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Beyond 'predict and provide': UK transport, the growth paradigm and climate change

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ABSTRACT

Thirty years ago, Adams (1981) depicted a future UK where everyone was a millionaire lorry driver, simply by extrapolating from contemporary official transport growth assumptions. These assumptions underpinned the 'predict and provide' approach which then characterised transport planning. Twenty years later, the *New Deal for Transport* White Paper (1998) abandoned 'predict and provide' as unsustainable. This paper argues that the same growth assumptions that Adams took to their logical (absurd) conclusion have re-emerged to define both transport and the drivers of transport demand. While non-aviation transport is supposed to be carbon-neutral by 2050, the implied reductions in emissions rely on an absolute decoupling of transport demand and its drivers for which there is no evidence in current planning. Targets rely on optimistic, narrowly framed technology forecasts and behaviour change assumptions which appear highly unlikely in the present socio-political climate. Moreover, such is the cost of mitigating these tensions between economic growth and other concerns, it is argued that the targeted outcomes of current policy are as undesirable as they are unlikely. The paper concludes by calling for a transport policy which considers mobility in an integrated, holistic fashion, rather than merely as a dimension of economic growth.

1. Introduction

Politics can be characterised as the management of contradictions. Transport planning is no exception. The contemporary planner faces a series of conflicts, most pressingly the reconciliation of energy security, carbon emission targets, mobility demands, and economic growth. This challenge is often avoided by undertaking narrowly bounded modelling exercises that simply assume the continuance of selected trends considered to be desirable. The limitations of this practice were demonstrated more than 30 years ago by Adams (1981), pp. 204–206, who constructed an 'absurd scenario' based on a literal reading of contemporary UK government plans for meeting perpetual transport growth. The absurdity emerges when reintegrating the isolated trends into a coherent world view. By the year 2205 – according to official models – average annual income would reach £1 m, with one lorry on the road for every man, woman and child. Adams' describes such a world, in which the population would spend its days in these lorries, endlessly roaming the English "tarmac plain" (ibid. p. 206) in the hunt for consumables.

Adams' scenario is the logical outcome of 'predict and provide' thinking: the continual expansion of transport infrastructure to meet inferred latent demand. The resulting future appears very different one from the one legally mandated by the UK's Climate Change Act 2008. This future is outlined by the Committee on Climate Change (CCC), tasked under the Act to identify means of achieving 80% cuts in greenhouse gas (GHG) emissions by 2050, and monitor progress towards them. To date it has produced a number of Carbon Budgets (CCC, 2008; CCC, 2010), which include a target of 26% reduction (relative to 2008) in transport emissions by 2020, and 44% reduction by 2030.

For 2050, the only transport-specific target is for UK aviation emissions, which are expected to return to 2005 levels of 35 $MtCO_2e$, equivalent to 20% of current transport emissions. Given the overall 2050 target of 80% reductions, this effectively means that the rest of the transport sector, including maritime, must be entirely carbon free, unless other sectors take up the slack.

An important commonality with Adams' scenario remains however – the perpetuation of economic growth, increasing by 62% by 2030. To avoid the kind of ecological devastation Adams invokes, the CCC requires a radical decoupling of transport emissions from GDP, the scale of which is shown in (Fig. 1). The future envisioned by the CCC then is one where the primary determinants of transport demand continue to grow strongly, while

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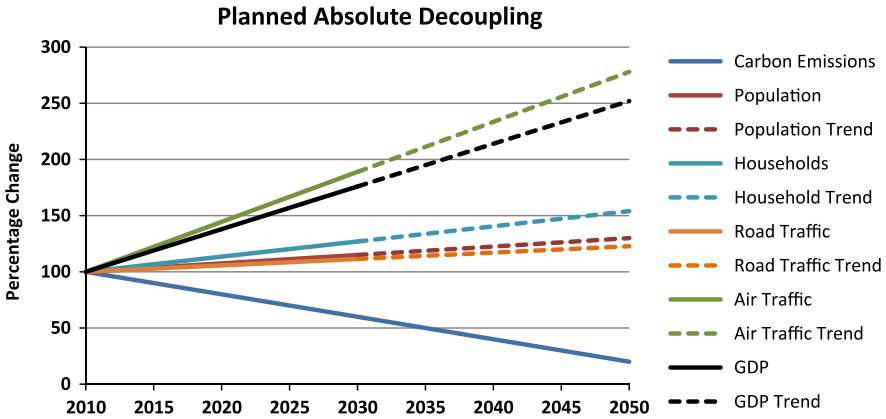

Fig. 1. Absolute decoupling of UK emissions from majors drivers assumed in CCC Fourth Carbon Budget (2010). Dashed lines for 2030–2050 extrapolated from 2010–2030 trends as these variables only modelled to 2035 currently. Trajectories simplified to straight lines.

related emissions are radically reduced. Its framing is one of the 'sustainable development', following the Brundtland Report (WCED 1987), which sought to reconcile competing demands for growth and environmental protection.

This paper considers the possibility of such radical carbon reductions in light of the recent history of UK transport policy, beginning in 1997, when the New Labour Government declared an intention to abandon predict and provide road building, in the White Paper *New Deal for Transport* (Dept of the Environment, Transport and the Regions (DETR), 1998). Following Adams' example, the paper will situate transport in a wider context, in which predict and provide is read as a sector-specific form of a dominant market-led growth agenda.

