis of journeys in legs and not the journey in its entirety and that drivers consider these segments sequentially rather than in the context of the entire route. I

agree with this statement and add that this principle forms the basis of trip modelling in nearly all models and is so in the M4 CaN model. For example, a traffic model would disaggregate a trip involving the use of Services into an access leg and a separate egress leg. That is consistent with individuals making decisions on the basis of journeys in leg and nit entire routes.

3.2.9. I do not accept that time and cost factors (distance) are minor factors in pre and in trip decisions. I take the opposite view (endorsed by WebTAG) that they are major factors, but I recognise that there may be other factors in addition, in particular circumstances such as those set out in Professor Pickup's letter.

3.2.10. As stated by Professor Pickup, for a majority of drivers, trip preferences are now programmed into satellite navigation systems (in-trip information) that can further simplify trip making decisions, and in which those preferences are consistent with the algorithms employed in transport models in respect of time and distance parameters. The information given regarding a trip remains the same irrespective of the particular behaviours exhibited including individuals' psychology, put another way, motorists who use and follow satellite navigation systems will behave in a rational way base on time and/or distance regardless of their psychological proclivities.

3.2.11. Travellers on the road network now have a number of aids in assisting them to travel from Point A to Point B. These include pre-trip information for instance derived from Google Maps which provides information on journey times and distance (which can be equated to cost) and in-trip information from road signage and satellite navigation systems. I would assert that trip information provided by satellite navigation systems is in balance with the routeing produced by the transport model for each leg or the entirety of a trip and equates to the basis of routeing in transport models. As a result of the increasing technologies, it could be said that there is less of a requirement for

drivers to arrive at an informed view of their own when making travel decisions.

3.3. The Model

3.3.1. The M4CaN transport model is a strategic model that has been developed in a way that conforms to best practice as stated in WebTAG. Its prime purposes are to inform as to the impact of traffic flows within the whole of the modelled area and specifically around Newport, 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. It has not been specifically developed to predict movements to and from Magor Services. Trips to such services may be pre-planned on the basis that it is placed at a convenient location along the route at a particular stage of their journey or in many instances arises for a particular need, such as taking a rest, having refreshment or simply to use the wash room facilities. Therefore, unlike the majority of trips on the highway network, trips to service areas in general are not in a steady state and that they vary in terms of numbers of visits on a daily basis, such that they cannot be realistically modelled in a transport model. The nature of such trips is that it is not possible for Operators of such services to forecast usage with any greater precision but are likely to assume given that nothing changes a constant turn-in rate.

3.3.2. The M4CaN model incorporates an aggregate highway assignment model which represents average conditions over the modelled period. These models are generally described as ‘Steady State Assignment’ models. The assignment model predicts the routes that drivers will choose and the way that the traffic demand interacts with the available road capacity. By definition, a Steady State Assignment model is one in which a single (average) set of cost conditions is assumed to apply across a fixed time period, typically one hour, and a fixed volume of trips (with uniform demand) is assigned to satisfy

these conditions. Using these models in scheme assessment, the aim of the assignment model is to reach an equilibrium such that costs and traffic flows are in balance, under the assumption that individual users will seek to minimise their own costs of travel through the network. The underlying principle is expressed as Wardrop's First Principle of Traffic Equilibrium which may be stated as; 'traffic arranges itself on networks such that the cost of travel on all routes used between each Origin – Destination pair is equal to the minimum cost of travel and all unused routes have equal or greater cost'

3.3.3. Whilst recognising that the M4 CaN transport model cannot accurately predict demand to the Services, the M4CaN transport model is appropriate in determining the journey times on the network to and from the Services.

3.4. Statistics Update

3.4.1. In Table MAS2, Mr Axon gives 'pit-stop' drive times for the Services both with and without the scheme as compared with the equivalent drive times for Leigh Delamere. The manner in which Mr Axon has measured distances and travel times does not take into account any time incurred when travelling in the services area itself. In practice, users are unlikely to register the point at which they have entered the 'internal junction'. Nor do the travel times take into account the time taken to navigate the car park and find a parking space. Mr Axon's approach minimizes the travel times for Leigh Delamere and accentuates the differences between Leigh Delamere and Magor.

3.4.2. Furthermore, the travel times quoted by Mr Axon for the two service areas have been calculated on an entirely different basis. For Magor, Mr Axon relies on my evidence which is, in turn, based on the M4CaN Transport Model. The M4CaN Transport Model identifies the entry and exit points to Magor Service Area in an entirely different way to method used by Mr Axon for Leigh Delamere.

