M3 Junction 9 Improvement Project

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Submission re 7.10 Modelling and Appraisal Report

SUMMARY

This is a submission that principally addresses the economic appraisal of the scheme, but also examines the modelling that leads to that appraisal and to the claims that the scheme serves the stated objectives. In an introduction we explain why we think the methodology of appraisal needs to be examined critically, in order that the appraisal specific to this scheme can be examined in more detail. It cannot be right that an examination of this scheme should accept at face value that a black-box methodology that serves the subjective ambitions of the Applicant, can deliver objective and credible outputs, without understanding what happens inside the black boxes.

Faux Science: Because no organ of government and especially no part of the Department for Transport (DfT) has ever researched or examined the fundamental assumptions of its methodology, it must be of concern to this Examination, to know how fragile and contrived those assumptions are. Accordingly, and because nobody else is doing it, in Parliament, in the Treasury or in the National Audit Office, we critically examine those assumptions before addressing the specifics of this scheme.

WebTAG economics is highly circular – it starts with an assumption of overall economic benefit for the nation, for which the DfT has shown no macroeconomic evidence, and proceeds to develop an atomistic microeconomic model based on its assumption, sums it all up and uses it as a base to assert an overall economic benefit to the nation. This is not inductive reasoning it is simply a coherent circle of error. Its justification lies in a false reading of the Eddington report that showed (total) GDP correlated with (total) road-building, when Eddington was at pains to point out that he did not know whether this was a causal relationship and if it were, which way the causality went. In fact, cross-correlation of time series shows that subsequent incremental GDP negatively correlates with incremental road building, something much more indicative of a causal relationship.

Willingness to pay is the fundamental optimisation principle proclaimed by WebTAG, but it ignores externalities – who is it that uses the road network and who pays for it? If these are different people the optimisation is not doing the right thing, unless regressive subsidy is an acknowledge policy of government. Externalities of road transport are huge, several times the total tax and duty take on the activity and with climate change getting bigger. Eddington stated externalities should be paid by the user, but such is the elasticity of road demand to price of use that if true costs were paid, at the very best, only around 20% of all current road traffic would result from users willing to pay the proper price for the use of the roads. It implies that around 80% of current road traffic is serving a negative economic purpose so far as the welfare of the nation is concerned.

An optimum level of road-based transport must exist for the overall welfare of the nation - productive activity in the absence of travel would be subsistent (more-or-less comfortable), but would be zero, if everyone were travelling all the time. Nobody knows which side of the optimum road-space we inhabit, except that the arguments above suggest we are on the side of declining prosperity and economic activity with increasing road-space. There are distinct signs of *'rebound'* and probably even *'backfire'* effects from roadbuilding, including the Metz observation of the *'myth of*

travel time saving' – we do not save time with new roads, we merely use the same to travel further for the same economic purposes.

Traffic forecasting in the DfT is like Treasury or OBR forecasting. It may disavow mere extrapolation of data, in building disaggregated atomistic models, but the models are always unevidenced, so that the process sums up, mere extrapolations. The manifest historic failure of such predictions, the *porcupine graphs*, are well known. A new factor, has appeared, however, in that future traffic levels have become a target of de-carbonisation policy and not a prediction. The problem for WebTAG and the appraisal of this scheme is that the policy-declared decarbonisation pathway (D-cP) implies far smaller user benefits.

Efficiency - Transport Appraisal, not Road Appraisal: In a well-ordered society we would look at transport as a system and look for the best way of bringing about a harmonious, functioning whole. We would not, as DfT does, partition the problem into silos; modal silos (roads, public transport, active transport) and funding silos (infrastructure and operational). The absurdity of this appraisal is that, quite apart from issues of equity, environmental and social costs, it makes no attempt to discuss real transport efficiency.

Wider Economic Benefits (WEB) are a nice cosy little *'counting angels'* idea that academic economists like to play, without any real evidence being provided and nothing to justify quantification. Recent literature, where this lack of evidence casts huge doubts on the practicality of the whole idea, concludes: *Claims of large WEBs are generally unjustified. When WEBs are claimed, an economic narrative and explanation is essential rather than applying "assumption laden black-box formulae as has increasingly been the norm".* The WEB calculation in this appraisal is all about black-box magic, without any serious analysis of assumptions, or indeed of any real statement of what the assumptions are.

Road Safety: A favourite assertion of the road builders is that road safety will be improved. The idea is that a high-capacity modern road has a lower accident rate than any road it replaces, but there has never been a demonstration by DfT or anyone else that we know of, that the road safety of the whole network is improved by the construction of any new road capacity. There are good arguments (not least in the induction of new trips and the Metz increase in length of trips for the same purpose) that it will not be, and we show that correlation data suggests a falsification of the WebTAG position on this.

Economic Analysis of this Scheme – Headlines: The basic BCR obtained from COBA user benefits and construction and other costs is unimpressive, sitting about the lower octile of BCR for UK highways projects. The Applicant chooses to outweigh this with a black-box-generated WEB benefit, without any serious attempt at an economic narrative to justify it. Even with this confection the BCR remains only at about the lower sextile of BCR for UK Highways without WEB.

Economic Analysis of this Scheme – Construction Costs: National Highways has a bad record of underestimating its construction costs, as recently highlighted by the National Audit Office. It is not clear to what extent the modelling report (MAR) takes account of current construction cost inflation. This is a complex project, with presumably higher risk than most motorway projects. MAR states that its estimate is 'most-likely', but presents no confidence estimate that must always accompany a most-likely estimate. Without this we do not understand how the Applicant can dismiss optimism bias, for which TAG recommends uplifts ~ 22-33%.

Traffic Modelling – Winchester Streets: There is nothing wrong (since they are testable) with the processes of modelling current traffic flows or using the model to predict what would happen with changes of network. What is important is to recognise what the statistical validation tests tell us about the reliability of this for making secondary assertions. Optimisation of a traffic model does not permit assumptions of validity in regions of the data where the

fit is not good. The optimisation process will naturally weight the bigger traffic flows higher (since their fractional errors of observation will be smaller) so that the fit will likely be less good proportionately for the smaller flows. The validation data over the Winchester streets has a standard deviation of mismatches of 26%. These mismatches are against a single observable snapshot of a local traffic distribution, itself of very high variability (from SD 20% to ~60% according to proxies used), so that the combined variance of the data against which DS-DM differences are asserted to be significant, ranges from SD 33% to 65%. Local effects (such as air pollution improvement) cannot be sensibly claimed against such a statistical background.

Traffic Modelling Elsewhere: The response to the ExA question on traffic in Twyford is that the scheme adds, what the Applicant considers to be, only a small extra burden of straws for the breaking of the camel's back. Yet there seems to be no model validation data for the B3335, so that no estimate is available for the reliability of the Applicant's assertion of an effect there. Nowhere in the MAR is there a reference to the decision to cancel the J9-J14 smart motorway. The answer to ExA question 14.1.2 says that the central barrier changes are included in the future baseline but says nothing about how or whether COBA was changed by the change in capacity that results from no longer assuming hard-shoulder running. Nor does it say anything about where and how the induced traffic computed from the VDEM model will dispose of itself south of Junction 9. What are the consequences of this for congestion further south, including Twyford Down and for diversion via the B3335?

Economic Analysis of this Scheme – User benefits: The user generalised cost benefits come out of the predicted traffic levels in a complicated way, linearly in an uncongested network, significantly greater if the DS is deemed to be relieving link or junction congestion. If the traffic forecasts are over-estimated, then the user benefits will at least be over-estimated in proportion and likely overestimated by much more. There are, effectively, two different government forecasts of road traffic, the one used in COBA and the one that informs the DfT's transport decarbonisation pathway (D-cP). The NTM is only a prediction of what will be, whereas the D-cP is what it is intended to be. This can only mean that the NTM forecast is in error because it fails to take account of government decarbonisation policy. The recent revelation that the D-cP falls below the NTM by 14% in 2035 and presumably much more for subsequent years (as D-cP falls as NTM rises) signifies a high overestimate of user benefits.

Economic Analysis of this Scheme – Accidents, Noise and AQ: If we accept the WebTag process and modelling for this, we still have to ask how the benefits and costs would be affected by rebasing with a D-cP rather than an NTM profile. Various estimates are made of these. The quantification of climate costs is as inscrutable as it is likely to be futile, since DfT does not take its duties seriously in this regard (how can planet-threatening activities be computed in economic terms?). The only assumption we can make is that the Applicant's cost estimate is likely to err on the low side.

***Economic Analysis of this Scheme* – Overall cost and benefit effects of changed assumptions:** If we make reasonable assumptions about optimism bias and rebasing traffic forecast to D-cP profiles, but make no adjustment for unrealistic climate cost modelling, the NPV for this scheme still becomes significantly negative. All that is left to make BCR positive is the fanciful WEB estimate, which comes out of black-box magic, without any serious economic narrative to justify it.

Economic Appraisal Conclusion: The Applicant has not made a reasonable case for assuming that this scheme is value for money, even with an appraisal methodology which is highly suspect and mostly evidence-free.

INTRODUCTION

The task before ExA is heavily circumscribed and we perfectly understand that there are norms, policies and methodologies of road appraisal that frame (or, rather, limit) what an Inspector can look at in the narrow timescale

assigned. But, because we are so convinced that a very large part of this framing is flawed and even fraudulent, we feel we would be failing in our duty, if we did not draw attention to the Emperor's lack of clothes.

We know we have to make a case within the framework of the appraisal of this particular scheme, and that the Examination will principally work within that framework and will make recommendations within it. But we hope that ExA will feel a wider duty to think about the trustworthiness of the framework. Since major schemes like this have consequences in relation to the major existential issues of our day, the duty is not just about finding a best solution within the rules of some framework, but a duty to the future. Can we imagine, looking back from a burning future and asking whether we did the right thing or just the expected thing in the past?

