

HOW TO MEET THE GOVERNMENT'S CARBON REDUCTION TARGETS IN THE TRANSPORT SECTOR

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1. INTRODUCTION

Transport is the only sector in which emissions have grown since 1990. The Scottish Government have set ambitious targets for reductions in carbon emissions of 42% by 2020 based on their 1990 level.

This paper considers a number of sources in consideration of carbon reduction in the transport sector, and how this is likely to be achieved. This includes work by Atkins in partnership with the University of Aberdeen for the Scottish Government on Transport Carbon Reductions, work by the Centre for Alternative Technology on Zero Carbon Britain 2030, and work by Fife Council on modal split targets for new developments and carbon reductions in the transport sector.

A commentary of the issues raised by the various pieces of work will lead to a synthesis of the likely way forward, and what challenges this gives us in an era of financial stringency.

The conclusion will be that carbon reductions in the transport sector are achievable, but not without changes in behaviour and the adoption of new business models. Prioritisation of resources will depend on the development of better evaluation tools to consider the wider benefits of moving to a lower carbon society. The improvement of micro-simulation transport models including better consideration of active travel modes and their associated wider benefits will also be a requirement.

By combining behaviour measures that encourage a shift to lower carbon travel, increased vehicle occupancy, and wider technological improvements and fuel switching, it will be possible to decrease transport energy demand towards the government's targets. The remaining energy requirement will be supplied increasingly with electricity, supplemented with some hydrogen and bio-fuel. These wider energy supply issues are also actively being pursued by the Scottish Government, putting Scotland in a good position to meet its future carbon emission reduction targets.

1.1 Transport Emissions

Transport emissions including international aviation and shipping were 14.5 MtCO₂e in 2008, 1.1 MtCO₂e higher than in 1990. Within this sector road transport emissions rose from 9.3 MtCO₂e to 10.0 MtCO₂e and emissions from aviation more than doubled from 0.8 MtCO₂e to 1.7 MtCO₂e.

Transport emissions including international aviation and shipping, make up just over one quarter of Scotland's total emissions, and more than two-thirds of these emissions come from road transport.

The next decade holds enormous potential to make significant progress into reducing road transport emissions through electric and other low carbon vehicles, and widening the choice in low carbon modes of travel available to individuals.

1.2 Wider Government Objectives

On 5th December 2008 the Scottish Government published the 'Climate Change (Scotland) Bill' which includes a commitment to reduce greenhouse gas emissions by 50% by 2030, and by 80% by 2050. The finalised version also includes an interim target of 42% by 2020.

In June 2010 the Scottish Government published its 'Cycling Action Plan for Scotland (More people cycling more often)' with a vision that "By 2020, 10% of all journeys taken in Scotland will be by bike".

The Physical Activity Strategy 'Let's make Scotland more active' was published in February 2003, with targets that by 2022, 50% of adults and 80% of children will meet the current recommended levels. To meet these recommended levels for 30 minutes moderate exercise for adults and 60 minutes for children on most days of the week will require an annual increase of 1% per annum.

'Scotland's own Road Safety Targets' set on 15 June 2009 are the toughest in the UK. They are looking to cut serious injuries by 55% and the number of fatalities by 40% by 2020, with intermediate targets set for 2015.

The 'Government's Economic Strategy' published in September 2011 declares that the purpose of the Scottish Government is "to make Scotland a more successful country, with opportunities for all to flourish, through increasing sustainable economic growth". This includes a commitment to "a Transition to a Low Carbon Economy".

The Scottish Government's 'Smarter Choices, Smarter Places' initiative supported seven local projects across Scotland to implement behaviour change strategies to increase the number of people choosing sustainable transport modes. This initiative ran from August 2008 to March 2011 with a meeting set for 23 May 2012 at Cosla's offices, Edinburgh to feedback on the experience gained.

2. CARBON REDUCTION IN THE TRANSPORT SECTOR

The Scottish Government's Transport Directorate appointed Atkins in partnership with the University of Aberdeen to undertake a study to identify the policy options available to reduce transport carbon emissions. This work was reported in the 'Transport Research Series: Mitigating Transport's Climate Change impact in

Scotland', in April 2009. It considered a Central Scenario and an Ambitious Scenario with a number of devolved policy options: technology, driving style, car demand management (fiscal and infrastructure), car demand management (Smart measures), freight, land use planning, and aviation. The cost effectiveness of each policy option was also considered. This work fed into the Scottish Government's consideration of carbon reduction proposals across all the sectors of the economy in the document: 'Low Carbon Scotland: Meeting the Emission Reduction Targets 2010-22', considered further in this section.

