‘Soft’ Measures – soft option or smarter choice for early energy savings in the transport sector?

Dr Jillian Anable
Transport and Aviation Topic Leader
The UK Energy Research Centre (UKERC), The Centre for Transport Policy
The Robert Gordon University
Schoolhill, Aberdeen, AB10 1FR, UK
j.anable@rgu.ac.uk

Dr Sally Cairns, Lynn Sloman, Prof Phil Goodwin, Alistair Kirkbride, Carey Newson
See Acknowledgements for the affiliation of all the authors

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Abstract
Transport is the sector in which energy use is rising most rapidly. However, energy consumption in the transport sector cannot be achieved by improvements in efficiency alone. Rather, more fundamental behavioural changes are required which alter people’s aspirations, motivations and ultimately their travel and lifestyle choices. With more or less coercive polices such as national road pricing and personal carbon allowances being at best a long way off, this paper discusses the potential for ‘softer’ policies which encourage voluntary behaviour shifts to contribute to transport energy reduction in the shorter term.

In recent years, there has been growing interest in a range of so called ‘soft’ transport policy initiatives. By facilitating attractive, relatively uncontroversial, and relatively cheap alternatives, these initiatives seek to give better information and opportunities which affect the free choices made by individuals. Initiatives include workplace travel plans, individualised journey planning, car clubs, public transport information, marketing and teleworking.

This paper will present the evidence collated for a recent study of ‘soft measures’ for the UK Department for Transport which concluded that: ‘*... the voluntary changes in car use brought about by soft measures could amount to a reduction in the order of 11% of traffic at the national level (high intensity scenario) and 3% in the low intensity scenario*’. Projections for peak period traffic reduction at the *local* level ranged between 5% and 21% in urban areas. This translates into a saving of 2.76 MtC by 2010. It is important to note that whilst this study suggests that car use can be reduced by up to 21% at the level of individual choices, converting these individual choices into the equivalent effect on traffic in aggregate depends on supportive other policies in particular to avoid induced traffic by other individuals filling the available road space. This was a strongly emphasised conclusion in the analysis.

This paper asks whether soft measures are an effective way of bringing about early energy savings in the transport sector and a means of preparing the way for ‘harder’ policies in the medium and longer term.

Introduction
The transport sector currently accounts for about a quarter of all UK carbon dioxide (CO_2) emissions excluding international aviation (DfT 2004). Official road traffic forecasts indicate that traffic will rise by between 20% and 25% to 2010 from 2002, a higher rate of growth than was experienced over the 1990s (DfT 2002). To date, the CO_2 emissions from increases in road traffic have been largely offset by improvements in vehicle efficiency. However, in the future, further fuel efficiency improvements are unlikely to keep pace and road transport’s share of total UK CO_2 emissions could overtake the domestic, industry and service sectors, rising to 29% by 2020 (Foley and Fergusson 2003). After 2020, the continued increase in emissions from road transport could erode carbon savings expected from greater energy efficiency and renewable energy use.

Hence, if significant reductions in CO_2 are to be achieved, the transport sector must play a significant role, and it must do this without relying on technological improvements to offset the expected increases in mobility. This paper will assess the potential for non-technological, **voluntary** behaviour change solutions – namely a group of initiatives which have come to be known as 'soft' measures.

In recent years, there has been growing interest in a range of transport policy initiatives which seek to reduce car dependence by providing information and non restrictive means to influence traveller attitudes and encourage *voluntary* behaviour change. In transport policy discussions, these are now widely described as 'smart' or 'soft' measures[1] and include such initiatives as workplace and school travel plans, car clubs, car sharing, personalised marketing, travel awareness, teleworking and public transport information and marketing.