Section 2 discusses how, in the *New Deal for Transport*, mobility would be managed by central and local planners in such a way as to direct travellers to the most appropriate modes and, where possible, to reduce the need for travel at all. Present trends would not be projected unquestioningly into the future. Section 3 assesses the links between transport emissions and GDP during this period, finding that, while they weakened, success was limited, and driven by factors which may have already run their course. In practice, the policy management of mobility was quickly circumscribed. Section 4 shows how subsequent models have returned to endless growth, and to the outcomes satirized by Adams. Section 5 acknowledges that predict and provide has broadened from the road-building fixation of previous iterations, but concludes that it remains subject to a neo-liberal vision of market-led governance that leaves policy makers with few options for achieving carbon reduction targets. Current strategy rests on wishful thinking about changing behaviour (Section 6) or technological fixes (Section 7), neither of which is likely to resolve the conflicts between mobility demands, economic growth, energy security and climate change. The result is less the management of contradiction than its aggravation. We conclude that current policy thinking is unlikely to produce the resolution required. Transport policy debates need to expand beyond a narrow focus on a particular approach to economic growth, and consider mobility in a broader sense as a social good that may need to be balanced against others.

2. Managing demand?

'*A New Deal for Transport*' (DETR, 1998) has been hailed as a pivotal moment in UK transport planning (Goodwin, 1999). In the second half of the twentieth century motor car ownership and use had increased rapidly. As early as the 1960s there was a realisation, documented in the influential Buchanan report '*Traffic in Towns*' (Ministry of Transport, 1963), that unlimited use of motor vehicles could not reasonably be sustained, particularly in urban areas. However, the policy of building roads and associated infrastructure in direct response to traffic growth continued for the next three decades. This programme reached its apex with the 1989 *Roads for Prosperity* White Paper, when the Conservative Government committed to doubling the scale of the existing road building programme to £12bn (£25bn in 2012 prices), in order to provide a "*vital further boost for British industry*" (Department of Transport, 1989).

In this context, New Labour's White Paper appeared radical: "Simply building more and more roads is not the answer to traffic growth. 'Predict and provide' didn't work" (DETR, p. 5). Despite the huge investment in roads under preceding governments, congestion was increasingly costly for businesses; vehicle emissions were growing, contributing to climate change and local air pollution; and a mobility gap was widening between those with, and without, cars. Policy would focus on alternatives to the car, with improvements to public transport, cycling and walking facilities, and freight moved from roads onto rail and waterways. The drivers for travel demand would be tackled by encouraging more localized employment and services.

These changes were captured in the concept of "transport demand management" (TDM) (Ison and Rye, 2008) or, in the US, "travel demand management", defined as "*any action or set of actions aimed at influencing people's travel behaviour in such a way that alternative mobility options are presented and/or congestion is reduced*" (Meyer, 1999). Rather than building new roads, the UK government would maintain the existing network and manage it more efficiently. In this respect, it resembled many of the other initiatives of the early years of New Labour, particularly in health care, which deliberately set out to reverse the previous Conservative government's reliance on market mechanisms. The White Paper's policy goals included providing a level field for choice between different transport modes, ensuring efficient integration between them, and setting targets for sustainable policies. The new approach encouraged multi-modal studies (DETR, 2000a), where all forms of transport, including walking and cycling, were considered. The paradigm shift was captured by the '*Management*' of TDM: where 'predict and provide' sought to identify, and cater to, latent demand – following rather than leading market forces – TDM would proactively shape it according to long term planning goals. This was required because of the difficulty for markets in internalising indirect and/or delayed costs such as increased congestion and pollution.

3. Decoupling transport

The 'coupling' of transport and GDP has long been recognised: the high mobility of people and goods enabled by oil-fuelled

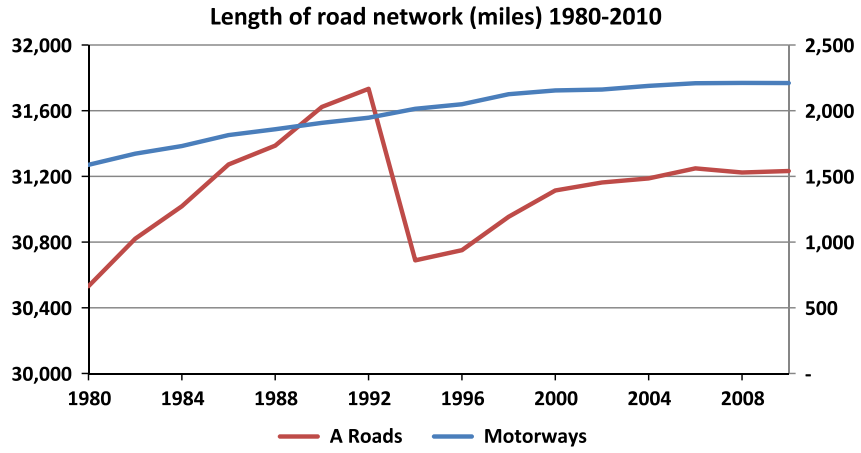

Fig. 2. Post-1980 road network length showing reduced growth following 1998 White Paper.
Note: A Roads fall in 1993 is due to change in classification scheme, and should be disregarded (DfT, 2012).