The Centre for Alternative Technology (CAT) also considered a comprehensive carbon reduction strategy including transport options in its 'Zero Carbon Britain (ZCB) 2030' publication. This is a more ambitious look at the subject, discussed further in this section.

At a more local level Fife Council have been considering modal split targets required for new developments, and what are the likely transport carbon reductions that may be achievable by 2020. This work is also summarised in this section.

2.1 Scottish Government: Low Carbon Scotland Meeting the Emissions Reduction Target 2010-2022

The European Commission is in the process of setting mandatory targets for the emission intensity of cars and vans as well as setting up a clean vehicle directive and a renewable transport fuel obligation. Together these measures reduce transport emissions by 1.4 MtCO_{2e} compared to the baseline projection by 2020.

A very ambitious implementation of all the devolved transport policies and proposals considered in the Atkins report could result in a further abatement by 2020 of 1.1 MtCO_{2e}, giving a total abatement (including those from EU policies) of 2.5 MtCO_{2e} in the transport sector. Transport emissions in 2020 would be 11.6 MtCO_{2e}, 13% lower than in 1990.

To summarise, the document gives the Milestones for 2020:

- A mature market for low carbon cars, resulting in average efficiencies for new cars of less than 95g CO₂/km
- An electric vehicle charging infrastructure in place in Scottish cities
- Personalised travel planning advice provided to all households
- Effective travel plans in all workplaces with more than 30 employees
- At least 10% of all journeys made by bicycle.

The significant intensity and scope of the measure, which would involve scaling up small pilot projects to a national scale, requires new business models and a pool of skilled labour that currently may not be available.

2.2 Centre for Alternative Technology: Zero Carbon Britain (ZCB) 2030

In ZCB 2030 a huge array of measures are identified in each sector to address carbon reduction and climate change. The table below shows the ambitious modal split targets that have been developed. However, despite these proposals the majority of the transport carbon savings in ZCB 2030 come from efficiency savings and new fuels. In the ZCB 2030 scenario the grid is completely decarbonised so electric and hydrogen vehicles are effectively zero carbon in use.

Transport Mode	Current % 2007 (pass. Kms)	ZCB 2030
Walk	4.89	10.0
Cycle	0.47	3.0
Rail	6.87	14.0
Coach	0.88	10.0
Local bus/train	4.94	6.3
Motorised two-wheelers	0.7	2.57
Air	1.11	0.17
Car, van, taxi	80.16	54.13

The vision of a zero carbon Britain makes some challenging assumptions about transport behaviour change:

- People will be fitter and more active, walking and cycling more often with a doubling of distance walked and a six fold increase in distance cycled
- With better and faster train services across the country, distance travelled by rail will be 14% of total distance travelled
- A modern and effective coach system will account for 10% of all distance travelled with priority lanes on motorways and a network of strategically located public transport interchange hubs
- Local bus services will have improved with the average Britain travelling 50% further on local public transport
- Less time is wasted travelling, with people living closer to workplaces and working more efficiently with the average distance travelled down to 20 miles per day (a 20% reduction)
- A 20% reduction in freight distance travelled
- With more places accessible by train within 2 to 3 hours, the reliance on domestic aviation will have drastically reduced, and people will stay closer to home for holidays focusing on British and European destinations so greatly reducing the demand for international flights

- Infrastructure improvements will include the building of a small number of new railway lines, a large number of cycle lanes and transport hubs, and the redevelopment of quality public space.

This transport vision results in a decrease of transport energy demand of 63% from 2008 levels by 2030 with the remaining energy requirements from electric and some hydrogen and bio fuels.

2.3 Fife Council Modal Split Targets/ Carbon Reduction

Modal split targets to be used in transport assessments for new developments were considered for the Strategic Land Allocations (SLAs) in Fife in November 2009. The table below shows modal share figures that have been collated from three British cities that have been pursuing sustainable development over a number of years, namely Edinburgh, Nottingham and York. If we look at best European experience then Basel in Switzerland has achieved the following modal split figures: walk 28%, cycle 21%, public transport 27%, and car and passengers 23%.