Soft measures attempt to affect the choices made by individuals, mostly by facilitating attractive, relatively uncontroversial, and relatively cheap alternatives. As a result they are often seen as the cheaper, easier, politically acceptable option. Compounding this scepticism is the fact that these measures are relatively new and evidence of their impact is patchy, sometimes contradictory and not yet particularly well documented. Consequently, these measures are largely or entirely omitted from established transport modelling and appraisal techniques, which deal with measures that are assumed to be more reliably understood. Likewise they are given much less priority in terms of local transport plans, staffing and budgets. Previous literature focusing on overviews of 'soft' or 'smart' measures is described in the next section.

The study on which this paper is based was commissioned by the UK Department for Transport (DfT) in an attempt to improve this evidence base and assess the potential future for soft measures (The main report: Cairns *et al.*, 2004 and its accompanying report of the case study evidence: Anable *et al.*, 2004 can be found at www.dft.gov.uk). The study reviewed current practice and experience at the local level in the UK and from some other countries and came to a broad view about the prospects for these policy instruments in the UK. This paper will provide an overview of the results and use the findings to estimate the carbon reducing potential of soft measures. The paper will make an assessment of how much soft factors could affect future levels of CO_2 production from the road transport sector if they were applied more intensively and on a larger scale than at present.

Definition and History of Soft Measures

A clear or consistent definition of a 'soft' measure has not yet been developed – and the specific list of soft measures reviewed in this study is given in the next section. The word *soft* is sometimes used to distinguish these initiatives from *hard* measures such as physical improvements to transport infrastructure, traffic engineering, control of road space and changes in price. However, some soft factors include 'harder' elements (for example, workplace travel plans often include parking management, including charges). Likewise, the term does not tend to include transport infrastructure improvements designed to improve conditions for walking and cycling – sometimes known as 'soft' modes. 'Soft' also refers to the nature of the traveller response, with initiatives often addressing psychological motivations for travel choice as well as economic ones and they tend to emphasis management and marketing activities rather than operations and investment. They are undertaken for a wide range of objectives such as increasing revenue for transport companies (by marketing activity for example), improving health by promoting and facilitating more exercise, reducing environmental damage, and reducing congestion. They are, however, almost always undertaken with the purpose of reducing single occupancy car use.

Although there is much accumulating evidence, and although some of these activities have a long history, it is still early days for soft factors, and the picture is changing rapidly as information and understanding grows. Hence, the potential effect of soft factor interventions is only partially understood. Their impact has been more or less well documented, more or less controversial and more or less comprehensive using a range of assumptions and evidence (See Cairns *et al.*, Chapter 2, for a review and discussion).

Arising from one such previous study (Halcrow Group Ltd 2001 and 2002), UK DfT guidance suggested that such policies might reduce traffic levels eventually by about 5% nationally. However, this assessment sparked considerable debate and the 5% figure is towards the low end of the range suggested by seven published estimates of the overall effect of packages of such measures, the high end of their estimates being about 20% overall, and up to about 30% for some specific urban locations (Dodgsen *et al.*,1997, 2000; WS Atkins, 1999; Halcrow Group Ltd 2001 and 2002; James, 2002; Sloman, 2003; Steer Davis Gleave, 2003; TFL, 2003). The biggest apparent differences between the reported figures arise from presentation. Figures expressed as a percentage of total national traffic inevitably appear small, and those expressed as a percentage of traffic in specific contexts, e.g. urban peak periods, are substantially higher. The national total calculations will have merit for certain purposes, notably calculation of carbon dioxide emissions, but in nearly all policies aimed at transport objectives such as congestion, mobility, social inclusion, local air quality or other environmental impacts, revenue generation, cost minimisation and economic impacts, it is the effects in a specific context that are useful. The study results were compared carefully, taking into account differences in the 'packages of measures' assessed in each study. Overall, there was some conformity in the figures taking into account differences in the scale and coverage.