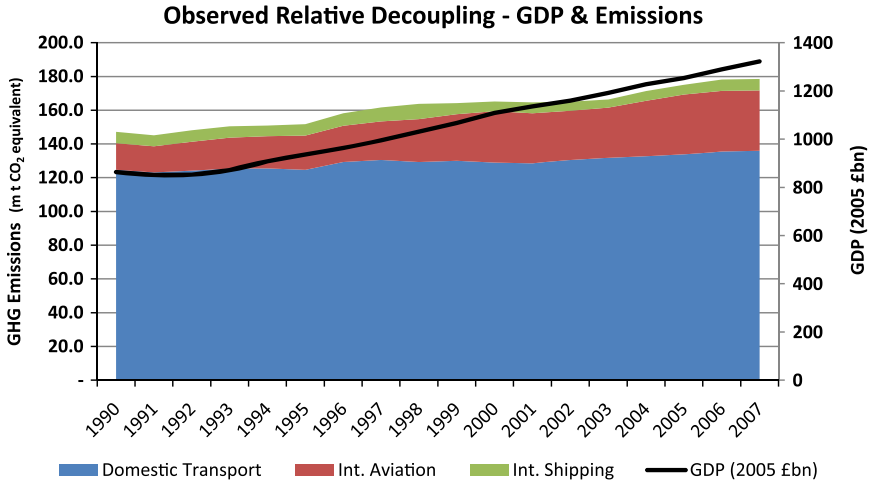

Fig. 3. Relative decoupling of UK transport emissions from GDP observed over last two decades. Emissions data from DfT 2010a, GDP data from (ukpublicspending.co.uk, 2011).

transport was a defining feature of twentieth century development, underpinning fundamental reconfigurations of time and space at all scales from suburbanisation to globalisation (Dennis and Urry, 2009; Kunstler, 2006). In the early 1990s, Bennathan et al.'s assessment for the World Bank, found that, in developed countries, freight "[*t*]*on-kilometers by road are chiefly explained by GDP*" (1992: *summary*). The adoption of TDM was ultimately an attempt to decouple transport and/or associated emissions from economic growth. Given the ambitious decoupling that future carbon planning sets out, it is important to consider this recent history and its implications.

Over the last two decades, the relationship appears to have weakened significantly in the UK. Between 1997 and 2007, the ratio of freight tonne-kilometres (by inland transport – road, rail and waterways) to GDP declined by 21%, while the ratio of passenger-km (by inland transport – cars, buses, coaches and trains) to GDP fell by 19% (Eurostat 2011). Total transport emissions rose by just over 10% (DfT, 2010a), while GDP rose by 33% (ukpublicspending.co.uk, 2011). These figures show that 'relative' or "weak decoupling"[1] (Tapio, 2005) – that is slower rates of growth in transport than GDP – has happened in recent years. In light of this, New Labour's decision to abandon 'predict and provide' road building in favour of TDM might appear to have been successful. Road expansion shows a clear reduction commensurate with the 1998 White Paper(Fig. 2). Considered alongside the slower rate of growth in traffic emissions relative to the wider economic context (Fig. 3), it is easy to assume that the policy change has considerably suppressed the sector's energy demands and carbon emissions without constraining economic growth. This in turn gives reason to be optimistic about future targets.

McKinnon's (2007) analysis of UK road freight – responsible for 20% of transport sector emissions – suggests, however, that the real picture is more complex. During the period of analysis (1997–2004) the measured elasticity between GDP and road freight was a promising 0.37, which is to say freight only grew at a third the rate of GDP. However, McKinnon attributes 33% of this decoupling to a recording bias, namely the increased penetration of the UK haulage market by foreign companies, who are not included in the figures. A further 22% is due to freight switching to rail or waterways. While this achieves a significant reduction in emissions, it does not eliminate them.

[1] 'Weak decoupling' is defined as the elasticity between emissions and GDP being between 0 and 0.8, where 0 is no relationship and 1 is a perfect relationship. In effect, what is meant by weak decoupling is that emissions continue to rise with GDP, but at a slower rate. 'Strong decoupling' (elasticity < 0) sees emissions plateau or fall as GDP rises.

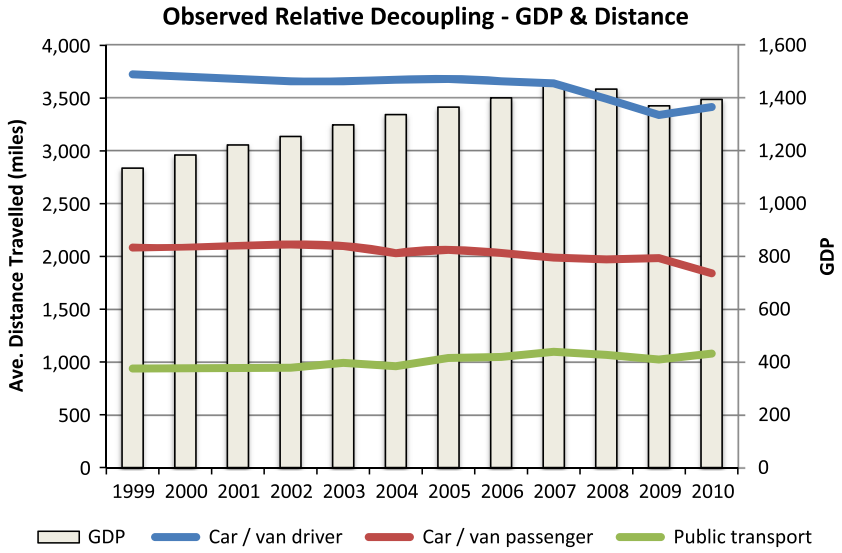

Fig. 4. Relative decoupling of UK average distance travelled from GDP. Travel data from (DfT, 2013b), GDP data from (measuringworth.com, 2013).