Transport Mode	Edinburgh	Nottingham	York	Fife	Rural	Edge of town	Urban	Cities
	2010	2009	2010	2004	2020	2020	2020	2020
Walk	26%	21.5%	15%	20%	20%	20%	20%	20%
Cycle	6%	1.6%	13%	1%	5%	7.5%	10%	15%
Public Transport	23%	16.6%	10%	12%	17%	19.5%	22%	27%
Car + pass	45%	59.2%	50%	67%	58%	53%	48%	38%

From this data modal share targets have been derived for 2020 for four scenarios: i) Rural, ii) Edge of Town, iii) Urban, and iv) City. One of the major features of these modal share targets is to increase public transport share by a step change in public transport provision for new developments and to retro-fit existing networks through the introduction of bus priority/ Bus Rapid Transport (BRT) networks. The other major feature is the increase in cycle use to a level more in line with our European partners across the North Sea through the provision of safe cycle networks integrating with existing/potential cycle networks. The target for cycling in cities by 2020 has been set at 15% in line with the Charter for Brussels target for all European cities which has already been signed up for by the City of Edinburgh Council. Rural areas are more car dependent with larger distances to travel and hence less cycle use. Targets for Edge of Town and Urban areas lie between the Rural and City targets based on the same issues of trip length and development density.

Another relevant piece of work was the development of a Transport input to the Fife Community Plan Partnership 'Climate Change Strategy' with the vision: To develop a low carbon multi-modal integrated transport system for Fife.

For each person in Fife to achieve a target of a 35.0% reduction in CO₂e in their surface transport usage by 2020 they will need to make some minor but achievable changes to their travel behaviour, including:

- Reducing the need to travel by 8.0%
- Increasing Public Transport usage as a mode share to 18.9%
- Increasing Walking as a mode share to 23.7%
- Increasing Cycling as a mode share to 5.0%
- 8.7% reduction in total car use
- 10.0% of car trips to be made by Hybrid/Electric cars
- Increases in car fuel efficiency technology by 26.0% in line with Scottish Government targets.

3. THE WAY FORWARD

The above sources present a range of options and targets for the achievement of the Scottish Government's 2020 Reduction in carbon emissions of 42%.

In the case of the Government's own work on a 'Low Carbon Scotland', the planned reduction in the transport sector is below the overall target, with greater emissions reductions planned in other sectors of the economy to achieve this target.

The Centre for Alternative Technology Zero Carbon Britain 2030 proposes a decrease in transport energy demand by 63% from 2008 levels by 2030, with the remaining energy requirement from electric and some hydrogen and bio fuels. This is a much more ambitious proposal overall with the need for more radical switch to more sustainable transport use and the complete decarbonisation of electrical energy supply by the use of renewables by 2030.

The work carried out by Fife Council in terms of encouraging new sustainable developments, with improved sustainable transport modal share targets, suggest a 35% reduction in transport emissions may be achievable by 2020.

3.1 Summary of way forward to reducing transport emissions

To summarise, the challenges that need to be tackled in the transport field to reduce emissions are to:

- Increase the amount of walking for trips up to 2 kilometres
- Increase in the amount of cycling for trips up to 8 kilometres

- Increase public transport use for rail, coach and local bus
- Increase car sharing, car leasing and car clubs
- Improve car fuel efficiency
- Increase use of electric and hybrid vehicles
- Reduce short haul air travel by switching to rail
- Reduce long haul air travel by choosing closer destinations.

4. THE CHALLENGE

A number of focused themes emerge from this review of current proposals to reduce carbon emissions in the transport field. These will now be considered in more detail with sections on: Active Travel; Increase Public Transport Usage; Car Sharing, Models of Car Ownership; and Travel Planning.

4.1 Active Travel

Nearly a third of all journeys are less than 2 miles and two-thirds of all journeys less than 5 miles. Walking and cycling, the active travel modes have a large part to play in offering choices to existing car users for many of the short trips we all make on a day-to-day basis. Walking and cycling also offer in many instances the best means of getting to and from public transport, for longer distance journeys. This is demonstrated in many European countries where their active travel modal share can be in the order of half of all journeys as is the case in Switzerland and the Netherlands.