DfT Study Aims and Objectives

The main objective was to collate and collect evidence from a diverse set of sources, including new case studies, about the impacts and cost effectiveness of 'soft' measures. Out of many potential definitions and groupings of soft measures,

1. The UK Department for Transport has recently published an extensive review of 'soft' measures under the title of *'Smart* moves' (Cairns *et al.*, 2004 and Anable *et al.*, 2004) – the report on which this paper is based. The words 'smart' and 'soft' will be used interchangeably in this paper.

the measures included in the DfT study (not assumed to be a final and complete listing of all such measures), were as follows:

- workplace travel plans
- school travel plans
- personalised travel planning
- public transport information and marketing
- travel awareness campaigns
- car clubs
- car sharing schemes
- teleworking
- teleconferencing
- homeshopping

The project aimed to refine understanding of the effectiveness of these measures in different types of areas and for different trip types (purpose, length etc), where such information could be obtained. This evidence will be used to inform decisions on the importance that should be attached to such interventions, future levels of resourcing, and the development of the UK National Transport Model (NTM). Overall, the study aims to answer three important questions:

1. What has been the impact of soft measures so far and under what circumstances and levels of resources have these impacts been achieved?
2. How much do soft factors cost, and what value for money do they represent?
3. By how much could soft factors affect future levels or growth rates of traffic, following about 10 years of implementation if they were applied more intensively and on a larger scale than at present?

This paper builds on these results to answer a fourth question:

4. By how much could soft factors affect future levels of CO_2 production from the road transport sector if they were applied more intensively and on a larger scale than at present?

Data Collection

There were two main activities undertaken in the study (i) a literature review and (ii) a series of local case studies. Together, the data sources aimed to collate detailed information, not yet widely available, about:

- what soft factor interventions are being used in different types of area;
- the size of the intervention (how many people have been affected);
- the effects of the initiative on car use – 'before and after' data where available;
- the likely changes in impact over time;
- what other effects have been achieved, such as improved accessibility;
- what resources have been needed to achieve these effects;
- any synergy between the intervention and other soft or hard measures;
- data on trends in car traffic levels available from other sources;
- the likely costs, and impacts, of scaling up interventions over the long term.

The case study locations were chosen to ensure a balance between metropolitan, urban and shire areas. In addition, the selection ensured that more than one measure could be investigated in at least some of the case study areas to seek insights into synergy between measures. Furthermore, some local authorities which have been less successful in a particular field were chosen in order to avoid 'cherry picking'. Following telephone conversations, web searches, analyses of local authority progress reports and discussion with the steering group, 12 UK local authority areas plus British Telecom were selected. These studies covered 24 different single or combined soft factor initiatives. Having chosen the case studies, a discussion guide was developed for each soft factor. Interviews took place between July and September 2003 with between 1and 3 people. These included both local authority, and initiative-related staff such as from the local public transport or car club operator, PTE, or associated consultancy. It must be noted, however, that the available data differed between case study areas so that the methodology varied to some extent between locations. In some cases, good 'before and after' data were available, and in other cases this was not the case. This is documented in detail in Anable *et al.*, 2004.

Calculating Coverage and Effectiveness of Each Measure

After collecting the evidence, the study considered what might be the impact of each individual soft factor following about 10 years of implementation. This information was based on the evidence from the case studies, supplemented by data from the literature review and where possible by judgement of plausibility or credibility. In particular, the case study interviews included questions on the future scale of implementation of each soft initiative.

In considering the questions outlined above, two scenarios were developed:

- 'low intensity' is a projection of the present rate of expenditure and level of commitment, taking account of the important initiatives which already exist, and will no doubt continue, by the most committed local authorities, and of commercial initiatives being undertaken by companies.
- 'high intensity' is based on an expansion of activity, commitment and resources to a substantially higher level, which would still be consistent with practical and realis-

tic experience, and feasible levels of expenditure, given the known constraints of staffing and funding generally.

Both scenarios are based on what was judged *could* be achieved by a realistic level of commitment to a programme building up over a ten year period. However, this should not be interpreted as a 'forecast for 2014', because no allowance is made for other things that will have changed by then (demography, income, economic growth, road user charging, revision and rolling forward of the UK Ten Year Plan for Transport (DfT 2002) etc) and also because the effects of soft factor initiatives will certainly be influenced by other policies.