In this submission, accordingly, we first make a general case (ECONOMIC ANALYSIS OF ROAD SCHEMES – GENERAL) about the trustworthiness of the framework and then we look at particularities of the modelling process and its results (ECONOMIC ANALYSIS OF THIS SCHEME).

Policy and Reality: In our preliminary submission, we made the point that policy cannot overrule reality.

> *Unreality pervades transport policy in the UK. No serious analyst of the Government's Transport Decarbonisation Strategy, for example, could be persuaded that it will deliver a trajectory to meet our treaty commitments on decarbonisation.*
>
> *Unreality has also pervaded the economic cost-benefit calculations that have underlain every road transport justification for nearly 60 years. Despite being pressed on many occasions, neither the Department for Transport nor National Highways have ever demonstrated any evidence that building roads confers an overall economic benefit on the nation. Neither the Treasury, nor the Parliamentary Select Committee have ever investigated the unfounded assumption of the DfT, that there must be a net value of roadbuilding programmes.*
>
> *The point we make is that the basic economic and climate effect assumptions on which national policy seems to rely are mathematically and logically challengeable and ought to be challengeable within this Examination.*

Since the 7.10 Modelling and Appraisal (MAR) document is at the heart of the case the Applicant makes, it is appropriate to explain and develop these opening remarks within this submission. The frustration that objectors have to schemes like this is that there is never any real opportunity to question the fundamentals. As indicated above, no Department of Government has ever made any argument or given any evidence to support the DfT's basic economic assumptions, nor has there been any refutation of the evidence and arguments made against those assumptions.

In the days when a road scheme like this could be examined by an adversarial process, there was the possibility of cross-examination of the Applicant's witnesses. In my personal experience of 14 road inquiries of the old sort, there were three where the Inspector(s) seemed genuinely interested in the arguments and the Applicants' responses, but, although those three inquiries were won by objectors for more specific reasons, the Inquiry position was always that the fundamental questions could not be resolved there, but should be taken up with government. The futility of any such approach has been Kafkaesque and, for completeness I detail the frustration of it in a separate submission: *WinFoE TSC SRN23 submission* (see under Fantasy economics below). Essentially the various departments never answer the questions, nor refute the arguments, they just ignore them.

Simply because the Applicant stacks almost everything in its favour and obscures its case in morasses of verbiage and faux science (in Jeremy Bentham's words - *'nonsense upon stilts'*), we are not arguing that this Examination has no validity or real purpose. We do recognise the danger of sounding hyperbolic, but we really do believe that this scheme is actually insane and that, in a sane society, therefore, this would have been killed off long ago and would not have even come to inquiry. But the Planning Inspectorate is there to examine whatever developments are proposed, however rooted they may or may not be in rationality. And occasionally road schemes are not rubber-stamped.

We cannot imagine what arguments there could be, in rationality, planetary responsibility or even morality, to justify the extravagance and manifest damage of a scheme like this, but it is obviously possible that the Examination will find some overriding argument for it. What we wish to establish in this submission is that there is no properly demonstrated evidence, for this scheme, of benefits to:

- The national or the local economy
- The rest of the network
- Winchester's population or its traffic disposition.

What we also wish to stress is that there cannot be an argument for approving something irrational just because some policy biases towards approval. Thus, because this project may have been deemed as one of *Nationally Important Infrastructure*, does not mean that that designation has been arrived at rationally. We cannot assume, for example, that the Infrastructure Commission, has determined that the strategic road programme is an essential part of a national transport policy.

Eight years after its creation, the Infrastructure Commission has still not got beyond thinking of the disposition of transport infrastructure provision as it is, rather than as it should be. In its 2nd Baseline Report[1] it appears to be vaguely thinking of cross-modal transport:

> *The government is investing substantially in interurban transport through projects such as High Speed 2 and the second Road Investment Strategy. An integrated rail plan, informed by the Commission's Rail Needs Assessment for the Midlands and the North, is also expected soon. A multi modal transport strategy for interurban connectivity would help ensure that investments like these are planned together effectively, optimising the use of different modes and considering the needs of passenger and freight travel together.* (Annex F5: Interurban Transport)
>
> *technological innovation, decarbonisation and behaviour change all mean that patterns of transport demand, and ways to meet that demand, may be very different in future.* (p. 16)
>
> *Challenge 9: Interurban transport across modes – the Commission will consider relative priorities and long term investment needs, including the role of new technologies, as part of a strategic multimodal transport plan.* (p.17)

So, coherent transport policy, not now, maybe tomorrow or sometime, but clearly the Department for Transport and the Infrastructure Commission do not yet do transport planning. Rail and Public Transport planning exist in a separate silo from Road Planning and nobody, apparently, tries to integrate them. National Highways sits in its cloistered world of fantasy economics, entirely cut off from the real world of an economics that ought to take account of trophic limits and the environmental imperatives on which planetary survival depends. Meanwhile. billions are spent, and environments are ruined, without any concern for whether current policy makes any sense.

The core of the recent High Court judgment on the A47 case appears to be that it is reasonable in law for a Secretary of State to act unreasonably if policy allows that. Whether or not that curious, Balnibarbian position survives appeal, we sincerely hope that this Inquiry will not feel bound to accept irrational positions just because those positions come down from irrational policy.

Black Box Priestcraft: The Planning Inspectorate must have a problem with these fast-track infrastructure Inquiries, with their very narrow timescales and their mountains of data and documents. We are daunted by the sheer scale of what is before us and can appreciate that Inspectors themselves must be under huge pressure to come to any clear understanding of what is going on. The process is deeply unfair and anti-democratic, and it was meant to be. When it was being proposed, the Green Alliance said of it *'the Government is removing a legitimate lever of protest and*

[1] https://nic.org.uk/app/uploads/Revised-Second-National-Infrastructure-Assessment-Baseline-Report.pdf

removing everyday people from the heart of the political process'. When we defeated the Easton Lane Link Road and M3 College Meadows route in the late 1970s and early 1980s, it was significantly because we had access to all the data and methodology, and the time to take apart the traffic modelling and economic analysis. Because of the timescales nowadays, we no longer see the details of the appraisal because it is hidden within black boxes.

We are required to take the outputs of a very large number of black-box computations without ever seeing the data and assumptions put into them. The MAR is riddled with the spewed-out results of TAG black-boxes and we are expected to accept that there is no *Garbage Out* because we are simply required to assume that there is no *Garbage In*. In this it resembles nothing so much as priestly arcana, *ex cathedra* pronouncements.

Worse than all this is the denial of one of the first principles of any science – when I did my first physics practical experiment, as an undergraduate, the supervisor did not want to know what value I had found for the charge on the electron, but *'where are your error calculations?'*. Road appraisal has been quantified *ad nauseam*, without ever testing whether the numbers add up or whether results are numerically significant.

ECONOMIC ANALYSIS OF ROAD SCHEMES - GENERAL

The Fantasy Economics of Webtag

Over many years, I have made many submissions on the economics of road building, not just to public inquiries, but to national consultations, select committees and directly to Ministers. These have been as individual submissions as well as on behalf of campaign organisations. A recent submission to the Select Transport Committee tries to collate these various representations. I will submit this as a separate document. It is long and, because it is an assemblage of submissions, it has a certain amount of repetition in it (though that is nothing new compared with the assemblage of documents before this Examination). I do not expect that the document will be read, but I submit it for completeness and as a background detailed reference to what I discuss below. I will try to summarise the arguments and the evidence here.

Road Schemes and Economic Growth - Phoney Science: Economics often pretends to have a basis in scientific method, though few scientists would be comfortable with its ability to assert mechanisms and relationships with such certainty in the absence of evidence. The scientific method either starts directly with observation or with questions leading to observation (experiments); proceeds to hypothesis (possible explanation) development with inductive reasoning; deductive reasoning will suggest experiments to test the hypothesis; experimentation and analysis of results; then either reject the hypothesis and look for another one, or move on to the same process for exploring the extent to which the hypothesis holds (new questions, new experiments). A basic principle of any investigative science is that hypotheses must be falsifiable, i.e. that they must be inherently capable of being tested and proven wrong.

Get deeper and deeper into hypothesised mechanisms that have not yet been proved wrong will lead to coherent models that have more and more credible predictive ability. Some models last centuries – Newton's dynamics was good enough for 250 years and still good enough to land on the moon, but the anomalous precession of Mercury found the weak spot and needed Einstein. Lord Kelvin's thermodynamic analysis concluded that the age of Earth could not exceed 200 million years – the analysis wasn't faulty, but radioactivity had not been discovered, so that its planetary heating capability was unsuspected.

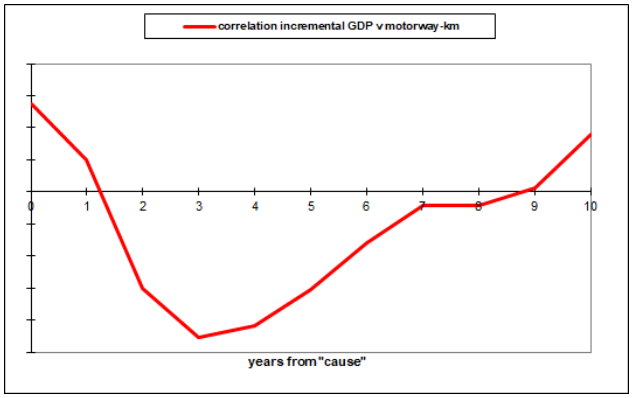
But the deeper science gets into physical mechanisms the more it is trusted and the more likely is it to predict effects reliably. In 1896 Arrhenius predicted global warming, remarkably accurately from the basic physics at the time. But it took all the hard graft of the data collection and physics-based modelling from the 1960s onwards to be relatively sure that we can rely on no lucky feedback mechanisms to offset the Arrhenius prediction. We may still just be lucky, but it is a madman's gamble to rely on that.