Other factors considered to make a "significant" or "very significant" contribution to the low recorded elasticity include a change in the composition of GDP; and export of industrial activity to other countries. Both are problematic for future carbon targets. The changing composition of GDP reflected a shift from manufacturing to services, which was encouraged by previous governments. The present coalition government is now trying to reverse this trend, with associated implications for transport demand.[2] If successful, a reversal of previous decoupling could be expected. Even if this particular policy shift proves to be mainly rhetorical, there are likely to be limits to the possibility of further shifts from manufacturing to services (Stern, 2011). While the export of industrial activity may be welcomed from the standpoint of UK targets, it is of little benefit globally. Indeed, such 'carbon leakage' may increase global emissions when the result is manufacturing in more carbon-intensive economies like China (Li and Hewitt, 2008). Neither transport metrics nor the CCC's UK carbon budgets capture the carbon 'embodied' in imported products. Its impact is recorded only in terms of freight emissions, a fraction of the actual environmental impact, which still exists off the balance sheet. Calculating embodied emissions is difficult, but the effect seems to be considerable, adding an additional 16.6% (Peters and Hertwich 2008) to 50% (Davis and Caldeira 2010) to total UK recorded emissions.

The picture for personal mobility is also complex. Between 1998 and 2007 total trips taken fell by around 5%, while distance travelled and time taken remained static (DfT, 2013a). Since the 2008 recession, clear falls have occurred: average annual total distance travelled fell 3.9% between 2007 and 2011 (DfT, 2013b). There is evidence that, in regard to car travel, an absolute decoupling from GDP was achieved: during the period of economic growth between 1998 and 2007, car travel fell 3.1%; and during the subsequent contraction, it has declined by a further 4.2% up to 2011 (Fig. 4). It was only significant growth in rail (26.9%) and local bus travel (9.6%) that kept overall travel figures stable prior to 2007.

In summary, some relative decoupling of transport emissions and GDP is likely to have been achieved since the late 1990s. For freight it is, however, probably weaker than official data suggest, and partly the result of factors, like offshoring manufacturing, that may reverse or are actually counter-productive as responses to climate change. DfT figures do suggest TDM and associated policies such as the Fuel Price Escalator[3] were successful in retarding private car use despite rising GDP, but overall travel only fell following the 2008 economic crash. Ultimately, between 1998 and 2007, total emissions from domestic transport still rose 3.3%. When combined with UK international transport emissions, the increase was 8.5%. While significantly below the ~25% increase in GDP during this period, this remains far from 'absolute decoupling' of transport emissions from GDP – emissions *reducing* while GDP grows, as required to reconcile economic growth with a 100% decrease in non-aviation transport emissions.

4. The resurrection of predict and provide

The limited nature of the decoupling achieved since the 1998 White Paper should come as little surprise for, in practice, the New Labour Government's commitment to TDM was questionable from the beginning. The tone was set by its support for the private member's bill[4] which became The Road Traffic Reduction Act 1997, a precursor to the White Paper. As a step towards reducing traffic, it required councils to produce reports on local traffic levels, but made no steps beyond this. As such it was attacked for "lack[ing] teeth" (Chisholm, 1997) even before the White Paper's publication.

Though the White Paper's intentions were widely welcomed, their implementation was criticized (Goodwin 1999) and they soon became muddled. A Ten Year Plan produced in 2000 (DETR, 2000b), focusing on transport delivery, was more concerned with investment in roads and railways than with non-motorised modes, and downgraded environmental concerns and demand management in favour of the motor car and road building. Responsibility for TDM measures was placed on local authorities, with little national support to realise the

[2] The 'knowledge economy' discourse common during the New Labour years is now being replaced by statements such as this as this from Chancellor George Osborne: "Derby is a great example of what Britain's economy should be in the future […] [a]nd a strong endorsement of the importance of manufacturing industry […]We have to get this country making things again" (BBC, 2011). Of course to what degree this rhetoric leads to concrete actions and outcomes remains to be seen.

[3] The Fuel Price Escalator was a mechanism by which duty on fuel increased annually. Though formally abandoned in 2000 following protests against fuel costs, subsequent governments have continued to increase the duty.

[4] A private members bill is one introduced by a Member of Parliament who is not a government minister and which does not form an official part of the government's legislative programme.

vision (Docherty and Shaw, 2008). Begg and Gray (2004) argued that a combination of public dissatisfaction with progress in transport, political shocks (primarily the national fuel duty protests in 2000, when refineries were blockaded) and institutional change led to a policy shift. With the focus on the problems of congestion, rather than pollution, and on the expansion of transport infrastructure, they asserted that the 'marriage' between transport and environmental policy was over. The challenge of reconciling these tensions through central planning had been abandoned almost before it had begun, and primacy had been ceded once more to market forces.

New Labour's abandonment of predict and provide and the return to passive governance appears borne out in official projections of futures in which the market's insatiable appetite for economic growth is displayed in simple statistical extrapolations. Key trends roll on indefinitely and government appears only to provide matching infrastructure. The questions raised by Adams, and by the 'limits to growth' school founded on the work of the Club of Rome (Meadows et al., 1972) and Hirsch (1977), are accommodated through modelling exercises that either assume a break in the historical link between these trends and their costs (i.e. the decoupling of transport and carbon emissions) or simply do not consider them.