Active travel has a very strong policy impetus contributing to all of the Government's key strategic objectives in terms of creating a Scotland that is: Wealthier and Fairer; Smarter; Healthier; Safer and Stronger; and Greener.

Despite this, only 1% of all trips in Scotland are made by bicycle. The car is the dominant mode for all journeys made in Scotland accounting for about two-thirds of trips. Walking is the second most popular at 23% of all trips made. In light of this the Scottish Government launched its 'Cycling Action Plan for Scotland - More people cycling more often', in June 2010. This document has the vision that:

"By 2020, 10% of all journeys taken in Scotland will be by Bike".

Investment in active travel also has a strong economic rationale. In this time of constrained public spending, investment in active travel is affordable, quick to deliver and offers the best value for money in relation to both transport and broader policy objectives.

The Cycling Action Plan for Scotland (CAPS) can be summarised in twelve main action areas summarised below:

- Increase on-road cycle training
- Making Cycling Mainstream courses
- Cycle Friendly and Sustainable Communities Projects

- School Cycle Training - Bikeability stages 1, 2, and 3
- Cycle Friendly Employer Scheme
- Complete the National Cycle Network and local cycle links
- Promote best practice in planning, access and design guidance
- Encourage cycling and rail integration
- Encourage more 20 mph schemes
- Look into liability and education campaigns for all road users
- Look at changes to Traffic Regulation Orders (TROs)
- Review and improve cycle and travel habits data collection

To achieve this impressive vision through the above actions we need to invest significantly more from existing transport budgets at both a local and national level and also from associated budgets such as health and education.

4.2 Increase Public Transport Usage

Three major sources have been drawn on that deal with the issue of increasing public transport usage: 'HiTrans Best Practice Guide 2: Public transport - Planning the networks' by Gustav Nielsen et al 2005; 'Transport for Suburbia - Beyond the Automobile Age' by Paul Mees 2010; and 'CAT's Zero Carbon Britain 2030' already referred to.

Hitrans Best Practice guide recommendations, in terms of solutions for public transport systems that are able to be a competitive alternative to the car, can be summarised as follows:

- Start with the heavy infrastructure and main transport corridors in the future
- Serve all major corridors with as few high frequency lines as possible, creating pendulum lines between corridors on opposite sides of the city centre
- Look for suitable tangential routes or corridors that might work together with the radial lines
- Consider urban and regional services at the same time
- Look at the 'pulse' timetable routing where travel demand frequencies are low
- Analyse the possible roles of different rail modes and different types of bus line options
- Study how access to the trunk line network can be improved through: bus service improvements; interchange development; provision of bike- and-ride and park-and-ride facilities; and improvement of roads for car users, bicycles and pedestrians.

Paul Mees's publication 'Transport for Suburbia' contains a comprehensive review of best practice across the world where authorities have achieved high modal share for public transport. His conclusions are wide ranging but include:

- The best approach is through the provision of integrated public transport networks, providing a ready made service that relies on transfers. This is the only way to ensure anywhere-to-anywhere travel while keeping high occupancy rates (e.g. Paris Metro). In network planning, transfers are opportunities not barriers.
- The objection to integration (e.g. the UK deregulated public transport approach) becomes a self-fulfilling prophesy, as market based systems make transfers inconvenient or even impossible, with extra fares, poor facilities and non-connecting timetables.
- Change will also be needed in transport policy, with 'balanced transport' giving way to active discrimination in favour of public transport and the genuinely sustainable modes of walking and cycling
- Before we can provide public transport solutions for suburbia, we must stop telling ourselves that the task is impossible.

CAT's 'Zero Carbon Britain 2030' also offers a number of ideas to promote more public transport use both through encouragement (softer measures) and through provision of better cost effective services (harder measures). Some of these ideas are given below:

- Local transport acts as the first step in long-distance public transport such as taking the bus or cycling to the station. Creating high-quality local transport solutions has the potential to unlock more sustainable long-distance travel. Currently 19% of car passenger emissions come from trips under 5 miles
- Coaches not only use less energy per passenger mile than do trains, but in addition the UK has an extensive road and motorway network. One possibility is to convert one lane in each direction on the UK's busiest motorways into a dedicated coach lane. Storkey (2009) recommends that around 250 coach transfer stations are needed to enable this sort of national coach network.

