PROOF OF EVIDENCE

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ON BEHALF OF
GWENT WILDLIFE TRUST

In the matter of:
Public Local Inquiry into the M4 relief road around Newport: Climate Change Implications

Contents

Introduction

Witness Introduction

1. Kevin Anderson is Professor of Energy and Climate Change in the School of Mechanical, Aerospace and Civil Engineering at the University of Manchester and is the Zennströmm professor of Climate Change Leadership at the University of Uppsala, Sweden. He is Deputy Director of the Tyndall Centre for Climate Change Research, the UK's leading academic climate change centre.

2. Professor Anderson is research active with recent publications in Science, Nature and Royal Society journals and he engages widely across all tiers of UK and Swedish government. Professor Anderson's research interests include: understanding the implications of rising emissions and the latest climate science for mitigation and adaptation policy; analysing opportunities for rapid decarbonisation of the UK's, Swedish and EU's energy system; and quantifying the role of international transport (aviation and shipping) in a low-carbon society. With his colleague Alice Bows, Professor Anderson's work on carbon budgets has been pivotal in revealing the widening gulf between political rhetoric on climate change and the reality of rapidly escalating emissions. His work makes clear that there is now little to no chance of maintaining the rise in global mean surface temperature at below 2^{o}C, despite repeated high-level statements to the contrary. Moreover, his research demonstrates how avoiding even a 4^{o}C rise demands a radical reframing of both the climate change agenda and the economic characterisation of contemporary society.

3. Professor Anderson has a decade of industrial experience, principally in the petrochemical industry. He was previously a Commissioner and Science Advisor on the Welsh Government's Climate Change Commission and is a Director of Greenstone Carbon Management - a London-based company providing emission-related advice to private and public sector organisations.

4. The Tyndall Centre

5. The **Tyndall Centre for Climate Change Research** is an academic organisation based in the United Kingdom that brings together scientists, economists, engineers and social scientists to research options for mitigating emissions and adapting to climate change. The Centre integrates

its insights across local to global landscapes and in the context of the broader sustainable development goals.

6. The Centre, named after the 19th-century scientist John Tyndall and founded in 2000, has eight core partners: the University of East Anglia, University of Cambridge, Cardiff University, University of Manchester, Newcastle University, University of Oxford, University of Southampton, and the University of Sussex. Fudan University (Shanghai) joined the Tyndall Centre partnership in May 2011.

Summary of Evidence

Key Points

a) A rise in global mean surface temperature of 2°C or more is now recognised by the international community as the threshold for dangerous climate change.

b) The most recent report from the Intergovernmental Panel on Climate Change (IPCC) was unprecedented in its emphasis on how an urgent and rapid transition away from fossil fuels is a prerequisite of avoiding such a 2°C rise.

c) The recent Paris Agreement tightened significantly the ambition of the international community to take action to limit global temperature rises associated with climate change to "well below 2°C" and to work towards limiting warming to 1.5°C.

d) The UK's current domestic climate change policies are premised on a 63% chance of exceeding 2°C and do not meet any reasonable interpretation of the clear equity dimension of the Paris Agreement (equity of carbon reduction). Consequently, the UK's position will need to be tightened considerably if it is to align with the explicit commitment enshrined within the Paris Agreement to take action to hold temperature rises to "well below 2°C" and to "pursue … 1.5°C", and to do so on the "basis of equity".

e) **Research has shown that for any chance of meeting this 2°C goal, a developed country like Wales should be aiming to reduce CO_2 emissions by at least 10% per annum**.

f) **The impacts of induced demand associated with building a new road will almost certainly result in the scheme increasing overall CO_2 emissions.**

g) Investing over £1 billion in a scheme set to increase CO_2 emissions, at a time where unprecedented reductions in carbon are required, is highly misguided and will impose still further misery on those poorer communities living in more climate-vulnerable landscapes as well as on future generations – including those within Wales.

h) If the Welsh Government is to uphold its repeated Climate change commitments and act in step with the Paris Agreement and its obligations under the Well Being and Future Generation Act (2015) for a 'low carbon society' (that takes account of global well-being), the M4 relief road cannot be justified.