3.4.3. In respect of speeds and journey times, the M4CaN model will take into account a combination of speed limits, observed speeds and the effect of traffic flows on speeds. Based on the distances in Table 1 of Appendix 8 and the times in Table 2 of Appendix 8, it appears that Mr Axon has assumed that users of Leigh Delamere travel at a fixed speed of 75 miles per hour on the slip road and access road – presumably without braking. Therefore, the comparisons drawn in Table MAS2 between Leigh Delamere and Magor are misleading.

3.4.4. In Table MAS2 which summarises pit stop drive times (the extra journey time associated with getting to and getting out of a motorway service area) I agree with Mr Axon's calculation of the extra journey time associated with getting into and out of the Services, at Magor, noting that the extra journey time relates to 2037 unlike journey time calculated for Leigh Delamere which I believe are current journey times. It is also my understanding that these extra journey times have been derived from my Revised Proof of Evidence WG1.2.1 Rev A Tables 11.1 and 11.2. In this respect, the extra journey time related to the offline Motorway Service Area shown in Table MAS2 relates to the difference between stopping and not stopping via the Re-Classified M4, whilst in respect of the Indirect Motorway Service Area which is referred to are the differences between the journey times on the three route alternatives stopping at the Motorway Service Area compared to travelling along the new motorway?

3.4.5. Clearly rest stops cannot be represented in the transport model since they do not occur in a steady state. Stops are made at services in response to particular needs or for the convenience of the travellers, which are likely to vary on a day to day basis. Such stops will be influenced by the purpose and length of travel and affected by seasonality.

3.4.6. Mr Axon has made a number of assertions in respect to the VISSIM model. Unlike the strategic transport model, the M4CaN VISSIM model is a traffic modelling technique that operates at the level of

individual vehicles. The vehicles are categorised according to attributes such as operational characteristics or vehicle types. Vehicles are modelled as a number of individual units. It therefore models vehicle operation and driver behaviours in stop-start conditions that result during periods of congestion in accordance with WebTAG.

3.4.7. Traditional strategic modelling deals with average speeds and average flows and therefore cannot take into account the high level of acceleration and deceleration present in heavily congested conditions. The DMRB highlights the need to consider instantaneous emissions models for more complex situations, and as such the output from the VISSIM model has been post-processed to calculate the carbon dioxide emissions. The reference in my Proof of Evidence relates to driver behaviour in respect of changes in acceleration and deceleration and not that to the wider issues of driver behaviour to which Mr Axon refers.

3.4.8. The inclusion of the eastbound off-slip avoids the need for eastbound travellers to access the Services via Junction 23 and thereby substantially improves the ease of access to them. This is indeed borne out by both the strategic model and VISSIM model outputs.

3.4.9. I have stated in Section 3 above, that the assignment model is a steady state model. Models of this nature fall into two categories; deterministic and stochastic. In simple terms a deterministic model is a mathematical model in which outcomes are determined through known relationships. In such models, a given input will always produce the same output. A stochastic model is a mathematical representation of a random phenomenon. Unlike the deterministic model, the stochastic model includes elements of randomness, this approach includes a deterministic component and a random error component. Such a model would produce different results even with the same initial conditions. Adoption of a stochastic approach would therefore mean that robust comparisons between the Supplementary

Scheme and the various Alternatives could not be made. The M4CaN model is a deterministic model and conforms to the requirements of WebTAG which states that stochastic models are generally only required where the network is not congested. Mr Axon and Professor Pickup state that drivers do not have a perfect knowledge of route options prevailing at any one time. However, I consider that the technology advances that now provides up to date information regarding network conditions and the routeing provided pre-trip and in-trip leads to drivers having such a high degree of knowledge that the transport models and its routeing algorithms are now consistent with the information that is provided to drivers.

3.4.10. Mr Axon states that drivers cannot mathematically process the many variables in the same way that transport models do. In assignment those variables are time and cost. There is wide available evidence to say that individuals have different values of time and that those with high values of time will choose routes that minimise travel times irrespective of distance, whilst those users with a lower value of time will minimise travel distance rather than travel time. Mr Axon then goes on to say that further adjustment is required by drivers to process the function of time and cost and that requires the intervention of a human brain. These adjustments include those arising from perceived convenience, simplicity, people's experience, received knowledge, preferences, and cognitive effort, all of which add to the number of variables that the driver has to consider.

3.4.11. The values of time used in the M4CaN Model are average values of time by distance and based on travelling in various conditions such as uncongested and congested networks.

3.4.12. For westbound traffic, having stopped at the Services and continuing its journey westbound, the model predicts that the journey time travelling westbound via the A4810 Glan Llyn and proposed new motorway is slightly longer than via the Re-Classified M4 despite the route being shorter. This result arises because of the effect of having

to pass through additional junctions along the route. Journey times via the proposed new motorway and Junction 23 are greater than via the re-classified M4 primarily because of the extra distance travelled and are greater than via A4810 Glan Llyn and the new motorway since the increase in travel distance is outweighing the junction delays via the A4180.