The best example of success in public transport modal share is in Zurich, which is covered extensively in both the Hitrans and Paul Mees publications. The Zurich model can be summarised as:

- Tram, bus, bicycle and walking are the ideal transport modes
- No parallel public transport operations should be allowed. Plan for role differentiation between bus and rail
- Create a network with many opportunities for high quality transfers
- Provide bike and car parking at many stops and stations in the public transport network
- User orientated fares, including free transfer between lines, modes and operators
- Idea of a few core frequent bus services, with local and rural feeder routes
- Network effect: all lines and all modes of transport feed each other to increase public transport modal share.

4.3 Car Sharing, Models of Car Ownership

Our perception of the cost of car ownership and car usage are such that the majority of car owners underestimate the costs of owning and using a car. Public transport is largely paid for at the point of use so the costs of usage are more transparent. It can be roughly calculated that these costs are as follows (these costs were calculated prior to the recent increases in fuel prices but they are adequate to illustrate the issues):

- Average cost of owning a car - 50 pence/mile
- Marginal cost of using a car - 25 pence/mile
- Cost of fuel - 12.5 pence/mile

With high car ownership, and the tendency to fill up the fuel tanks on a regular basis, many car owners only perceive their car journey costs in terms of fuel costs at best. As these costs are only about a quarter of the average cost of owning a car then this explains why the use of public transport, where available for a journey as an alternative to the car, is considered an expensive option.

This is why the alternative of car leasing, car clubs and pool cars has many advocates as they help highlight the true costs of car use at the point of use. Their uptake would encourage the choice of active travel modes, public transport modes and the option of car sharing for many journeys that are currently made by single occupants in their own cars, like the regular journey to work. Any encouragement of higher occupancy car usage leads to reduced costs, emissions and energy use.

Encouraging different forms of car ownership is one of the many tools that is considered under travel planning (covered in the next section), a relatively new professional area, which looks at measures to encourage more sensible use of the car and the use of sustainable travel alternatives.

4.4 Travel Planning

Travel Planning looks to adopt the Four E's model to reduce CO2 emissions from transport (from CAT's ZCB 2030):

- Enable: - websites on travel choices; better public transport information; better public transport facilities and services; car sharing; cycle training; electric vehicle recharging points
- Engage: - publicity campaigns; links between environmental, health and community groups; local solutions through active community engagement; community 'no vehicle days'; address misleading fuel efficiency claims; increase warnings about carbon costs of transport

- Exemplify: - limit parking spaces; increase cycle and shower facilities; home working options; telephone and video conferencing; source goods locally
- Encourage/Enforce: - increase taxes on carbon intensive transport options; subsidise costs of public transport; offer subsidised or low interest bike payment schemes; low carbon emission zones.

Another way to look at travel planning is to look at the various trip types such as journeys to work, to school, and for personal business/leisure and to develop travel plan strategies based on these categories.

Travel planning has been shown to reduce transport emissions by between 10% and 15%. However, because it relies to an extent on behaviour change it cannot be seen as a one off activity, otherwise the benefits obtained may not be sustained.

Scottish Government has supported the Smarter Choices, Smarter Places pilot schemes in seven separate communities across Scotland. It is important that the lessons learnt from these initiatives are disseminated widely and that the successful measures are identified and rolled out across Scotland. This will require sufficient funding to be identified and committed at both a national and a local level.

5. BUSINESS MODELS AND EVALUATION TOOLS

This final section considers some of the tools needed to enable the development of the business cases required for the implementation of the behaviour change and infrastructure initiatives outlined in this paper, to tackle the transport emissions and the Government's wider objectives.

This covers: the Business Models explored in 'Mitigating Transport's Climate Change Impact in Scotland: Assessment of Policy Options'; Transport Delivery Models emerging from the issues raised; Better Evaluation Tools/ Investment Models to take cognisance of a wider range of Government's wider objectives; and the related need for Improved Micro-Simulation Transport Models to evaluate and illustrate these new strategies.