A New Deal for Transport acknowledged that the indefinite expansion of road travel was not possible in a world of finite resources, whether spatial, material, fiscal, or social. Transport planning no longer questions this. The DfT's Road Transport Forecasts up to 2035 (DfT, 2009) assume that traffic (vehicle kms) will increase by 43% on 2003 levels, driven by GDP growth of 2.2% per annum. This would value the UK economy at £3.3tn in 2050 (at 2005 prices), an increase of 139% on 2010. These forecasts are linked to projections of a continuing increase in the UK population (Office of National Statistics, 2011) with a central estimate of 71.4 m by 2030. There seems to be a positive relationship between economic growth and population growth, not least in terms of the contribution from immigration: the more economic growth the UK experiences, the greater the population growth and transport demand (Mitchell and Pain, 2003). This population is predicted to be older and living in an increasing number of households: the latter has a strong impact on travel demand (Giuliano and Dargay, 2006) and resource use more generally (Liu et al., 2003). The DfT's own TEMPro model[5] forecasts households increasing by 27% to 33 m in 2030 (CCC, 2010, p. 126). The Government's other major modelling exercise – DECC's *2050 Pathway Analysis* – assumes similar growth (indeed stronger growth in respect of GDP): "*over the 40 year period the population grows by 25%, the number of households by 50% and GDP by almost 200%*" (2010, p. 34).

5. Taking stock and looking ahead

UK transport policy has not simply turned full circle to its pre-1997 state. The fixation on new road building has clearly ebbed, with rail and aviation taking more prominent roles. The UK's current flagship transport project is High Speed 2, a 250 mph rail line that will initially connect London to Birmingham, at an expected cost of around £20bn. Though it marks a break with the road-building of earlier decades, it remains a predict and provide project: responding to anticipated market demand rather than seeking to shape it. Although a proposed second stage will link the economically lagging northern cities, the build order suggests that HS2 is primarily focussed on moving UK residents in and out of London more quickly and in greater numbers. The government has simultaneously claimed that HS2 will promote environmental goals: Philip Hammond, then Transport Secretary, declared that "[HS2] would help us to build a sustainable economy – by encouraging millions of people out of cars and off planes onto trains." (Hammond, 2011). The government's own document states, however, that its effect on transport sector emissions will be neutral (DfT, 2010b, p. 16). The original 2007 study, commissioned by the DfT to consider the carbon implications of high speed rail, based on a London-Manchester route, found that, once construction was taken into account, 35% *more* CO_2 would be produced than by equivalent car traffic (Booz Allen Hamilton, 2007).

Furthermore, by enabling regular commuting from Birmingham to London, HS2 also creates a new possibility for high carbon behaviour. Without the complete decarbonisation of energy supply, HS2 cannot hope to contribute even to relative carbon reductions. The wisdom of further concentrating growth in the London area is unquestioned. In sustainability terms, this is the UK region with the densest population, the highest house prices, the greatest demand on land for new housing, the highest levels of road congestion (DfT, 2010c), and greatest projected water stresses in coming decades (Environment Agency, 2008, p. 1). Parts of the region already have less water per person than Sudan (Environment Agency, 2007, p. 6).

Despite repeatedly delaying decisions on airport expansions around London, the Government's targeted growth in aviation – despite the challenges it poses for carbon targets – provides further evidence of market-driven planning. The non-economic costs of airport expansion, particularly in the form of local resistance in such a heavily populated area, could ultimately prove so intractable that much of the planned-for traffic finds its way to alternative European hubs. Graham (2008) describes this as "'predicting but not really providing', of coming to terms with the environmental dilemma entirely by default" (p. 158). Such an outcome would demonstrate the fragility of predict and provide planning when limits externalised by its processes impose themselves regardless. This is something we return to in Sections 7 and 8.

Road building also appears to be accelerating once again. Road capacity has been expanding at an increasing rate since 2000 by adding lanes to existing roads (Fig. 5). Looking ahead, in the 2013 Budget, Chancellor George Osborne committed to "spending more on new roads than in a generation" (Osborne, 2013).

Greater recognition of the costs of mobility has led to some TDM successes, notably London's Congestion Charge. There is acknowledgement of the promise of integrated transport, even if this has yet to be realised (Givoni and Banister, 2010). However, predict and provide remains embedded within transport policy, for the simple reason that transport remains subservient to the economic growth agenda (Owens and Cowell, 2011, Chapter 5). Even at TDM's moment of adoption in 1997, it appears that this subservience was never challenged. Instead 'sustainable development' provided the salve that would mitigate any pain from acknowledging limits: growth would continue untroubled.

The speed with which predict and provide returned signals how unsuited TDM is to the current era of neo-liberal governance. Market demand in the South East spurs the construction of HS2 and future airport expansion. The continuing growth of GDP, supported by an expanding population (whether migrants moving into the economic area or, in the case of HS2, expanding the economic area outwards) only seems possible with complementary growth in mobility. Predict and provide is not the source of the tension, but simply a transport-specific manifestation of the neo-liberal model adopted in pursuit of the growth paradigm:

> [*T*]*he model allows governments to treat the operations of markets and corporations per se as 'above' or 'outside' the societal frame of*

[5] The Trip End Model Presentation Program (TEMPro) forecasts future travel demand and is used by the DfT for transport planning.