This is how science works. The Department for Transport and National Highways do none of these things. WebTAG does not ask the basic economic questions; it does not do any inductive reasoning; it does not do any experiments and apart from some small empirical curve fitting (e.g. of queue lengths at junctions), it does not do any analysis, it makes no attempt to falsify its assumptions. What it does is simply assert.

It simply asserts that the road programme brings economic growth. The Applicant here will be unable to find any evidence that it does so and that is simply because the DfT has never looked for such evidence. When it has been repeatedly asked what evidence there is, it comes back with two statements. Firstly (and this is the one the politicians use to justify road programmes) it sums up the WebTAG benefits of all the road schemes and gives that as a contribution to the wealth of the nation. But this is not inductive reasoning but the mere circularity of a coherent falsehood. Webtag assumes a benefit from road building as an axiom, so that taking its calculation of benefit dependent on this axiom cannot be a proof of the validity of the axiom.

The second statement is that the Eddington Report[2] found that road building and road traffic correlates with GDP. Of course it does. GPT is more-or-less a monotonically rising trend and so, unfortunately, is road traffic. But air pollution deaths are on a rising trend, so is obesity or asthma, but we don't assert that these trends are improving GDP. What the DfT ignores is that Eddington clearly stated that he did not know in which direction the correlation went – is it cause or effect? Do we get economic activity[3] as a result of building a road or do we build roads because the economy is active enough to fund the building of roads? Or is there no relationship between them at all? The DfT hasn't answered this question.

Proof of significant correlation that can be hypothesised as causality will always be difficult – science is difficult. But, there is in fact some evidence of correlation that cannot be brushed aside as a simple correlation of monotonic trends and must be explained. It is in the gradients of the trends that there are particularities of data that may show correlation that is not the mere accident of the correlation of more-or-less linear trends. Significant correlation of non-monotonic curves is a much better indication of inter-relationship, rather than common relationship to some third set of data. And much more likely to show up any causality. Thus we can determine the cross-correlation[4] integral of the time series of annual growth of road capacity and annual growth of GDP. If road building increments are deemed to be the 'cause', then the integral represents the 'result' (i.e. the way GDP increments follow the capacity increments) in the time following the cause. The result[5] is:



This is classically the result you would expect if the causal relationship was deemed to be *'road building leads to economic decline'*. It is not, of itself a proof of that hypothesis, but it is a very good indication that the opposite

[2] https://webarchive.nationalarchives.gov.uk/20081230093524/http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/
[3] i.e. additional economic activity to that which is associated with the building of the roads
[4] https://en.wikipedia.org/wiki/Cross-correlation
[5] The same integral form occurs over whatever reasonably extensive time frame is selected for the data set and for other measures of road capacity increases (e.g. all-road length increases)

hypothesis (i.e. the DfT hypothesis) is likely to be untrue. DfT have been invited to comment on this apparent falsification many times, but have never chosen to do so.

Road Schemes and 'Willingness to Pay' - Externalities: The fundamental principle of WebTAG cost/benefit analysis is that there are demand-supply curves which are mediated by a 'willingness to pay'. This would be fair enough, if the government, as a provider, was paid for the costs of that provision by the user - quantity would match demand. If government can improve efficiency of its provision, then effectively the cost of that provision declines and the demand tends to increase – at least until demand is saturated and the user spends money saved from a price reduction, on something else. The activity associated with these 'transactions' contributes to the GDP of the nation, though this, of course says nothing about its value to the nation in terms of wealth or happiness, which can be positive or negative.[6]

The government assumption is that the activity that results from this transaction in road transport is not just the activity that directly results (i.e. the actual movement of vehicles, buying and selling of oil, etc.) but the activity enabled by this transport (e.g. the manufacture of goods that can be sold further afield, or tourist spending). This assumption leads to the assumption that there is a public benefit resulting from this activity and that, therefore, enabling an increase in demand to be satisfied through network efficiency improvements, signifies an increased public benefit.

But we know from the above cross-correlation that the evidence is actually against this assumption – the road programme appears to correlate with subsequent decline in activity. This, of itself, does not signify there is no public benefit from enabling such demand. GDP isn't everything and there are many public goods which are enjoyed without significant or even any monetary exchange activity being involved, hard as that may be for the fanatics of Tufton Street to understand.

But there is a much bigger logical problem within Webtag, than the falsification of its basic assumption that GDP benefits from road building. The problem lies in the 'willingness to pay' because that transaction assumes that the receiver of benefit is the one that pays for it. The whole nature of supply and demand balance assumes a freely made and fair transaction on both sides. If we once put subsidy into the equation the question becomes not *"is the user willing to pay?"* but *"who is it that pays for the user?"*, when the curves shift and generate more demand and supply than the user pays for. And *"does the benefit to the user redound to the general public good?"*

Is there a subsidy to the user with road transport? The user certainly pays something for what he/she gets. Not counting the purchase and running costs of the vehicles, which clearly don't figure in the transaction, there are taxes and duty on vehicles and fuel. There is a common assumption that these taxes pay for the provision of the roads and a common complaint that they essentially form an extra revenue for government – *'milking the motorist'.* Politicians usually give tacit credence to this assumption and this complaint. But what is the evidence for the assumption?

There have been several studies of the externalities of road transport. Externalities include the costs to the public purse of ancillary services (that are not borne by the DfT), including police and justice services, NHS emergency provision and most parking provision (where parking fees do not cover the value of land capital forgone). They also include the cost to the public of other capital value forgone, such as agricultural land and the value of street space lost to pedestrians and active travel; they include the cost of getting in the way of other activity of public benefit (e.g. congestion impedes ambulances and has a cost in lives affected by that and congestion gets in the way of efficient

[6] Robert Kennedy's famous words on Gross National Product at Kansas University: *"it measures everything in short, except that which makes life worthwhile"*
https://en.wikipedia.org/wiki/Robert_F._Kennedy%27s_remarks_at_the_University_of_Kansas#:~:text=Yet%20the%20gross%20national%20product,integrity%20of%20our%20public%20officials.

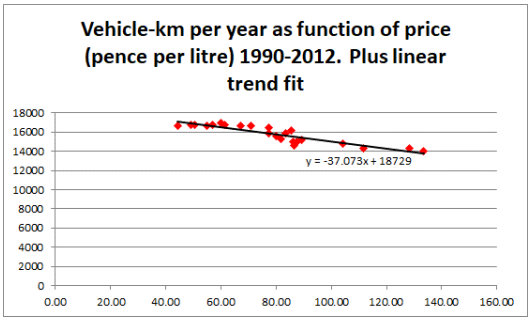
public transport); they include the costs of positive harm to people through air pollution, noise pollution and intimidation; they include costs of social exclusion of those who do not own or drive cars (costs including increasing difficulty of accessing facilities which move further away from them); they include pollution costs to agriculture and costs of loss of landscape, heritage and biodiversity; and they include the existential cost of climate change.

All such studies have concluded that externalities well exceed user taxation. The biggest was the Blueprint 5[7] study, which concluded that the externalities of road transport amounted to around three times the total tax and duty take on the activity. Even this study failed to include many of the externalities that I listed above and its estimate of climate costs would be seen as far too small today[8], in the light of present knowledge of what global warming will do to us. The estimated cost of air pollution at the time of Blueprint was nowhere near what we see it as now[9]. Also the proportional level of road tax and fuel duty has gone down since Blueprint. So that it is clear that the externalities of road use amount to a very large subsidy on the activity. The DfT has never denied the validity of the Blueprint 5 study.

Road transport, therefore, is very highly subsidised, by at least as much as Blueprint showed and, in view of the growing acceptance of pollution costs and climate costs[10], almost certainly a lot more. There are all sorts of reasons for public subsidy and it is sometimes arguably right to use universal subsidy to achieve changes of behaviour, even where that benefits people who do not need it. But it is very hard to argue that it is right to subsidise regressively, i.e. subsidising the better off at the expense of the poorer. But that is exactly what the subsidy to road transport does – the externalities fall mostly on the most-deprived.

Eddington was very explicit about externalities in transport – they should be paid for by the user. DfT has never commented on this though it commissioned Eddington and it has cited his report several times for other things (including for DfT's erroneous interpretation of Eddington's GDP conclusion – see above). If the user paid for the externalities, then we have to seriously ask what the consequences would be for the current road transport disposition. In fact we can get a pretty good idea.

Total traffic (veh-km per year) appears to vary pretty linearly in relation to petrol pump prices:



A similar elastic relationship holds for fuel prices in real money, though the range of prices is fairly narrow[11], which somewhat restricts the validity of extrapolating the relationship to much higher costs. Nevertheless, the linear relationship is the only relationship we can extract from the available data. If the Blueprint externalities were to be clawed back from the users, it is equivalent to adding three times the tax take (fuel duty / VED) to the average fuel

[7] Blueprint 5: The True Costs of Road Transport ; Maddison D, Pearce D, Johansson O, Calthrop E, Litman T &Verhoef E; Earthscan, London 1996

[8] It is indeed arguable that carbon emissions are '*costing the Earth'.*

[9] PHE's estimate just for $PM_{2.5}$, of 29,000 early deaths (aged 25+ years) p.a. with an average loss of 10 years life, computes, on DfT values-of-life parameters, to £25B p.a. – i.e. about the size of the RIS2 programme.

[10] Including, ironically, NH, by acknowledging the need for climate mitigation for the survivability of its own infrastructure.

[11] Unlike with public transport where user costs have risen very significantly, motorist and road freight costs have declined in real terms.

price the user pays. We can then use the linear elasticity equation to find the level of traffic that would result. It works out that traffic would fall to about 20% of current levels.