Background

7 The latest report from the intergovernmental Panel on Climate Change (IPCC) is unprecedented in its emphasis on how an urgent and rapid transition away from fossil fuels is a prerequisite of avoiding a 2°C rise in global temperatures, characterised as dangerous climate change. Work by Anderson and Bows (2008, 2011) has translated such global carbon analysis into the implications for wealthier and poorer nations, with a Tyndall Centre report for the Welsh Government further refining the analysis to understand the repercussions for Welsh rates of mitigation (Calverley *et al*, 2009).

8 Global emissions in 2016 of carbon dioxide (CO2) from fossil fuels are over 60% higher than they were at the time of the first IPCC report in 1990. Moreover, the annual rate of growth in emissions in this new millennium is three times greater than during the 1990s. Even in the UK, with its strong rhetoric on mitigation, consumption-based emissions (taking account of carbon related to imports and exports) are essentially unchanged from what they were in 1990[1], despite the most significant economic downturn since the great depression.

9 Set against this backdrop of abject failure, the science of carbon budgets (IPCC 2014) combined with the maths of emissions paints a stark picture in relation to the mitigation efforts now required from relatively wealthy nations such as Wales. For there to be any reasonable chance of limiting temperature rises to 2°C or below, emissions from nations such as the Wales need to be falling by well over 10% per annum – a hugely challenging task.

10 The danger of climate change, and the need for urgent action, is recognised in the Climate Strategy for Wales (2010). The 3% per annum reduction target set out in the Strategy is acknowledged as a political, rather than scientific target, and the need for even greater reductions is made clear. The Strategy also underlines the need for the Welsh Assembly and wider public sector to lead by example.

[1] http://www.globalcarbonatlas.org/?q=en/emissions

11 It is essential that the scale of the challenge is not made even more significant by policy decisions that have a high potential to increase emissions, both in the short-term and by creating a lock-in to carbon intensive activities and infrastructure in the medium and longer term. Consequently, considerations of climate change have to be central to the decision-making process.

Scope of Evidence

12 It is clearly evident that insufficiently rigorous analysis has been presented by the Welsh Government to appropriately address the implications of the M4 proposal for the total level of greenhouse gas emissions.

13 The purpose of this evidence is to highlight the impacts that the scheme is very likely to have on emissions, to encourage a much higher profile for climate change in the decision making process and to for Wales to demonstrate integrity in relation to its international commitments as enshrined in the Paris Agreement. This evidence draws on and, where appropriate, reproduces:

(i) The potential impact of the proposed M4 relief road on greenhouse gas emissions[2] (September 2015) by Dr Steven Glynn – (Sustainable Change Co-operative) and Prof. Kevin Anderson (Tyndall Manchester) - I am informed that this report was sent to the then Minister, Edwina Hart.

(ii) A statement on the Carbon Report for the proposed M4 scheme (April 2016) by Dr Steven Glynn (Sustainable Change Co-operative) and Prof. Kevin Anderson (Tyndall Manchester) - This report was submitted as an Annex to Wildlife Trusts Wales response to the Draft Orders.

Greenhouse Gas Emissions and Proposed Changes to the M4 Corridor

14 The draft Plan Consultation Document – *M4 corridor around Newport* (2013) – set out a number of reasons for the proposal. Primary among these is that the capacity of the road system is being reached, with implications for increased congestion and knock on effects for the local economy, safety, noise, and air pollution (including greenhouse gas (GHG) emissions). The document suggests that, "*in the future, the situation is expected to deteriorate further*" (p.9) as traffic is predicted to increase by over 20% by 2030 (see figure 5, p. 11). This would, according to the

[2] http://www.wtwales.org/sites/default/files/tyndall_centre_-_the_potential_impact_of_the_proposed_m4_relief_road_on_greenhouse_gas_emissions.pdf

report, result in increased emissions due to the stop-start nature of traffic. With the preferred Black Route proposal, problems of congestion would, so the draft Plan claims, be significantly reduced, impacting on the assumed emissions.

15 Given the urgency of reducing carbon emissions, it is important that the proposals are carefully examined in relation to what they mean for *total* emissions. In this regard it is striking that an aim of the draft Plan is for "*reduced greenhouse gas emissions per vehicle and/or person kilometre*" (p.17). It is essential to understand that, from the perspective of climate change, emissions per vehicle are effectively irrelevant – it is overall emissions that count. Reducing emissions per vehicle does not necessarily deliver an overall reduction in emissions; historically, improved efficiency has typically being accompanied by increases in overall demand and hence emissions.