3.4.13. I do not disagree with the view of Mr Bussell, that there may be some psychological effects that need to be considered alongside journey times, however the issue that then arises is what is the scale and quantum of those psychological effects over and that of time and cost. With regards to the westbound, egress, I am of the view that the desire to minimise cognitive effort and the desire to minimise journey time are closely aligned i.e. both point to drivers egressing from the Services taking the reclassified M4.

4. ALTERNATIVES

4.1. Alternative 8: Free Flow J23 and Connection at J23A, with Grade Separated M48 Roundabout.

4.1.1. This alternative comprises an additional eastbound free-flow connection at J23. The proposed M48 roundabout would be grade-separated and connected to the B4245. At J23A, a westbound on-slip would provide a connection to the westbound carriageway of the proposed new section of motorway, via the proposed Newport Road Roundabout. The slip road would pass over the proposed new section of motorway via an overbridge.

4.1.2. Alternative 8 results in a switch of eastbound traffic from the proposed new motorway to the A4810 and the reclassified M4, together with a switch of westbound traffic from the A4810 and reclassified M4 to the new motorway. There is an increase in westbound traffic through Magor rather than accessing the motorway at J23 and a decrease in eastbound traffic through Magor arising from improved access onto the motorway west of Magor.

4.1.3. In summary, Alternative 8 provides improved access for west Magor, the Wales One Business Park and Magor Motorway Service Area. However, there is reduced access for Undy, Rogiet and Caldicot.

4.2. Alternative 9: Free-Flow J23 and Connection at J23A, without M48 Roundabout.

4.2.1. This alternative comprises an additional eastbound free-flow connection at J23. There would be no M48 roundabout or connection to the B4245 at J23. At 23A, a westbound on-slip would be provide a connection to the westbound carriageway of the proposed new section of motorway, via the proposed Newport Road Roundabout. The slip road would pass over the proposed new section of motorway via an overbridge.

4.2.2. Alternative 9 results in eastbound traffic switching from the proposed new motorway to the A4810 and reclassified existing M4. Westbound traffic would switch from the A4810 and reclassified existing M4 to the proposed new motorway. There is an increase in two-way on the B4245 through Magor, Undy and Caldicot and an increase in two-way traffic on the A48 corridor between Langstone and Caldicot.

4.2.3. In summary, Alternative 9 provides improved access for west Magor, the Wales One Business Park and Magor Motorway Services. However, there is reduced access for Undy, Rogiet and Caldicot without the B4245 connection at J23. Increases in two-way traffic arises on the BB4245 through Magor, Undy and Caldicott together with increased two-way traffic on the A48 corridor between Langstone and Caldicott.

4.3. Alternative 10

4.3.1. This alternative comprises an additional eastbound free-flow connection at J23, which would allow the proposed M48 roundabout to be reduced in size. At J23A, a westbound on-slip would provide a connection to the westbound carriageway of the proposed new section of motorway, via the proposed Newport Road Roundabout. The slip road would pass over the proposed new section of motorway via an overbridge.

4.3.2. Alternative 10 results in eastbound traffic switching from the proposed new motorway to the A4810 and reclassified existing M4. Westbound traffic would switch from the A4810 and reclassified existing M4 to the proposed new motorway. Westbound traffic through Magor would increase because traffic originating in Undy and heading west would travel through Magor rather than accessing the motorway at J23. There would be a decrease in eastbound traffic through Magor due to improved access onto the motorway west of Magor.

4.3.3. In summary, Alternative 10 results in improved access for west Magor, the Wales One Business Park and Magor Motorway Services. However, there is reduced access for Undy, Rogiet and Caldicot.

4.4. Alternative 11

4.4.1. This alternative comprises an additional westbound on-slip that would connect the existing J23A to the westbound carriageway of the proposed new section of motorway, via the proposed Newport Road Roundabout. The slip-road would pass over the proposed new section of motorway via an overbridge.

4.4.2. Alternative 11 would result in westbound switching from the A4810 and reclassified M4 to the proposed motorway. There would be an increase in westbound traffic on the B4245 through Magor because traffic originating in

Undy and heading west would travel through Magor rather than accessing the motorway at Junction 23.

4.4.3. In summary, Alternative 11 provides improved access for West Magor, the Wales One Business Park and the Magor Motorway Services whilst increasing westbound traffic on the B4245 through Undy.

4.4.4. I confirm that the statement of truth and professional obligations to the Inquiry from my main proof still apply.