Consider what this means. At the very best only around 20% of all current road traffic would result from users willing to pay the proper price for the use of the roads. It implies that around 80% of current road traffic is serving a negative economic purpose so far as the welfare of the nation is concerned. This is consistent with the result on the negative correlation between roadbuilding and GDP growth and gives some quantitative indication of the scale of the uneconomic activity that road use brings.

The evidence on this has been presented to the DfT, the Transport Select Committee and NH on many occasions and no evidence against it or any counter-argument has ever been put forward by those bodies.

Road schemes and Jevons Paradox: The most extraordinary assumption made by the road builders is that it must always be beneficial to improve the capacity of systems and infrastructure and to reduce the costs of use. This assumption is made regardless of consideration of whether the system is subsidised. But the assumption is clearly logically false. A country without transport infrastructure (i.e. without any possibility of moving goods) would clearly have a low level of activity and, though off-the-grid basic local agrarian society has been sustainable in the past, it is probably not so at the higher levels of population of today. On the other hand, if transport infrastructure took all the land in a country there would be no trophic base for the basic needs of life, i.e. there would be no activity.

This signifies that there has to be a certain level of road infrastructure and its use that is optimum for the sustainability of the economy. That in turn signifies that provision of more road infrastructure and more use of it beyond the optimum must result in a negative economic consequence. The question is which side of the optimum are we on? The only evidence that seems to exist is in the correlation tests and the elasticity response to users paying true costs (evidence that has not been contested and against which the roadbuilders have presented no countervailing evidence or argument) is that we are already in the position of being beyond the optimum – road building weakens the economy.

> *In economics, the Jevons paradox occurs when technological progress or government policy increases the efficiency with which a resource is used (reducing the amount necessary for any one use), but the falling cost of use increases its demand—increasing, rather than reducing, resource use.*
>
> Wikipedia

Increasing efficiency of a system (e.g. by concentrating on one aspect of an economic system) may not, therefore, always be advantageous to the whole system. Generally, there is a degree of *'rebound'*, signifying that a lesser benefit results than is expected by aggregating simple efficiency calculations. *Full rebound* is when no overall benefit arises and *backfire,* or Jevons effect, is when the efficiency changes end up in overall negative benefit. The concentration, of National Highways and WebTAG, on the virtue of time saving, seems to be a classic case of the Jevons Effect.

David Metz has demonstrated[12] that all the major road building of the last several decades, has resulted not in the saving of motorists' time, but in the motorists spending the same amount of time, but driving further. Now NH will say that that merely signifies that motorists are realising new opportunities to travel further. But how can they know that? There seems to be at least as much likelihood that it is the same opportunities moving further away, and there seems to be plenty of experiential evidence of this effect. Shopping facilities move from the street corner to the edge-of-town and then to car-centred hypermarkets down the motorway; cottage hospitals close and hospital

[12] Metz, David; '*The Myth of Travel Time Saving*', Transport Reviews, 28:3, 321 – 336; 2008

facilities amalgamate in much larger hubs; GP practices similarly merge into GP hubs; local schools similarly dissolve into larger education establishments with large catchments and so on. This is all indicative of a trend to greater distances travelled for more or less the same purposes. The related problem of impoverished (especially rural) public transport means much greater pressure on those who can do so, to access desired facilities by car; for those who cannot do so it amounts to social deprivation (for those without cars, either by reason of affordability, health or age) – their access to facilities is worse than that pertaining a hundred years ago.

Putting aside the matter of motorist and road freight subsidy for the moment, we should ask why this could happen in a market economy. Why should the economy have evolved to make access to the same facilities involve longer and longer journeys? This must be because a liberal, unrestrained free-market economy will always be asymmetric in the functioning of its transactions. For a provider of goods (whether it be material or services) it usually makes sense to seek economies of scale. Often those economies of scale are beneficial to the purchasers or users of goods and services, but they are less often beneficial to those employed by the provider. The point is that the power in these transactions is always weighted towards the producer or provider. The power moves towards improving the efficiency of an economy of scale, even if that works towards reducing the efficiency of accessing the goods. Effectively the supplier produces goods cheaper and the buyer gets the goods cheaper at face value, but he/she pays more through the cost of access. If he/she paid the true cost of access then the market balance would shift towards shorter journeys for the buyer and either longer journeys for the seller/producer or more evenly geographically distributed sources of production and the employment that goes with it.

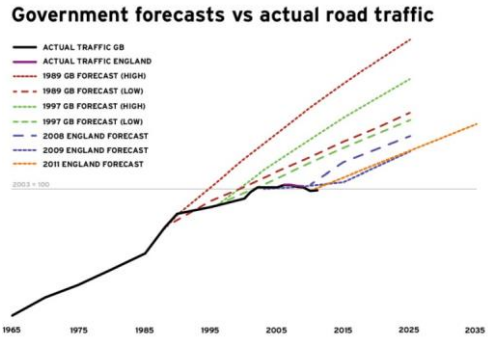
Since the road transport system that enables this transactional balance relies on very large subsidy, the asymmetry of power in the market is magnified. The provider of goods benefits both directly from transport subsidy (i.e. the subsidy to road freight) and indirectly from the subsidy to its customers in accessing its centres of economy of scale. While some economies of scale have advantages that are not dominantly economic (e.g. big hospitals can do much more than lots of smaller, more local hospitals) it cannot generally be sensible to so geographically disperse facilities away from their users. This entropic process would surely be unlikely to occur in an equilibrium market devoid of large transport subsidy.

Just to conclude on the Jevons Effect, a significant part of the DfT's transport decarbonisation strategy is reliant on the development and use of electric vehicles. EVs clearly have their own environmental problems, some of them very worrying, and they do make all sorts of unreasonable presumption about priority access to whatever renewable energy will be available. But they do represent an energy efficiency gain and will surely figure in any future sustainable transport scenario. But in a business-as-usual subsidised road-transport disposition, that efficiency gain seems very likely to bring about further rebound effects.

WebTAG and Cost-benefit calculation: It ought to be clear from all the above that there is no reason to attach an iota of significance to a cost-benefit analysis of any road scheme, based on the accumulation of any kind of time or cost savings supposedly gained by the user in a transactional market stacked with regressive subsidy. If the overall economy (as measured by GDP) declines as a result of overall road building, it is reasonable to assume as a first approximation that no single scheme can have an overall economic benefit. It may be that a single scheme would work counter to the generality and actually generate benefit, but how could this be demonstrated?

If the applicant does not accept these conclusions, it surely must explain why and produce evidence to refute our position. If this Inquiry has any kind of fairness, it should require such an explanation and such evidence. It is unfair to hide behind the gobbledegook of WebTAG and say that that is policy or how it has always been done. It is unfair if this Inquiry simply ignores such arguments.

Road Schemes and Traffic forecasts: We are never allowed to question the national traffic forecasts used in these schemes, even though the infamous 'porcupine graphs' are well known:[13]



Though they demonstrate that government forecasters are always overdoing it (Treasury growth forecasts are also porcupines) in the case of traffic forecasts they have a self-fulfilling nature – not that the overall traffic levels follow the steep upward curve, but that where there are predict-and-provide road interventions the induced new traffic does result (thus the massive growth of traffic on the A34 and M3 was not the predicted 'normal' growth at the time of the interventions, but resulted directly from those interventions).[14]

We referred in our earlier statement to Professor Marsden's information, obtained under FoIA legislation, which showed that there are two very different government forecasts which cannot be reconciled. So it is no longer a case of saying that forecasts are not legitimate matters for discussion at public inquiries. We discuss this below in relation to the user benefits of this scheme.

'Valuing' Externalities: The DfT has flirted with the concept of attaching a quantitative value to environmental or other less tangible qualities that seem, to many, to be important to society and the survivability of the planet and life in all its forms. They have, for example, proposed a methodology for valuing landscape. And, they even proposed a methodology for quantifying a subjective appreciation of the Stonehenge monument, with or without the tunnel scheme. This *'contingency valuation'* was then extraordinarily shoved into the cost-benefit analysis to offset the highly negative BCR. And therein lies the obvious danger of this sort of legerdemain – a survey of opinion of this nature is so clearly open to tendentious framing. And it ignores in-combination effects – the continued existence of an individual passenger pigeon may have seemed of negligible value when the skies darkened with their flocks, but how would we estimate the value of our loss when the cumulative hunting led to their extinction?

Those environmentalists who rightly complain that cost-benefit analysis *'knows the price of everything and the value of nothing'*,[15] but who then go on to say we should be valuing all the important things, are unfortunately falling into this cynical trap. If you price the priceless, the philistine will find a way to pay for making it worthless. The whole WebTAG framework is designed so as to generate enormous fictitious economic benefit out of trivial supposed, atomistic time savings; it is easily rigged to outscore some supposed 'valuation' of intangible subjective assets. We must resist this quantification of the things that are most important. We have to hope that there are human beings involved in the examination and appraisal of projects like this, who can see value beyond what computational machines are telling them.

Above all, it is not necessary. We know that there are very large quantifiable externalities and that they could be clawed back through mechanisms such as fuel duty or, in a way more focused on specific externalities, through

[13] Beyond 'Predict and Provide'; Phil Goodwin Presentation 2016

[14] Nobody from NH (or its previous aliases) was openly predicting at the time of Twyford Down Inquiries that there would be so much extra traffic 30 years later that further capacity increases, like the proposed scheme here, would be necessary. Though the 'secret report' on the Twyford Cutting widening showed internally what they were thinking.

[15] Oscar Wilde's definition of a cynic.

location-dependent road pricing. If we did this, most of the traffic problem with its quantifiable externalities would go away. If, once transport were put on this fair footing, and there were still deemed to be major infrastructure requirements for any given mode, then appraisal of them could be carried out on a basis that valued sustainability and equity.