16 In the assessment of the preferred black route, the draft Plan does recognise the possibility that additional road capacity could lead to an increase in emissions in the medium term (p.31). However, that a new road is very likely to lead to increased demand (*induced demand*), with yet further greenhouse gas emissions, is not adequately considered in the plan. There is also no consideration of two other important factors that will result in additional emissions: the carbon associated with the construction material and processes; and any disturbance of soil that will result in further releases of CO_2.

Induced Demand

17 The concept that new or improved roads induce more traffic has been recognised for many years. A report for the Department for Transport in 1994 concluded that, "*induced traffic can and does occur, probably quite extensively*" (The Standing Advisory Committee on Trunk Road Assessment (SACTRA), 1994, p.ii). While, in the short-term, an increase in traffic on the new road may be diverted from other roads, over the medium term it is very likely to result in an overall increase in traffic (Litman, 2014). The assessment in Goodwin (1996) is damning, arguing that new roads bring: unexpected short-term growth in traffic; greater long-term overall growth; greater peak period growth; and limited relief to alternative routes.

18 Induced demand is of particular relevance to the M4 relief scheme. SACTRA (1994) suggests that the issue is likely to be most prevalent for improvements to roads in and around urban areas and "*strategic capacity-enhancing interurban schemes, including motorway widening*" (p.iii). As well

as increasing traffic levels, induced travel can also help "*create more automobile dependent transportation systems and land use patterns*" (Litman, 2014, p.28). In combination, these factors are very likely to result in the new road giving rise to increased, rather than decreased, GHG emissions.

19 An important report commissioned by the Norwegian Public Roads Administration has concluded that "*road construction, largely speaking, increases greenhouse gas emissions*" (Institute of Transport Economics, 2009, p.i). William-Derry (2007) has tried to quantify the degree of increase in GHG emissions – suggesting that each one lane mile of urban highway will, over 50 years, result in an additional 81600 tonnes[3] of CO_2 due to the increased number of vehicles using the road. When a new road is built there will inevitably be an increased level of carbon emissions associated with that road. For example, the A46 Newark – Widmerpool scheme, which saw 17 miles of new dual carriageway constructed alongside the existing road, is estimated to have resulted in an addition of 28938 tonnes of CO_2 emissions in the first year after opening. This equates to 425 tonnes per lane mile, and, if replicated for the M4 black route (14 miles, 3 lane carriageways), would see emissions of around 35700 tonnes.

20 The key question then is whether the increase in emissions on the new road would be offset by decreased emissions on the old route? The evidence on induced demand suggests strongly that they will not, and that total emissions will increase. Further evidence of induced demand and increasing emissions comes from another example – the widening of the M25 from J16-23. According to the Highways Agency this resulted, in the first year of opening, an 18576 additional tonnes of CO_2. Given that it is not a new road, it would seem that the most obvious reason behind the increase is that more traffic was using the road. This is a clear example of induced demand in action[4].

Emissions Embedded in Construction

21 There is no consideration in the draft Plan of the fact that all construction projects result in additional carbon emissions. Should the M4 corridor proceed, it will inevitably result in significant emissions related to the carbon associated with the production of the materials used and the construction process itself.

[3] Stated as 90000 US tons in William-Derry (2007)

[4] These figures are taken from a reply sent by Highways Agency in response to a freedom of information request from Gareth Clubb, Friends of the Earth Cymru.

22 For example, it is estimated that the carbon associated with the asphalt, aggregate and bitumen used in building roads is 40kgCO_2/tonne[5]. Drawing on life cycle analyses, Williams-Derry says that:

> "*after accounting for the manufacturing of concrete, steel, and other energy-intensive construction materials, as well as fuel consumed by construction equipment, building a lane-mile of roadway releases between 1,400 and 2,300 tons of CO_2*" (p.2).

23 He also highlights the fact that roads require ongoing maintenance and that, over 50 years, this could result in an additional 3100-5200tons CO_2. Taking the A46 Newark – Widmerpool scheme as an example, figures from the Highways Agency show that 113082 tonnes of CO_2 were released in the whole construction process, equating to 1663 tonnes of CO_2 per lane mile. If replicated for the M4 black route, this would represent construction emissions of around 139500 tonnes of CO_2[6].