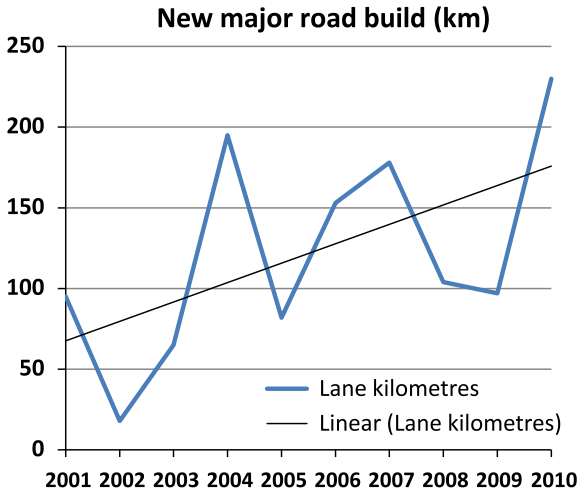

Fig. 5. New motorway and trunk road building by lane kilometres (DfT, 2012).

> *reference* […] *while government's role is limited to enabling, rather than leading or directing* (Webb, 2012, pp. 112–113).

This approach limits the options for governments. If their role is merely to respond to or enable market demands, then the resulting conflicts cannot be addressed by pre-emptive management of those demands. The options are effectively limited to attempts to achieve 'voluntary' changes in the market choices of individuals or corporations, or hoping that new technologies will come to the rescue and create forms of mobility that do not generate carbon emissions. In the final two sections, we consider these options. In the near-term, technology offers few opportunities for lowering transport emissions, so behaviour change is crucial (Hickman and Banister, 2007, p. 384), and accordingly that is where we begin.

6. Changing travel behaviour

The appetite of contemporary governments for direct regulation of behaviour in areas like security does not extend to challenging major economic interests (Fisher, 2009; Judt, 2010). Here voluntary initiatives are preferred, demonstrated most dramatically in the 'nudge' phenomenon, derived from Thaler and Sunstein's (2009) influential behavioural economics book. Nudge approaches have become central to the current UK Government's policy framework, to the extent that Prime Minister Cameron has created a 'nudge unit' within the Cabinet Office. As the term suggests, nudge attempts to encourage citizens to act in preferred ways, through default options or small incentives designed into social processes or institutions, rather than by introducing explicit rules or directives. In effect, it creates an illusion of choice, seeking to achieve collective goals without directly challenging the neoliberal paradigm. *Constraining* high carbon mobility – in the way that *A New Deal for Transport* sought to constrain road transport – has given way to an emphasis on *encouragement* of alternatives.

This approach is evident in the DfT's recent 'Smarter Choices' programme, comprising

> *techniques for influencing people's travel behaviour towards more sustainable options such as encouraging school, workplace and individualised travel planning […] improve public transport and marketing services such as travel awareness campaigns, setting up websites for car share schemes, supporting car clubs and encouraging teleworking.* (DfT, 2011a)

In the UK this is now the primary policy method for achieving more sustainable travel patterns. The 2020 figure of a 5% reduction in car-kms assumed by the CCC is based on the achievements of the DfT's Sustainable Travel Towns programme, which ran in three towns between 2004–2009 (Sloman et al. 2010). Reductions in national traffic of up to 11% over 10 years are thought to be possible (Cairns et al., 2008). This is one of the few elements in UK national transport planning to generate empirical evidence that sustained absolute reductions in travel or emissions can be achieved.

Concerns have been raised, however, about the implementation of nudge approaches (e.g. Bonell et al., 2011; Marteau et al., 2011). A key example, highly relevant to transport, is the question of what happens when a nudge meets a larger force pushing in the opposite direction. While getting people to switch from cars and to public transport is a central element of the Smarter Choices approach, the car has an established and powerful hold on precisely the same subconscious processes that are targeted by nudge:

> *Cars provide status to their owners through their various sign-values that include speed, home, safety, sexual success, career achievement, freedom, family, masculinity and even genetic breeding.* (Urry, 2008, p. 116)

Car advertising is a constantly regenerated source of such images, reinforcing concepts like "driving pleasure" (Hagman, 2010).The ubiquitous promotion of this "car culture" (Owens and Cowell, 2011, p. 103) dwarfs anything that government information campaigns, like those in the Sustainable Travel Towns programme, could hope to achieve. It is not just cars that are promoted, but also behaviours that require cars, or other high carbon transportation (Urry, 2010): television shows encouraging '*Escape to the Country*' (and the extended commute and distances to services that follow), or newspapers' exotic holiday supplements.

Governments do not hold a monopoly over the methods advocated by *Nudge*. Nudges are a primary means through which growth is pursued in a consumer society: encouraging consumption by promoting (predicting) consumer desires, and providing for their fulfilment. The public are not blind to the contradictions between messages of consumption and carbon reduction, and so a degree of cynicism and inaction can be expected (Butler, 2010; Webb, 2012). Such contradictions threaten nudge approaches more widely. While the construction of cycle paths is an important step towards providing an alternative to car travel, the promotion of car culture remains a hindrance to uptake. Government campaigns ebb and flow, but promotion of the status quo (i.e. car dominance) remains constant.

The demands of a growth-focused economy impact transport indirectly as well, with the result that individuals are 'nudged' *away* from low carbon behaviours. Land use is a critical dimension of travel demand, being fundamental to the context in which people make travel mode decisions. It is clear, for example, that low-density urban sprawl is tightly intertwined with private car use, as America's twentieth century demonstrates (Kopecky and Suen, 2010).

The 2012 *National Planning Policy Framework* (NPPF) (Department for Communities and Local Government (DCLG), 2012) represents a major change to land use policy in the UK. It identifies the need for "promoting sustainable transport" but its priority is clear: "At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development" (*ibid.* p. 4).