Efficiency - Transport Appraisal, not Road Appraisal: In a well-ordered society we would look at transport as a system and look for the best way of bringing about a harmonious, functioning whole. We would not, as DfT does, partition the problem into silos; modal silos (roads, public transport, active transport) and funding silos (infrastructure and operational). We would not have the manifest absurdity of looking at this M3J9 scheme without asking how things could be different if we appraised it as a transport scheme.

The absurdity of the appraisal before you, is that, quite apart from issues of equity, environmental and social costs, it makes no attempt to discuss real transport efficiency. Much of the rebound or backfire consequences of making private motoring and road freight more efficient, relates to the subsidy these things receive, so that true costs are not perceived by the user, but by society as a whole. But DfT's desire for system efficiency through atomistic reduction of costs to users. who don't perceive all of those costs anyway, ignores the huge transport efficiency gain that could be got through public transport and rail freight. It, moreover, ignores the fact that the current road-user subsidy competes with those efficient modes and thereby make them less efficient.

Wider Economic Benefits: Given all the biases towards a favourable economic result in WebTAG COBA analysis of user benefits, one would think the DfT didn't need to dream up additional imaginary benefits. Once one accepts the whole atomistic concept of valuing user time and cost savings, one can obviously play around with additional atomistic factors and imagine so-called *agglomeration* effects, independent of supposed user benefits. Everything that applies to the criticisms of user-cost savings in a transport system where it is not the user that is bearing the costs of his/her activity, must apply to these 'agglomeration' effects, if they exist at all. If there is a productivity gain somewhere, as a result of a transport mode that carries unresolves externalities, then much or all of that productivity gain is also derived from those externalities – how is the nation as a whole benefitting from that?

Everything we have said about roadbuilding correlating with reduced GDP signifies that there cannot be an effect of gaining national economic benefit from further road building, whether it be from subsidised user benefits or subsidised productivity gain in agglomerations that feed on the subsidised access to them.

Agglomeration is about the observation that concentration of people in cities results in higher productivity there. The argument essentially here is that the road infrastructure is allowing the effective growth of cities (e.g. Southampton) without physically/geographically growing them, by effectively increasing their catchment. The productivity argument is a highly dubious one, since productivity of enterprises within a city cannot be the sole measure of the economic wealth (let alone the 'welfare', a word rather strangely misused in WebTAG) of the city and its inhabitants.

WebTAG 2.1 claims that

> *Research has shown that these wider economic impacts can be significant and can arise in a number of ways. These include productivity gains resulting from improvements in how well businesses are connected to each other as well as potential employees, and benefits arising from structural changes as businesses and households relocate.*

It does not bother to tell us what research says this, nor that this must be highly selective, since most research on the web is either critical of the concept or its applicability or it is agnostic about it. The recent review paper I cite below is highly critical.

Nor is there any recognition within this shameless attempt to justify ever more car travel as a means of accessing cities, of the obviously greater efficiency of accessing them by almost any other means. The road space and central car parking space in Winchester is very limited and it doesn't explain the large number of people moving around the centre (the footfall). Clearly many more people could access Winchester, for example, and have more space for economic activity if the efficient access of bus travel and active transport were not so impeded by car congestion. Even if we just supposed that the WEB calculations from Webtag were meaningful, what we do not see is what the Wider Economic Disbenefits are from subsidised car transport and road freight getting in the way of more efficient modes of access and denying space for more efficient economic usage.

Assuming that any of the mathematics behind WEB were credible in the absence of any practical demonstration of its applicability, the whole idea of WEB would only make sense if it assessed the effects on a multimodal basis. If car access to cities impedes a more efficient access, then it takes away the WEB that that access would achieve.

For WEB to be a logical part of the cost-benefit analysis its value must be deemed to be a national productivity gain, so it is necessary to ask whether a local productivity gain has any consequences for other parts of the country, and can those consequences be negative? Therein lies the rub. The logic of the agglomeration idea is that the bigger the agglomeration the greater the productivity gain, which signifies that the nation would gain from all activity moving to bigger and bigger agglomerations, ultimately to London or maybe the Midlands. So what does this say about regional priorities; what does it say about the government policy of levelling up?

A recent paper[16] sounds a very strong warning against the *black-box* nonsense of TAG Unit 2-1:

> *The standard economic appraisal of transport infrastructure includes transport user benefits but may require marginal adjustments for additional economic benefits (WEBs) in a few cases.* ***Claims of large WEBs are generally unjustified****. When WEBs are claimed, an* ***economic narrative and explanation is essential rather than applying "assumption laden black-box formulae as has increasingly been the norm****". Small agglomeration benefits may occur with actual increases in employment density. However, it* ***needs to be demonstrated that the transport infrastructure will increase employment density.*** *Pending further research, changes in effective density due to lower transport costs are unlikely to have significant productivity effects without changes in actual employment densities. The value of output associated with travel time savings increases with imperfect competition, but this factor is likely to be offset by due allowances for productive work during work trips and for some trip-maker preferences for leisure. Transport improvements may marginally increase labour supply or moves to more productive jobs. These benefits are captured by the rule of a half assessment in a standard evaluation method. There may be small additional benefits from increased tax revenue. Consistent with most of the literature, when transport investment displaces other investment, there are no additional macro-economic benefits. Substantial changes in transport infrastructure may generate producer surpluses in addition to transport user savings where there are high existing transport barriers or where significant economies of scale occur or comparative advantages are achieved. Transport infrastructure may also generate residential development that would not otherwise occur. But cause and effect need to be shown. Fundamentally, any claims for WEBs should be carefully demonstrated in the context of any proposed new transport infrastructure. It is inappropriate to simply assume that a WEB exists.*

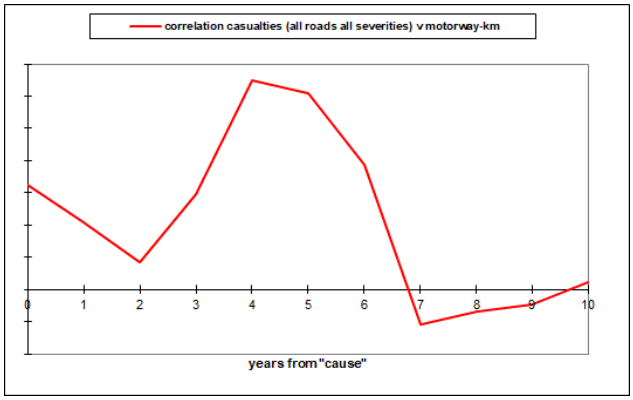
Accident benefit: In our opening statement we challenged the idea that road safety is improved by road building, as a nice little invention of the Webtag appraisal process. The idea is that a high-capacity modern road has a lower accident rate than any road it replaces, but there has never been a demonstration by DfT or anyone else that we know of, that the road safety of the whole network is improved by the construction of any new road capacity.

Accidents and accident rates and severity have declined steadily over decades, but that seems likely to have been mostly to do with technology and speed limit measures. A new road will usually have a lower accident rate than the

[16] P Abelson; *A critical review of the wider economic benefits of transport infrastructure*; International Journal of Economics & Management Sciences; Review Article; *Volume 10:10, 2021*

parts of the network it bypasses, but that road will generate more trips and those trips will on average involve a greater distance (Metz) and almost all trips end up on other parts of the network. Nor do we know what the SRN end-effect (i.e. where the trip leaves the new road onto the rest of the network, with a built-in speed behaviour) will be. The roads off junctions on the M3 and the A34 will be modelled as types of those roads and given the speed characteristics of the network averages of those types of road; it will not have any cognizance of the fact that those roads are fed from the M3 and A34.

If we carry out the same cross-correlation exercise as we did before for road and GDP increments, we get for casualties:

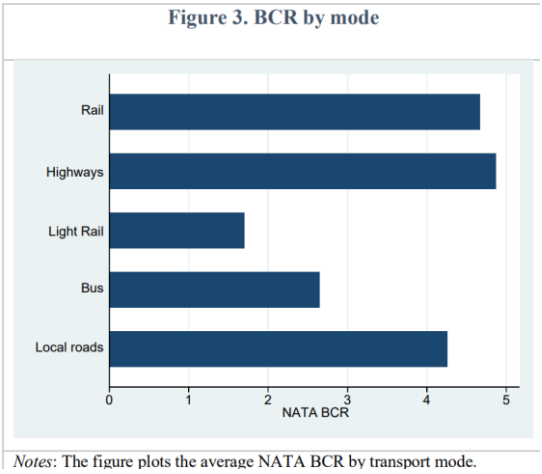


So the data seems to indicate a net casualty increase follows a net road capacity increase. Similar graphs occur for accident and for total-road increments. Again the DfT has been shown this data and has never refuted it.

ECONOMIC ANALYSIS OF THIS SCHEME

Assuming that all the arguments above are ignored or convincingly contested, what can we say about the cost-benefit analysis as it is presented?

Headlines: Firstly and obviously, that the basic COBA BCR is unimpressive. It represents a return on investment over the scheme life of 35% or a compound interest rate of about 0.5% per annum, so that, together with Treasury discount 3.2% (3.5% for 30 years, 3% for 30 years) this is equivalent to an annual return of 3.7% – what kind of organisation thinks that would be a good use of funds invested in a long term project, with unspecified risk? Average UK transport project BCR (data from Eddington, assembled by SERC and LSE[17]) suggest that average highways BCRs are getting on for 4 times as large as that for this scheme:



This is like-for-like, because these BCRs are without WEB.

[17] *Regional Differences in UK Transport BCRs: An Empirical Assessment*; N González-Pampillón and HG. Overman; Centre for Economic Performance Occasional Paper 53; *2020*

Secondly that the WEB exceeds the COBA NPV, so that the Applicant is relying on a highly implausible black-box process to get to a BCR of 1.72, still only a third of the average non-WEB BCR for highways schemes.