5.1 Business Models: Policy

The policy options considered in Atkins and University of Aberdeen's work for the Scottish Government were divided into seven sub-categories:

- Technology options: - electric car technology & network development; procurement of low carbon vehicles;

- Driving Style: - active traffic management; national motoring package; speed reduction on trunk roads;
- Car Demand Management (Fiscal / Infrastructure): - bus/ rapid transit infrastructure investment (including bus priority); cycle infrastructure investment; walking infrastructure investment; bus/ LRT fares reductions; rail investment; high speed rail links; national network of car clubs; national road user charging; workplace parking levy; introduction or increase in parking charges (public parking); introduction/ raise in residential/ private parking charges;
- Car Demand Management (Smart Measures): - widespread implementation of travel plans; provide community hubs; bus quality contracts/ statutory partnerships;
- Freight: - freight best practice;
- Land Use Planning: - urban density increases;
- Aviation: - improve public transport surface access to airports;

This wide range of policy options was given a comprehensive business appraisal in terms of their likely carbon reduction potential to 2012, 2017, 2022 and 2030 for both the 'Central' and 'Ambitious' Scenarios, including the cost effectiveness of each option in terms of: Present Value (£) / tonne abated between 2010 and 2030. The behaviour change options were most cost effective because they only required very limited new physical assets and infrastructure; the least cost effective required complex technology infrastructure or provision of significant physical infrastructure on the public transport network.

For abatement beyond 2022 it is considered that the key influence will be the increasing use of electricity to power the vehicle fleet either directly or through the production of hydrogen. However, the role of supporting transport policy options will remain important.

5.2 Transport Delivery Models

The major transport delivery issues arising from the sources considered in this paper are:

- Car leasing, rather than car ownership
- Regulation of public transport: Integrated networks; Integrated ticketing; Cross subsidisation of services; and 'Pulse' timetables and feeder services
- Investment in infrastructure and services linked to modal split targets.

In Section 4.3 it was illustrated that car owners tend to underestimate the cost of car ownership and usage, so they do not use more sustainable and actually lower cost transport choices available. One of the ways forward in this matter is the more vigorous investment and encouragement by the public sector at both national and local level in the alternatives of car leasing, car clubs and pool cars plus of course car sharing. This is particularly relevant in encouraging people not

to own more than one car. The benefits of this approach lead to less single occupancy car usage thus reducing individuals travel costs, making public transport more economically viable, and reducing overall transport carbon emissions in the process.

Section 4.2 on increasing public transport usage suggested that the UK's deregulated public transport set-up may not be the best way forward in terms of encouraging the provision of public transport choices that can compete with the car. In the short term, many of the principles outlined such as integrated networks, cross subsidisation of services, 'pulse' timetables, and feeder services could be discussed with the existing private sector operators. They could be encouraged to adopt these practices in order to grow their market of customers in the areas where they currently operate. Some of the public transport operators have already implemented a number of these initiatives, such as the express bus network operated by Stagecoach in Fife where there is integrated timetabling at key bus stations to allow connections between express services. At a national and recently European level Stagecoach are operating the Megabus services that are very much in-line with the ideas developed in the 'CAT ZCB 2030' transport proposals for an integrated national coach network. In terms of the provision of hard shoulder coach/bus operations on the motorway network a scheme is now being implemented on the northern approach to the Forth Bridge with a new Park and Choose Interchange being built at the Halbeath Interchange together with a bus priority system on the M90 to the Bridge. In the longer term, the consideration of a more integrated approach to public transport regulation would allow many more of these ideas to be progressed, to the benefit of increased public transport mode share, with reduced transport costs to the public, and reductions in carbon emissions.

The investment in infrastructure and services needing to be linked to modal split targets can be illustrated in the current situation in active travel. In Scotland the amount of Scottish Government transport budget allocated to cycling has been around 1% over the last few years (refer to the Spokes (The Lothian Cycle Campaign) annual survey of investment in cycling in Scotland). However, the Scottish Government have set an ambitious target of 10% of trips by cycling by 2020. There is therefore a strong case for the setting of transport budgets at both the national and local level in line with the targeted mode share, rather than at the current mode share. Otherwise, the level of investment will be insufficient to achieve the target by 2020. In the Netherlands, where modal share for cycling is 25%, £25 per head per year is spent installing and upgrading its cycling infrastructure compared to Scottish spending of only £2 to £3 per head per year.