> *Planning should operate to encourage and not act as an impediment to sustainable growth. Therefore significant weight should be placed on the need to support economic growth through the planning system* (*ibid.* p. 6).

The key term here is 'sustainable', a word tasked with mediating between current market demands and future wellbeing. Speaking on the draft of the NPPF, former Chairman of the Sustainable Development Commission, Jonathan Porritt, said:

> *Anybody who claims sustainable development is dead when you've government uttering the words more often than any government has done before would be in a difficult place* […] [*S*]*ustainable development isn't dead in that it doesn't have any role in this government. What is really problematic is the degree to which what they mean by sustainable development is actually counter to what sustainable development really means* (Porritt, 2011).

Far from ensuring land use planning achieves spatial organisations that minimise the need for high carbon mobility, the NPPF subordinates transport planning to economic growth. The NPPF aspires to give people "a real choice about how they travel" (DCLG, 2012, p. 9) without acknowledging that the ability to exercise choice is constrained by the planning framework, or lack thereof. If handing precedence to growth and consumer choice results in urban sprawl (Garlick, 2012), the construction of cycle lanes is unlikely to spur desirable behaviour changes in commuters facing lengthening journeys.

Ultimately, behavioural interventions are hamstrung by highly resourced, entrenched socio-technical cultures of consumption (Shove, 2003); *"a powerfully seductive culture that promotes individual acquisitiveness and routinely places emphasis on the immediate and/or short term, on individual self-interest and material well-being"* (Smart, 2011, p. 132). As long as society remains configured around consumption-based growth, it is difficult to envisage how limited, nudge-based, behavioural interventions can have any lasting impact on transport emissions in a political culture where policy makers feel increasingly unable to 'interfere' with 'sovereign consumers'. Indeed, current government rhetoric is of "ending the war on motorists", by discarding some of the very measures – parking space limits and parking charges – previously advocated by the DfT (DCLG, 2011). In this environment, there seems little possibility of achieving the required behaviour change-sourced reductions in transport emissions.

7. The technology fix

The alternative weapon in the neoliberal policy maker's armoury is that of technology. If the energy propelling transport can be decarbonised, the sector's direct threat to climatic stability can be addressed (though not other costs, such as congestion). Markets are commonly lauded for their ability to drive technological innovation, so there might be grounds for optimism within the current paradigm that technical solutions can be found to the problem of high carbon mobility.

'Rebound effects' challenge such optimism however. These concern the relationship between efficiency of resource use and market demand. Improvements in efficiency spur demand, while demand shapes how efficiency is utilised (for example, as improved fuel economy or increased comfort). The result is that savings are less than expected. In certain cases the increase in demand can eclipse savings, referred to as "backfire" (Breakthrough Institute, 2011).

Rebound works at several levels (*ibid.*). Direct rebound occurs when efficiency improvements in a service reduce costs and stimulate demand. Indirect rebound sees the wealth saved from the greater efficiency invested in another area of the economy. Notably, the smaller the direct rebound effect, the more saved wealth is available to power indirect rebound. There are also macroeconomic effects, which are unpredictable system-level impacts. One example is the 'frontier effect', where efficiency improvement leads to the creation of entirely new products and markets: improvements in battery technology for electric vehicles could spur a raft of new consumer goods along with associated energy demands.

A meta-analysis of the impact of efficiency improvements on the distance travelled by cars puts the direct rebound effect at 10–30% (Sorrell, 2007, p. 31), which is significant, given the ambition of targeted emissions cuts. Moreover, these studies do not account for indirect effects. In regard to car travel, major indirect effects are changes in vehicle design, and rates of occupancy (Moriarty and Honnery, 2008). Increases in engine power; power demand from auxiliary features such as air conditioning and in-car entertainment; and weight from safety features like roll cages, have all contributed to rebound effects. The potential scale of such backfire is demonstrated by the finding that US fleet-average fuel efficiency of Ford cars is now lower than that of the Model T 80 years ago (Woodcock et al., 2007, p. 1085).

Some relief for transport planners, if not travellers, comes from the fact that rebound relies on below-cost improvements. If the cost of the new technology equals or exceeds the saving made, then no demand stimulation is created. In regard to home energy use, the CCC expect efficiency cost savings through to 2020 to be offset by rising energy prices (CCC, 2010, p. 42). The rising costs associated with extracting increasingly hard-to-reach sources of crude oil suggest that transport will face similar pressures. In addition, the current preferred option for decarbonising transport is the electric vehicle, which is likely to remain more expensive than established technologies for the foreseeable future. Fuel taxes can also be utilised to prevent direct rebound effects, and universal carbon taxes could inhibit indirect effects.

This raises a difficulty for the growth paradigm, however, as low energy prices are an essential enabler of economic growth (Brown et al., 2011). If new low carbon technologies are more expensive than common energy systems have been historically, and if – as in the case of oil – existing fuels themselves increase in cost, then achieving targeted growth rates becomes highly difficult, if not impossible. Given the reliance of the existing paradigm on expanding GDP to maintain socio-economic stability such a development would generate acute pressure on government to shift policy away from carbon reduction.