Construction and Maintenance Costs: National Highways have a serious problem to address with its construction and maintenance cost estimation. The latest National Audit Office Report[18] found:

> *By 2025 National Highways will have completed less work on road enhancements and at a higher cost than originally planned. Some change is expected when delivering a portfolio of projects, but there has been more change than anticipated. At the same time, National Highways and DfT could have done more to plan for and manage the potential risks to their portfolio of enhancement work. In recent months, inflationary cost pressures have risen beyond levels that could have been anticipated by National Highways and DfT, who will face difficult decisions about how to prioritise work. National Highways and DfT should seek to improve the planning and management of their portfolio of enhancement projects.*

The modelling report does not say when the scheme construction and maintenance costs were actually put together, though it implies it last updated this last year. Construction cost inflation[19] is currently running at around 11% and since inflation generally is running quite a lot higher than was expected by central government last year, we can reasonably assume that the inflation assumptions in MAR5.4.1 are now suspect.

This is a complex project, with presumably higher risk than most motorway projects. MAR states that its estimate is the 'most-likely' estimate, but maximum likelihood estimates must carry a 'confidence region' (or error bar). This does not seem to appear in MAR. So how confident is the Applicant in the estimate? Without stating a confidence estimate we do not understand how the Applicant can dismiss optimism bias. We assume from the TAG-A1.2 (2022) description that this project is at Stage 2.

Table 7 Stage of scheme development according to scheme category

Category	Stage 1	Stage 2	Stage 3
Local Authority and Public Transport Schemes	Strategic Outline Business Case (SOBC)	Outline Business Case (OBC)	Full Business Case (FBC)
Highways England Schemes	PCF Options Phase	Order Publication/ Works Commitment	Construction Preparation
Railways	Grip Stage 1: Project Definition	Grip Stage 3: Option Selection	Grip Stage 5: Design Development

And in Table 8 we assume that this scheme fits somewhere between 'Roads' and 'Bridges and Tunnels'.

[18] *Road enhancements: progress with the second road investment strategy (2020 to 2025)*; NAO; Nov 2022

[19] ONS: Construction Output Price Indices (OPIs), Quarter 1 (Jan to Mar) 2023

Table 8 Recommended optimism bias uplifts for different projects at different stages of the life of a transport project				
Category	**Types of projects**	**Stage 1**	**Stage 2**	**Stage 3**
Roads*	Motorway, trunk roads, local roads	46%	23%	20%
Rail	Metro, Light rail, Guided buses on tracks, line upgrades, high-speed rail	56%	33%	30%
Fixed links	Bridges and Tunnels	55%	32%	28%
Building projects	Stations and Terminal buildings	70%	48%	44%
IT projects	IT system development	69%	50%	42%
Land and property	Property purchases	33%	14%	0%
Rolling Stock**	Powered and unpowered vehicles	61%	38%	35%

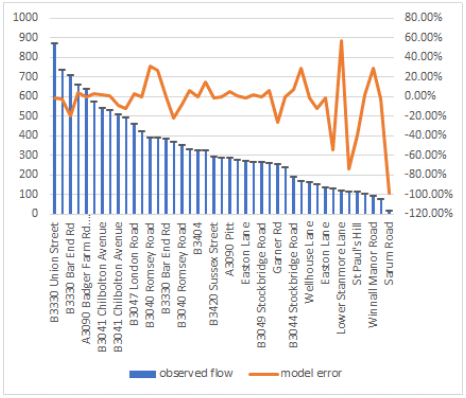
Source: Oxford Global Projects (2020)

This puts the recommended optimism bias at between 23 and 32%, corresponding to uplifts of PVC from £113M to between £139M and £149M.

Traffic Modelling: We believe that modelling of existing traffic on a network is a perfectly sensible process. Its assumptions are shown to be reasonable, by its ability to show that modelled flows match observe flows to some degree of accuracy (verification). It is an optimisation problem akin to least-squares polynomial curve fitting to 1-dimensional data. If we have hypothesised a model curve that matches the observed data with a distribution of small residuals then we can start to believe in it, but always with caution. We would believe it was reasonable to interpolate in a region provided we took account of the residuals of the fit in that region. Since the traffic model has involved some thought-about descriptions of the relationship between network elements (links or junctions) and their likely speed-flow characteristics, the equivalent to the validity of interpolation is the validity of re-arranging the network with additions or subtractions of network elements that are of the same kind as those that went into the model (reassignment).

We would not expect an optimisation to be valuable, extrapolated significantly beyond the range of the original data. This is not the immediate problem with COBA – the forecasts in traffic growth ought still to be valid for reassignment of a model to the network, unless we are taking the traffic levels into territory well beyond the data used to form the model. The main problem with traffic forecasts in COBA arises out of the failure to account for the errors in the forecasting model (or rather the errors in the assumptions in that model). All we can do, if we are forecasting as an extrapolation exercise, is take cognizance of how we failed before. The porcupine graphs have shown that the DfT has shown an unerring (sic) ability to overestimate these, and those graphs can actually quantify the historic overestimates as reasonable data to put into the COBA. If we are forecasting on the basis of commitment to a policy pathway (like D-cP), then the matter of errors is really sidelined by the question of how much we believe that policy will be kept to. Though exceeding such a pathway has the implication that such excess must be detrimental to whatever the government may estimate the value of that pathway to be (i.e. does the government care much about tackling emissions?); there are no benefits to the nation of exceeding a pathway that is deemed of optimum value, indeed such excess must be regarded as disbenefit to the nation.

Optimisation of a traffic model does not permit assumptions of validity in regions of the data where the fit is not good. We presume the optimisation process for the Winchester model will weight the big flows more. The fit will then likely be less good proportionately for the smaller flows. We can see this in the validation data over the Winchester streets (here ordered by flow size):



Here the size of the model fit error (i.e. the residual difference between the model and the observed data – positive signifies the model estimate is higher than observed flow) generally tends to be proportionately higher for the smaller flows than the larger. The standard deviation of the residuals over these Winchester streets is about 26%, but even a relatively high traffic flow street like Romsey Road has a residual of about 8%.

Apart from the major A34/M3 flows where we suppose average (AADT) data is used, the model fits above are compared with relatively small data samples from the smaller streets. Do we have any other indications of the variation in traffic flows in Winchester, apart from those of common experience? I live on Upper High Street, where I observe very high variability in flow. Overall central traffic probably correlates reasonably with the use of car parks. WinACC/WinFoE have carried out car park occupancy surveys for many years. These surveys are carried out dominantly in mid-morning on normal weekdays The mean occupancy of central surface car parks is 69% with a 14% standard deviation. If the mean occupancy is taken as a proxy for central traffic then the variability of this proxy is represented by a SD of around 20%.

Another measure of variability of traffic can be got from the AQ data at St George's Street. We can extract the data for a given time of day. Thus in 2023 so far the means as proxy for traffic levels at 9:00 are

	NO2	PM2.5	PM10
mean	34.5	10.2	17.3
SD % of mean	59%	70%	63%

All of these measures show a high variance as percent of mean on the streets of Winchester.

The variability of traffic flow on Winchester's streets at a given time of day is high, the variability of central car park occupancy is high and the variance of the model fit to one given set of street flow data is high. It is very hard to see how any modelling of traffic flows in the Winchester street network and the modelled effects of those flows (such as air pollution) can be meaningful against such variance. A modelled effect will sum the DS-DM differences of whatever quantity (e.g. pollution measure) is being examined. This sum has to be statistically significant against the combined variances of the model-fit (the verification variance for Winchester streets – SD 26%) and the variance of the traffic flows on those streets (on car park occupancy measure SD 20%; on pollution measure ~60%). Variances add, so the DS-DM differences have to be measured against a DM value with SD from 33% to 65%.

The Applicant response to the ExA question on Twyford's traffic says:

> *Twyford is located outside the Application Boundary and not reported in the application submission documents. The strategic traffic modelling shows a very small increase in the average daily traffic flows (predicted to be less than 200 Passenger Car Unit average 2-way per day in the 2027 opening year) with the Scheme.*

Since no apparent verification has been done of the strategic model's (or the Winchester model's) ability to fit observed data at Twyford, how can we know what the reliability of this assertion is?

Furthermore, it is not clear how modelling has been affected by the decision to cancel the J9-J14 smart motorway. There is nothing in 7.1 that mentions Smart. The answer to ExA question 14.1.2 includes:

> *The M3 Junction 9 to 14 all lane running (ALR) scheme, is included in Road Investment Strategy 2 (RIS2), however, on 15 April 2023 the Government announced that plans for new smart motorways would be cancelled. Despite this, National Highways is planning to upgrade the existing central reservation barrier to concrete, to deliver safety benefits. This Scheme is known as the M3 Junction 9 to 14 Safety Barrier Improvement Scheme. Given the central reservation work from the M3 Junction 9 to 14 Safety Barrier Improvement Scheme is due to take place prior to the construction of the Scheme, it has been considered as part of the future baseline.*

What does this mean? Before the cancellation, presumably the future baseline included the capacity increase south of Winchester. The upgrading of the central barrier does not allow the capacity increase that would have existed with the use of the hard shoulder. So exactly what description of road capacity has gone into the COBA analysis?

Furthermore, if the traffic modelling from the future baseline has not taken account of the reduced capacity south of Winchester what is the Variable Demand Model doing with the traffic induced by the M3J9 scheme? What is it saying about future congestion south of Winchester (and for that matter on the Twyford Down cutting)? How do we know what additional traffic will impose itself on the already blighted communities of Twyford and Colden Common.

User benefits: The user generalised cost benefits come out of the predicted traffic levels in a complicated way, linearly in an uncongested network, significantly greater if the DS is deemed to be relieving link or junction congestion. If the traffic forecasts are overestimated, then the user benefits will at least be overestimated in proportion and likely overestimated by much more.