5.3 Better Evaluation Tools/ Investment Models

In Atkins and the University of Aberdeen's report on 'Mitigating Transport's Climate Change Impact' they state that: "Current appraisal processes, including STAG (Scottish Transport Appraisal Guidance), tend to apply a relatively low weighting and value to carbon savings in relation to other welfare benefits such

as time saving. Attributing a higher weighting to abatement is likely to play an important role in promoting progress”

The whole issue of multi-criteria transport appraisal was discussed in my paper “Quality of Life Transport Indicators under a Single Outcome Agreement” which was presented to the STAR Conference in 2009. This considered a wider transport evaluation framework based on the Government’s five strategic objectives: Wealthier and Fairer; Smarter; Healthier; Safer and Stronger; Greener; to allow the appraisal of multi-modal transport schemes in line with the requirements of the Single Outcome Agreement (SOA) between the Government and COSLA. Transport objectives were developed around Travel Cost, Travel Time, Safer Travel, Active Travel and Greener Travel ‘Quality of Life’ indicators on a seven point scale from A-G and beyond, which allows for objective appraisal and target settings in line with the requirement of the SOA. The links with STAG (Scottish Transport Appraisal Guidance) are also explained. The paper looked at examples of short, medium, and long distance trips and showed that by evaluating schemes against the wider Government objectives the more sustainable, lower carbon, safer and healthier modes of travel performed better than single occupancy car travel. The paper came to many similar conclusions as contained in this paper: “Sustainable economic growth can be achieved in Scotland by increasing emphasis on active travel through walking and cycling for shorter trips; and for regional journeys through public transport provision, including bus priorities, bus rapid transit and park-and-ride for both bus and rail. The provision of high occupancy vehicle lanes on the strategic network to encourage bus/coach use and car sharing can also be recommended and at the UK domestic level a strong policy argument could be made for the provision of a high speed rail network, to reduce the use of air for journeys of this distance.”

5.4 Improved Micro-Simulation Transport Models

Transport Models need to be developed that are:

- Simple to understand
- Able to carry out multi-modal appraisal based on the Government’s strategic objectives
- Activity based models considering trip purpose
- Able to model door-to-door options including walking and cycling modes for short trips and as feeders modes to a network of integrated public transport services
- Able to allow ‘what if’ scenarios to be tested in line with proposed mode split targets
- Able to utilise new data collection techniques such as those based on ‘blue-tooth’ technology

Micro-simulation modelling has now developed to such an extent that it would provide the best platform to develop a transport model with the above characteristics. In fact a number of recent articles have been published in Traffic Engineering and Control (TEC) which show this development is already well under way:

'Modelling variable demand using micro-simulation', by Steven Wood SIAS (TEC April 2011)

This paper describes the development and application of a variable demand and multi-modal modelling framework including public transport that has been designed to operate in conjunction with micro-simulation. The methodology has been applied on a recent project commissioned by Wiltshire Council to extend an existing S-Paramics model of Chippenham to provide a multi-modal capability that conforms to WebTAG.

'Transportation modelling for model walking and cycling communities', by Angus Bargh, John Kelly and Vicky Li (TEC February 2012)

This paper describes the integration of micro-simulation with other innovative sub-models including pedestrian models and in particular with cycling distribution and assignment models which presents an unprecedented opportunity to determine both the impact and staging of proposed network improvements. This model was developed for the Hastings Area in New Zealand by Traffic Design Group.

6. CONCLUSIONS

In conclusion this paper recommends the provision of:

- Integrated transport networks and services providing door-to-door journeys by walking, cycling and public transport
- New business models to encourage the use and provision of sustainable transport modes
- New technology to provide low carbon travel options
- Transport infrastructure and services investment linked to modal split outcomes
- New micro-simulation models and evaluation frameworks to identify sustainable transport solutions

Thus resulting in the delivery of National Carbon Reduction Targets in the Transport Sector, plus the delivery of related health targets for increased cycle use, and safety targets through the reduction in injury accidents.

Finally it is interesting to note that countries that provide integrated sustainable transport networks and services don't require Smarter Choices Programmes.

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