Potential for Carbon Emissions from Disturbed Soil

24 The Gwent levels consist of up to 10m of alluvium and peat[7]. As Lindsay (2010) demonstrates, areas of peat sequester and store carbon, while also emitting methane. The balance between these two processes varies depending on the site, but, in most cases, has a positive effect in terms of reducing GHGs in the atmosphere (e.g. see Table 16, p.115).

25 Disturbing the peat as part of road construction could reduce the ability of the land to sequester carbon (as there will be less peat land), while remaining peat may, if it is degraded, start to emit CO_2 and methane as it decomposes and lose carbon through other means. The actual impact that the proposed scheme would have is not clear at present, and further investigation is required. However, the potential for increased emissions should be recognised and the release of short-lived climate pollutants (such as methane) be given serious consideration.

Analysis of the M4 Carbon Report

26 The approach of the Carbon Report (Appendix 2.4 to the Environmental Statement) is to compare projected carbon emissions associated with two scenarios:

[5] http://www.carbontrust.com/about-us/press/2014/01/lafarge-tarmac-carbon-trust-launch-low-energy-road-building-materials
[6] Stated as 90000 US tons in William-Derry (2007)
[7] http://www.ggat.org.uk/cadw/historic_landscape/Gwent%20Levels/English/GL_Features.htm#lanfor

a. "do-minimum" – assumes that the already committed improvements are made to the road network, but that the M4 Scheme is not built;
b. "do something" – is the same as the do-minimum scenario, but with the new M4 Scheme assumed to be in place from 2022.

27 The main conclusion is that the carbon emissions in both scenarios, up to 2037, are broadly the same – i.e. that the new M4 scheme will not lead to an increase in emissions. Whilst we welcome this new report, which makes a serious attempt to quantify carbon emissions, there are however a number of important issues that need to addressed.

Insufficiently Rigorous Analysis

28 For the period analysed (2022-37), the Report finds that that traffic-related carbon emissions for the "do-something" scenario are, year on year, slightly lower than the "do-minimum" scenario. This is attributed to the reduced stop-start nature of traffic flow as congestion is reduced. The gap between the two scenarios decreases over time as '*induced demand sees "an increase in traffic inflow due to the provision of increased capacity*" (p.10).

29 It should be noted that recent and rapid advances in automated vehicles are anticipated to deliver significant improvements in the efficient flow of vehicles on existing road infrastructure. Such advances are very likely to see major changes across the vehicle fleet within the 2022-37 timeframe, yet these are given insufficient consideration in the Report's analysis of stop-start congestion.

30 Although the Report recognises the well-established concept of induced demand, it makes no direct reference to the degree of induced demand that is considered and how it was derived. As previously mentioned, new roads typically bring short-term growth in traffic[8], something that appears to have been neglected in the Report. However, induced demand will continue to have an affect over the medium and longer-term and, given the 15-year period considered in the report, the impact this would have on carbon emissions does not receive due consideration.

8 Goodwin P B (1996) "Empirical evidence on induced traffic", Transportation, Vol.23 Issue 1, pp.35-54

31 Questions could be asked about this short period of analysis. The authors state that analysis further into the future is subject to considerable riddled with uncertainty; this is not only the case for both scenarios but also is an inadequate response to the wealth of empirical data arising from historical road expansion projects. It is important to note that if the Carbon report's traffic growth trend between 2022 and 2037 for both scenarios is projected forward, then 2038 is the first year where the carbon emissions from the "do-something" scenario exceed the "do-minimum" scenario.

32 To conclude, the Report presents a very partial analysis, and even then the details within it are not adequately explained. Its analytical time-frame and projected levels of induced demand are too constrained, with a reasonable extension of both of these likely to offer importantly different results. Given this, the Report does not sway my view that proceeding with the M4 scheme will lead to an increase in carbon emissions and play against Welsh Government's commitments under the Paris Agreement.