As pointed out above, there are, effectively, two different government forecasts of road traffic, the one used in COBA and the one that informs the DfT's transport decarbonisation pathway (D-cP). If the latter is policy (and see below whether it is adequate policy) then it differs from the NTM forecasting in nature. The NTM is only a prediction of what will be, whereas the D-cP is what it is intended to be. This can only mean that the NTM forecast is in error because it fails to take account of government decarbonisation policy.

Professor Marsden's finding was that by 2035 the D-cP puts traffic 14% below that on which the Applicant's model is based. What does this do for the user benefits? Without further knowledge of the time-series differences between the D-cP and NTM it is difficult to compute exactly how those differences pan out as discounted adjustments to the benefits. Clearly the difference in traffic level will be much greater than 14% after 2035 because the D-cP level probably still goes down and NTM certainly goes up. Furthermore, any reduction (before or after 2035) will move predicted congestion rightwards in the user benefit calculation and therefore downwards in the discounted value.

On an uncongested network it would be reasonable, as a first approximation, to simply scale the user benefits down by 14%. In an imminently congesting network (as is claimed by the Applicant) the NTM-based forecast will be overestimating the user benefit by much more than 14%. Without seeing the COBA printout and the traffic level details ofD-cP, and discovering what benefits arise on what links and junctions at what dates, we cannot make any estimates of how much more benefit is being computed than would be there if the D-cP were kept to.

There is a further factor that will arise from this discrepancy in future traffic levels. Because progress against the transport D-cP has so far been poor (without COVID it would have been in the opposite direction) it is likely that over the next few years there will be a failure to meet the D-cP, so that by the time the user benefits are supposed to start the DP will need to be reset to a steeper decline to maintain the same integral under the curve (the net zero ambition relates to cumulative emissions).

Accident benefits: As argued above, we find no reason to believe that the DfT has ever demonstrated positive benefit from road building and indeed has declined to counter evidence of disbenefit. But within the flawed assumptions of WebTAG we can still question the accident benefit attributed to this scheme. Again this benefit will vary with the forecast traffic assumptions. If the D-cP is valid (and it is policy) then the accident benefits will scale downwards from the values computed from the NTM forecasts. We do not have enough sight of the COBA to work out the scale of the necessary downward adjustment, but it is a reasonable first approximation to say that the benefits would drop proportionately to the traffic levels assumed, i.e. by the same 14%.

Noise cost: I have no particular critique to make of the computational processes involved in modelling noise, but having once been technically involved in a geographical sound modelling project, I can also fully understand the difficulty of doing modelling well. Due to landforms, land and building surface properties and wind variability, there is a considerable uncertainty in the output of such modelling. Our local experience bears witness to this. At the time of the Twyford Down Inquiries, the applicant was asserting an actual noise benefit in Winchester town, which appeared to many to be plausible since the M3 was being taken further away from the centre than the A33 Winchester Bypass. But the promise was not kept.

> *In 2004, Winchester Cathedral received £86,000 from the Highways Agency in compensation for increased traffic noise from the M3. The Rev. Michael Till explained that "the noise comes beaming straight across The Close. It does change life having a perpetual background noise"*
>
> Wikipedia

But the Cathedral was not the only, nor the least adversely affected part of Winchester. Not counting those on the east of the city who were predicted to get more noise, all of the residential population on West Hill (from Oram's Arbour westward) now suffer from M3 noise, even when the prevailing wind is westerly, when they did not before and much of northern Winchester's residential population suffer similarly from the growth in traffic on the A34 that Twyford Down generated.

So claims of only a small noise increase cost, even in the immediate vicinity, have to be taken with a very large dose of salt. The noise assessment for the current scheme is confined to the areas east and west of the scheme footprint and does not, therefore, count any additional noise elsewhere (e.g. at Twyford), resulting from the traffic this scheme induces.

Nevertheless, if we are to accept the flawed processes, we should ask what would happen to this noise cost estimate if the forecast were D-cP instead of NTM. The amplitude of incoherent air pressure disturbance will vary proportionately with traffic levels, but the noise perception will go as the logarithm. A 14% traffic reduction signifies a 0.6dB noise reduction, implying that the noise cost would go down about 6%.

AQ Benefits: There is a general point to be made about the mysterious business of finding value in supposed air pollution reduction. The most damaging air pollution largely arises from road traffic. Road traffic is what the road programme is significantly responsible for generating. A local analysis ignores the air pollution costs elsewhere (particularly for new trip ends in urban centres) of the induced traffic. But let us ignore the exported pollution of this scheme and look at the allowed methodology of appraisal for this case.

It is difficult to establish from the 6.1 or 7.1 documents exactly what assumptions are being made in the calculation of AQ 'benefits'. The Emissions Factor Toolkit (EFT)[20] on which modelling relies states that its data applies to years 2018 to 2030. The toolkit at V11.) states:

> *EFT 11.0 allows users to define Input Years up to 2050.*
> *2031-2050 outputs are limited to England (not London) only.*

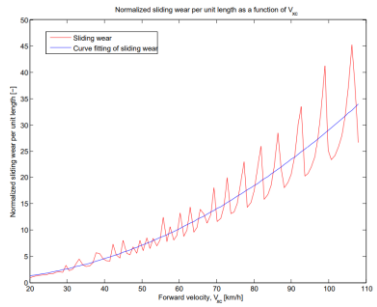
[20] *Emissions Factors Toolkit v10.1:User Guide*; DEFRA; August 2020

Emissions outputs for the years 2031-2050 are provided in support of climate assessments and appraisals only. Where emissions are to be used after 2030 to inform air quality assessments, the appropriate caveats around the limitations of the analysis must be included to accompany the assessment.

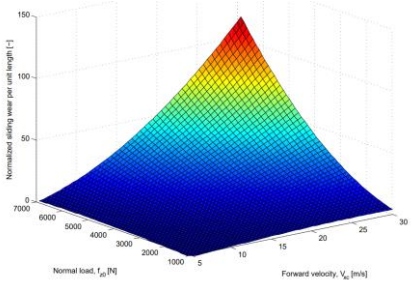
This appears to be warning about uses of the data beyond 2030 except for climate effect appraisal. As a monetary appraisal exercise it is hard to see how this permits assessment of pollution costs. Could this question be asked?

We are not clear where the bulk of the supposed air pollution benefit is coming from – changes to emissions on the major roads in this scheme as a result of the local congestion relief or from the internal Winchester road network, supposedly relieved of traffic.

Considering emissions directly resulting from the traffic on the major roads in this scheme, the first thing to say is, as we showed in our opening statement, the nation's congestion as a whole is not relieved. Continuing traffic growth, much of it generated by schemes like this, merely moves congestion elsewhere and so means increased pollution elsewhere. Furthermore, there does not appear to be any explicit account being taken of the D-cP in this, so it is difficult to know how the Dc-P traffic levels and the Dc-P assumptions of future vehicle fleet composition figure in the calculations. The vehicle composition over the scheme life is important. The explanation of AQ benefit presumably arises from supposed congestion relief, where tailpipe emissions dominate. Queueing vehicles with engines on are polluting more than moving vehicles and stop-start behaviour also affects brake wear. Free-flow traffic thus seems intuitively to be better, but the simple argument does not take account of the growing dominance of brake and road pavement wear pollution over the tailpipe pollution. This friction pollution[21] per distance travelled increases with free-flow speed (more than a factor of 10 between 20mph and 70mph):[22]



The Applicant will say that the EFT will be taking account of all this because it models both tailpipe and friction pollution. But if the EFT is not cognizant of the D-cP it cannot be aware of the vehicle fleet composition changes that that pathway dictates. This is significant because EVs have significantly greater friction-wear effects by virtue of their greater weight (exponential again)[22]:



And if they represent a growing proportion of the fleet, their effect on pollution will be greater where the modelled traffic speeds increase – i.e. in just the traffic modelled scenario where the rest of the appraisal of the direct emissions is assuming a pollution benefit. It is likely, therefore, that the local air quality 'benefit', from supposedly

[21] It seems likely that the road wear and tyre wear emissions will have the same speed relationship since it is the same friction process that generates them.

[22] *Parametrizing tyre wear using a brush tyre model*; H Salminen thesis; Royal Institute of Technology; Stockholm; 2014

reducing these emissions, if it exists at all, will be significantly reduced if the modelling used more appropriate D-cP traffic levels.

Secondly, if we consider the pollution arising from the internal network of Winchester, we have two major reasons for doubting the modelling credibility. The first of these, as we have indicated above, is that DS-DM differences computed from traffic modelling on the internal network, have a very large variance of modelling and observation measures to contend with, and produce answers with any statistical significance.

The second concern is that pollution is near impossible to model in urban environments[23], especially an old town of narrow streets set within hills. Even with flat topography, a pollution dispersion model has to anchor itself to a distribution of actual measurement sites and there are very few of these around the country. Pollution dispersion models are used indicatively (notably Imperial College's Address Pollution) but not authoritatively, and are certainly not appropriate to any supposed ability to discriminate quantitatively (let alone monetarise). There are two measuring sites in urban Winchester, St George's Street and Romsey Road. Only St George's Street measures the most important particulate pollution, and this highly trafficked street does not figure in the traffic model verification.

That anything can be usefully modelled about traffic on Winchester's streets over the lifetime of this scheme, is highly debatable, since we do not know what traffic reduction policies will emerge over the coming years. At the moment we have what is called the Winchester Movement Strategy, which has traffic reduction as its proclaimed main objective. This so-called strategy has not yet emerged in any coherent form after 7 years of gestation and is becoming highly controversial. The strategy is being run by the County Council (the major lobbyist for this M3 scheme) and is increasingly dominated by old-fashioned highways engineers' predict-and-provide thinking, rather than any kind of transport strategy. The City Council is more environmentally aligned and has a say in how this Strategy should evolve. Whether sensible modern transport thinking will prevail or not, what is clear is that the future transport disposition within the streets of Winchester is highly debatable, so that it makes no sense to any economic calculation based on what is fundamentally unknown.

