The potential impact of the proposed M4 relief road on greenhouse gas emissions

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Background

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 the 2°C characterisation of 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)

Global emissions in 2014 of carbon dioxide (CO_2) 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 today marginally higher than they were in 1990[1] this despite the most significant economic downturn since the great depression.

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 a reasonable chance of limiting temperature rises to 2^oC or below, emissions from nations such as the Wales need to be falling by around 10% per annum – a hugely challenging task. 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 made clear. The Strategy also underlines the need for the Welsh Assembly and wider public sector to lead by example.

It is essential that the scale of the challenge is not made even more significant by policy decisions that have the potential to increase emissions in the short-term and create lock-in to carbon intensive activities and infrastructure. Consequently, considerations of climate change have to be central to the decision-making process. Concerning the proposed M4 relief road, it is evident that insufficiently rigorous analysis has been presented to appropriately address the implications of the proposal for the total level of greenhouse gas emissions. The purpose of this brief note is to contribute to an open discussion of the impacts that such a scheme may have on emissions and to encourage a higher profile for climate change in the decision making process.

Greenhouse gas emissions and proposed changes to the M4 corridor

The draft Plan Consultation Document – *M4 corridor around Newport* (2013) – sets 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, 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 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.

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

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. 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. 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

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. Induced demand may be of particular relevance to the M4 relief scheme as 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.

The question "Does road improvement decrease greenhouse gas emissions?" was asked directly by an important report commissioned by the Norwegian Public Roads Administration. The conclusion was 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[2] 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, resulted in 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. The key question then is whether the increase in emissions on the new road be offset by decreased emissions on the old route? The evidence on induced demand suggests that they will not, and 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

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

road, it would seem that the most obvious reason behind the increase is that more traffic was using the road. Induced demand in action[3].

Emissions embedded in construction

Within the draft Plan there is no consideration 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. For example, it is estimated that the carbon associated with the asphalt, aggregate and bitumen used in building roads is 40kgCO_2/tonne[4]. 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). 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[5].

Potential for carbon emissions from disturbed soil

The Gwent levels consist of up to 10m of alluvium and peat[6]. 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). 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.

Conclusions

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 framing to its policies is proposing the M4 relief road; a development that will almost certainly lead to an increase in total carbon emissions.

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. By adopting a 'predict

[3] 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.

[4] http://www.carbontrust.com/about-us/press/2014/01/lafarge-tarmac-carbon-trust-launch-low-energy-road-building-materials

[5] See footnote 2 above.

[6] http://www.ggat.org.uk/cadw/historic_landscape/Gwent%20Levels/English/GL_Features.htm#lanfor

and provide' approach, there is a real danger that, as a result of induced demand, the growth in traffic will prove self-fulfilling. 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. If tackling climate change is a priority, and the 2°C target taken seriously, then the Welsh Government should not encourage schemes that result in higher GHG emissions and which lock travellers into higher carbon lifestyles.

If the Welsh Government is to uphold its repeated Climate change commitments and develop evidence-based policies informed by science it difficult to envisage how the M4 relief road can be justified.

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