Limited Scope of the two scenarios

33 A second issue with the Report is that the scope of the two scenarios is very limited; a situation clearly reflected in their choice of names. "Do-something" implies that the M4 scheme is the only option that could be considered – it shuts down debate of genuine alternatives. What would the impact on carbon emissions be if a proportion of the potential £1.1billion budget were to be spent on alternative schemes to enhance public transport, cycling or indeed high-speed virtual communication? It is highly misleading to limit considerations to building the M4 scheme or not. If climate challenges are to be seriously addressed, greater imagination and higher levels of rigour are urgently required. Ultimately, the Report applies a very partial and twentieth century analysis to a system level and twenty-first century problem. Such approaches are no longer appropriate for addressing contemporary problems, particularly when they need to be considered within the tight carbon budgets accompanying the Paris Agreement's temperature commitments.

The Paris Agreement

34 The Report essentially reduces the debate to whether the M4 scheme will increase or slightly decrease carbon emissions. This is insufficient in light of the recent Paris Agreement which, as set out above, tightened significantly the ambition of the international community to take action

to limit global temperature rises associated with climate change to "*well below 2°C*" and to work towards limiting warming to 1.5°C.

35 A report undertaken for the Climate Change Commission for Wales, on the implications of Paris for Wales, concluded that for only a 33% chance[9] of staying below 2°C, the Welsh carbon budget was limited to 11-18 years' of current emission levels. Moreover, if Wales is not to renege on the Paris 1.5°C commitment, as demanded by some of the poorest and most vulnerable nations (from Bangladesh through to the Association of Small Island States), then the timeframe and scale of action is far more demanding. In light of this, the question that needs to underpin all proposals is: how can this potential development be reconciled with the Welsh Government's commitments enshrined in the Paris Agreement?

36 In this regard, investing over £1 billion in a scheme that theoretically will see only a marginal reduction in emissions, and in reality is very likely to see an increase - at a time where unprecedented reductions in carbon are required - is highly misguided. The M4 scheme is emblematic of a failure to acknowledge the challenges enshrined in the Paris Agreement. If it proceeds it will illustrate the Welsh Government's disregard for its climate change commitments, and the impacts of unchecked emissions on future generations of Welsh citizens and those poorer and climatically vulnerable communities elsewhere in the world today.

Conclusions

37 At the same time as IPCC scientists deliver an uncompromising assessment of the climate change challenge, it is troubling that a government claiming an evidence-base for its policies is proposing the M4 relief road; a development that will almost certainly lead to an increase in total carbon emissions.

38 Much greater and more innovative thought needs to be given as to why the scheme is deemed necessary and what alternatives exist. At a more prosaic level, the draft Plan shows that traffic levels through Junction 26-27 of the M4 have barely changed since around 2000 (Fig 4, p.10), and yet, this static trend is assumed to end abruptly in 2012 followed by a predicted growth in traffic of over 20% by 2030. This assumption needs to be very carefully unpicked and analysed.

[9] The analysis showed that, when emissions from developing countries were taken into account, higher probabilities of staying below 2°C were not possible.

By adopting a 'predict and provide' approach, there is a real danger that, as a result of induced demand, the growth in traffic will prove self-fulfilling.

39 Rather than assuming a growth in traffic, questions should be asked as to how the recent and prolonged levelling off in traffic growth can be maintained, and even reversed, while improving the overall quality of 'productive' travel options. While the draft Plan states that, "*For a significant number of journeys, there are no convenient public transport alternatives to the car*" (p. 14), it also goes on to say "*The M4 around Newport is used as a convenient cross town connection for local traffic, with insufficient local road capacity*" (p.15). These are exactly the type of journeys that could be made by other forms of lower carbon transport if they were available, accessible and encouraged.

40 If tackling climate change is a priority, and the 1.5 and 2°C targets are to be taken seriously, then the Welsh Government should not facilitate, or even permit, schemes that result in higher GHG (or even static) emissions and which lock travellers into high or still higher carbon lifestyles. Schemes such as the M4 extension, are far removed from the obligations set out in the Well Being and Future Generation Act (2015) for a 'low carbon society', and for a 'responsible Wales', where global well-being needs to be taken into account. Climate change is a profoundly existential challenge to many hundreds of millions of the global poor living in climatically vulnerable communities. Decisions made in Wales will impact not only the quality of their lives but also whether such lives are actually viable. In the twenty-first century and with a wealth of science-based evidence making clear how *our* actions impact *their* lives, Wales has a real opportunity to demonstrate informed, cogent and moral leadership.

41 If the Welsh Government is to uphold its repeated Climate Change commitments and develop evidence-based policies guided by science, the M4 relief road cannot be justified.

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