It is hard to see, therefore, with what authority any quantitative air pollution modelling is carried out by the Applicant. The logical position would be to dismiss the monetarisation of this dubious data altogether. If the AQ benefit arises primarily out of the free-flowing aspects of the major road traffic rather than the internal Winchester network, and all other aspects of the modelling are accepted then at least the 'benefit' should be reduced to reflect the D-cP rather than the NTM forecasts, so we could assign a 14% drop to this. If the majority of the 'benefit' is arising from the internal network then no credibility should be assigned to it at all, since it is statistically indefensible.

Greenhouse Gas Quantification: The monetarisation of the expected GHG emissions is inscrutable to us and we do not know what has prompted the changes in values in the 7.1 Rev1. We have to take for granted that all costs of GHG emissions belonging to induced traffic are counted, wherever on the network they are. We do not know how realistic the assumptions of carbon pricing per tonne will be, carried over the scheme life, but note that since the Paris Accord the EU price has gone up (by an order of magnitude in the last 4 years alone). The whole notion that a government department can consciously propose to increase carbon emission at a time when it ought to be going out of its way to do the opposite, is beyond our comprehension. So we make no case for revising this figure, but certainly see no case for assuming a D-cP scenario would reduce it.

Overall cost and benefit effects of changed assumptions: If we accept the Climate cost, but make the adjustments we think we have justified above then the basic COBA result goes negative:

[23] Urban Air Pollution Modeling; A Srivastava and BPS Rao; 2011; open access: https://www.intechopen.com/chapters/16145

	NTM £M			D-cP £M
PVC	-112.71	Optimism Bias	23%	-138.63
User benefits	150.05	D-cP reduction 14%	14%	129.04
Accident	22.92	D-cP reduction 14%	14%	19.71
Noise	-1.34	D-cP reduction 14%	6%	-1.26
AQ	4.74	D-cP reduction 14%	14%	4.08
Climate	-24.11			-24.11
NPV	39.54			-11.18

With an optimism bias of 32% NPV becomes -£21.3M. Without AQ benefit (for which there is no credible justification), the NPV becomes -£15.3M with the lower bias and -£19.4M with the higher.

WEB: TAG Unit 2-1 is loaded with warnings:

> *Wider economic impacts can be appraised whenever there are considered to be significant market failures in secondary markets (non-transport markets), which are likely to have a significant bearing upon the welfare impacts of a transport intervention. The assessment of wider economic impacts should only be undertaken under the following circumstances:*
>
> 1. *it is proportionate to do so – see 'Guidance for the Technical Project Manager' for further information on proportionate appraisals; and*
> 2. *the appraisal is accompanied by an Economic Narrative – see section 5 for guidance on developing an Economic Narrative.*
>
> ***Established monetised impacts, such as user benefits are included in the initial BCR, whilst valuation methods that are not considered sufficiently widely-accepted, well-researched or tried-and-tested to be definitive are included as sensitivity tests. No wider economic impacts are considered as robust as user benefits.*** [my emphasis]
>
> *The economic impacts of transport investment are context specific, which has two implications:*
> *i. The inclusion of economic impacts within transport business cases should be considered an integral part of the appraisal design and not an add on at the end of the process; and*
> *ii. When applying WebTAG in scheme appraisal, the approach taken should be selective and not mechanical;*

Firstly the section I embolden must surely indicate that WEB cannot be on a par with user benefits in appraisal. It has to come under the heading *'not considered sufficiently widely-accepted, well-researched or tried-and-tested to be definitive'*. The Abelson paper[16] I cited above makes it clear that the whole process is not *widely-accepted* or *tried-and-tested*. If it were *tried-and-tested*, the Applicant will be able to point to examples of post-scheme analysis that matched the WEB assessments and to show that there are not examples where the opposite is true. Can the Applicant do so?

Secondly, the Applicant's justification for quantifying WEB (7.1 §5.7) does not come over as an economic narrative at all. Vague hand-waving evidence-free assertions abound and then we are referred to some software packages - all pure black-box *mechanical* stuff.

What are the justification details?

MAP 7.1	Remarks	*Relevant TAG*
§5.7.5 The Scheme is expected to address capacity issues on routes to international gateways and help provide more efficient routes to	Reduced travel costs is double-counting – these already exist in COBA (albeit ignoring more efficient, higher welfare alternatives in different modes).	*TAG A2.2 §1.1.4 The value for money assessment is based on national welfare impacts. Key to any assessment of induced*

global markets through reduced travel costs	There is zero analysis here of potential displacement. Why are Southampton port efficiency improvements supposed to be cost-free elsewhere, especially considering the Levelling Up agenda?	*investment is displacement – the extent to which induced investment impacts at the local level represent a relocation of investment from other locations. Changes in investment at a local level may not represent benefits at a national level.*
§5.7.6-7 TAG unit 2-2 suggests a simplified approach to estimating the benefits related to changes in imperfectly competitive markets, using a proportion of the calculated (Level 1) business user and reliability benefits. The DfT Wider Impacts Dataset provides an uplift parameter of 10% which are included in the Level 2 benefits noting that reliability benefits were not quantified, so this only includes business user benefits.	The only uplift referred to in TAG2.2 is land-use uplift. Land-use change appears not to be considered under level 2 (MAP§5.7.1). But no argument is given that existing land-use is imperfectly competitive or, more importantly, that the imperfect competition changes with the provision of this scheme. Since a major argument by the Applicant is that Southampton Port development is assisted, we have to ask how a monopoly (ABP) port becomes more competitive as a result of the non-user-benefit investment? A benefit given to a monopoly will have displacement costs elsewhere (other ports). How does the national economy benefit from this? Since there is no argument given for why this should not be so, the 'mechanical' use of the 10% magic number is unjustified.	
§5.7.9-10 An agglomeration economy suggests that there are benefits gained from businesses within an industrial sector locating themselves within close proximity of each other. The effective density of these clusters of businesses can be changed by transport investment making it easier to travel through the cluster, facilitating interactions.	This is merely a statement of agglomeration theory. There is zero evidence or argument that this theory is appropriate to this location. No argument is given that displacement would not occur.	*TAG A2.4 §2.2.6 Key to any assessment of agglomeration is displacement; in other words the extent to which changes in local productivity are additional at the national level. Displacement reflects the extent to which an increase in economic activity in one location is partially or fully offset by reductions elsewhere.* ***The default assumption in transport appraisal is the full displacement of employment impacts resulting from transport investment (see TAG Unit A2.3).*** *That is, unless there is evidence of a net national impact of a transport scheme on employment in the UK, it should be assumed that the net job impact is zero*
§5.7.10: Agglomeration benefits were quantified following the approach set out in TAG Unit 2-4 using the WITA software11 and transport model data.	We are straight into black-box justification without an economic narrative that meets the requirements TAG Unit 2-4. What of the instructions on the right have been carried out by the Applicant and where is it written up?	*TAG Unit 2-4 §2.7.1 Any analysis of productivity impacts should be justified in an Economic Narrative, as set out in section 5 of TAG Unit A2.1. Within the Economic Narrative, the scheme promoter should describe what, if any,*

	I ask ExA to look at the complexities of the WITA software and the explanation of it, with its caveats in TAG 2-4. How do we know what assumptions the Applicant has put into this black-box and with what justifications?	*productivity impacts are expected to occur and justify these. Furthermore, the scheme promoter should identify the welfare effects associated with any productivity impacts, whether these impacts are captured fully by user benefits or whether there are market failures, which provide additional sources of benefits and disbenefits*
§5.7.12 A proportionate approach was taken in quantifying the agglomeration benefits based on consideration of the underlying transport model features and available data. This was based on considerations explained in the Economics Appraisal Package, TAG Unit A2.4 guidance (specifically Appendix C), and liaison with the WITA software developers. The geographic focus of the agglomeration calculations reflects where Winchester is one of the primary employment locations in the Enterprise M3 area and the Scheme is expected to boost productivity by removing congestion.	Where is the argument being made that there is a static cluster benefit to be had for the Enterprise M3 LEP? Is there any analysis here that references the M3LEP strategy[24]? The strategy declares that this area has one of the highest productivities (GVA per head) in the country. Why is it 'proportionate' or appropriate to put **national** investment into increasing it? – how is this supported for an overheated southern economy not effectively displacement of investment from areas much more in need (Levelling Up)? In using a black-box multiplier, what evidence does the Applicant provide that the elasticity relationship between productivity and 'city density' holds for a local economy at the high end of productivity? An average productivity uplift cannot in any case apply to a high productivity region – if productivity were already as high as it could be, what does uplift mean? There is also a *post-hoc-propter-hoc* question here. Is GVA/head high here because of static clustering, or it that the technical education and skills that bring about high productivity lead to rewards that allow those people to live in an environment like Winchester? Agglomeration is a complex argument (see Abelson[16]) and there is no indication that the Applicant is capable of arguing it.	

The Applicant seems to make no real attempt to justify its assumptions about WEB or give any reasons why Abelson's conclusions should not apply here. TAG does not give even the spurious sense of authority of user benefits to its WEB black box output and recommends that any results should be there just as additional 'sensitivity' assessments,

[24] Local Industrial Strategy M3LEP

rather than being used, as the Applicant uses it, to offset a poor User Benefits result. Since the latter itself cannot be shown to be positive under the circumstances of politically-intended traffic levels (D-cP), there seems to be little reason for believing this scheme has any overall economic benefit.

It is a great pity that the transport and economic modellers can funnel so much effort into making elaborate software structures to churn out unsuspected, unevidenced and often fanciful value from what the road builders do, and yet can put no effort into or find no resources to examine the very real externalities of what their projects bring about.