If energy prices can be kept low enough to enable future economic growth, and adverse rebound effects mitigated through instruments such as carbon taxes, what would the energy supply of UK transport in 2050 look like? The CCC targets conventional car efficiency of 80 gCO_2/km in 2030, a marked improvement on the current average of $\sim$170 gCO_2/km, but achievable with the right incentives (indeed such improvements have driven the relative decoupling of passenger transport in recent years). However, the only hope for the *absolute* decoupling of transport and emissions is the widespread electrification of vehicles (CCC, 2010; DfT, 2011b) which offers the possibility of entirely removing direct emissions from transport. The issue then becomes indirect emissions. Mackay (2009)(p. 198) calculates that electrifying all UK road vehicles, as envisaged by CCC targets for 2050, would create an additional 60 GW of electricity demand, which equals current peak demand. Demand management could spread out competing loads, but some 45 GW of additional capacity would still be required (*ibid* p. 206).

The point to be made here is not that the UK cannot meet the demands of an entirely electrified transport network – though the physical limits of energy production are given far less consideration than they warrant (Brown et al., 2011) – but that it will come at considerable political, economic, environmental and social cost. Given the difficulties that successive UK Governments have experienced in simply replacing current energy production, the notion of creating an additional 75% capacity in less than 40

years should caution anyone assuming decarbonisation offers a painless 'techno-fix'.

8. Conclusions

The 'absurd scenario' set out by Adams (1981), pp. 204–206 is still discernible in UK Government forecasts, despite its conflict with official emissions targets. Growth forecasts have been tempered, so that in place of the 3% GDP growth driving 2% freight growth identified by Adams, the CCC presumes 2.2% GDP growth leading 0.5% freight growth, and 1% total road traffic growth (2010, p. 157). This is of course the same "up and to the right" (Bleecker, 2009, p. 17) vision of perpetual future growth, and is ultimately no less absurd, just absurd on a longer time scale. However, the true lesson of Adams' scenario is found in its vision of a UK reduced to a "tarmac plain": that as much as perpetual growth is unachievable, it is, in its costs, also fundamentally *undesirable.*

The solution proffered by government planning is that of absolute decoupling: economic growth without breaching limits. TDM was intended to achieve this, and certainly some relative decoupling was achieved during subsequent years. Evidence of the necessary absolute decoupling is harder to find. Notably, it was achieved for private car use in the decade following the White Paper, however growth in other modes kept overall levels stable. Overall, emissions continued to rise, particularly once international travel is accounted for.

Furthermore, even these isolated successes may not be sustained, for the central planning required by transport demand *management* quickly fell from favour in under successive neoliberal governments. Though it is no longer fixated solely on cars, the market-responsive predict and provide that has re-emerged remains fundamentally unchanged. The largest project on the DfT's books – HS2 – is being presented as sustainable development, while creating the same inflationary demands as the road building programme of the 1980s. Rebound effects can be expected to bolster travel, just as they threaten to do if fuel efficiency measures make travel cheaper. Meanwhile, in an effort to boost growth in the face of current economic woes, land use reform is being pursued in ways that will likely encourage urban sprawl and reliance on private cars.

The result is the pursuit of absolute decoupling through 'nudging' behaviour against the force of countervailing 'shoves' from entrenched socio-technical systems of consumer culture, and optimistic techno fixes which come with their own conflicts. Achieving the CCC's (2008, 2010) desired decarbonised transport system will require abutting numerous other limits: political, social, economic, spatial and environmental. This is the lesson of the tarmac plain.

While UK emissions are only a small contributor to the global total, the reduction targets it has set in law make it an important test case for other developed economies, and the potential consequences of a failure to achieve those targets are greater. Eighty per cent reductions by 2050 are entirely achievable, if the means are not subservient to efforts to boost growth. Targets might be achievable with economic growth, but no comprehensive account yet exists of how this might be possible. Given the difficulties generated by growth ideology, the evidence that growth in and of itself may be irrelevant to wellbeing in developed economies (e.g. Wilkinson and Pickett, 2009), and questions as to whether continued growth is even possible (e.g. Heinberg, 2011; Murray and King, 2012), we must surely begin a reassessment of the nature of transport planning.

Predict and provide road building was abandoned because, from the holistic perspective taken by *A New Deal for Transport*, its costs were simply too great. However, like so many of the innovations of the early years of the Blair governments, it fell victim to the loss of confidence in the possibility of social democratic management of markets in pursuit of wider social goals. The limits that it recognised remain however, and as this paper has demonstrated, there is good reason to be highly sceptical that the CCC's attempts to resolve tensions through decoupling are achievable.

As it becomes more apparent that states cannot, in the longer-term, remain passive as future directions are determined by markets, there is surely a case to be argued for renewed transport demand management, based on holistic perspectives that make explicit reconciliation of efficiency with equity and sustainability. This will require an approach that starts from the more fundamental question of *mobility* rather than from the second-order questions of *transport* (Urry, 2008).

The mobility agenda sees the demand for movement at all scales as the result of a set of societal choices about values and social organization, rather than the ineluctable working out of impersonal market forces. Transport is simply one of the ways in which to realise the consequences of those choices. Mobility asks us to examine how and why certain patterns of movement have come to be regarded as fundamental to the societies in which we live, and whose voices and interests have come to dominate in that assessment. Rather than envisioning the future in terms of the past – by rolling historic statistics endlessly onwards into the future – it asks what kind of a future (or range of futures) might we want for ourselves and how major infrastructure investments might, or might not, contribute to that. This process necessarily rests on a more comprehensive and democratic process of public engagement than on the pretence that the econometric models of state actors locked into the growth paradigm can deliver an objective and impartial solution for the optimum route from here to there. Instead, a wider set of questions must be asked about where 'there' is. Once initiated, such a conversation seems unlikely to settle on the tarmac plain as a preferred destination.

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