There were four stages to the analysis in the study and a fifth added for this paper. Each stage calculated:

1. Coverage and Effectiveness for each soft measure (based on case study and literature review evidence)
2. Impact for each Journey Purpose (work travel, journey to school, business travel etc) based on the evidence
3. Impact on national traffic – projections based on the evidence
4. Value for money – based on the evidence
5. Impact on national CO_2 emissions – projections based on the evidence

The end result was a figure for 'impact', wherever possible expressed in terms of car mileage[2], for both the high and low intensity scenarios and for both urban and rural locations. Impact was the product of coverage and effectiveness, defined as:

- Coverage – the proportion of the population affected in some way
- Effectiveness – the amount by which car travel could be reduced within the affected population

Each type of soft factor was examined through a unique combination of literature review, interviews and case studies and from this different assumptions and judgements were made. Space restrictions in this paper do not allow these to be presented in detail – *therefore, we describe in detail the evidence base, assumptions and judgements used to derive estimates of coverage and effectiveness for one out of the ten soft measures examined – Workplace Travel Plans (WTPs).* We then go on to present an overview of the main assumptions and figures used to derive estimates of the coverage of each soft factor in the high and low intensity scenarios in both urban and rural areas after 10 years of implementation (Table 2) and the different sets of assumptions used to derive effectiveness figures (Table 3). Readers are referred to the main report to clarify the sources of information for the assumptions used for the other soft factors. In all cases the figures are derived from the evidence collected for the study.

EVIDENCE BASE FOR COVERAGE OF WORKPLACE TRAVEL PLANS (WTPS)

There were seven local authority case studies of WTPs as listed in Table 1. Each local authority had been promoting WTPs for between five and eight years, although some had only been doing this intensively for a shorter period of time (1-2 years). All had adopted a strategy of working preferentially with larger businesses, and the proportion of *employers* covered by their travel plan work was therefore small, at less than 1% of all businesses in the local authority area. It ranged from a low of 30 employers (in York) to a high of 145 employers (in Birmingham). The case studies are written up in detail in Anable *et al.*, 2004.

However, the number of *employees* engaged in travel planning was a significant proportion of the total workforce in the areas covered, ranging from 8% of the workforce (56 000 employees) in Merseyside to nearly 30% in Birmingham, Nottingham and York (136 000, 52 000 and 26 000 employees respectively). Cambridgeshire had reached 12% of the county workforce (34 000 employees), but by virtue of concentrating their effort in the main county town, Cambridge, this represented a much higher proportion of the workforce in that town (29%). The proportion of the workforce reached in each of the case study authorities is all the more remarkable bearing in mind the low level of resources typically applied to this work, which ranged from 1 to 3 full-time equivalent posts.

Table 1. Summary of Local Authority Engagement in travel plans (Summer 2003).

Location	Number of staff in companies with WTP	Number of companies local authority is working with	% staff	% companies
Birmingham	136 000	145	29	0.5-0.6
Bristol	29 960	60	13	--
Buckinghamshire	21 700	33	11	--
Cambridgeshire	34 000	44	29 or 12*	0.5 or 0.3
Merseyside	55 870	57	8	--
Nottingham	52 000	35	28	0.5
City of York	26 187	30	29	0.6

** First figure is the % of employees in the two main target districts (Cambridge City and South Cambridgeshire). The second figure is for the percentage of all employees in the county.*

2. In most cases, impact is expressed as a percentage reduction in car *trips*. However, there are a few exceptions, where we had information that enabled an estimate of the impact on car mileage. On the whole, car mileage data is more useful. Where it is lacking, we assume that *mileage* is reduced by the same proportion as trips. This may introduce a bias, usually but not always an underestimate, especially important where the combined effects of soft measures (and other policies) are such as to encourage a greater proportion of local travel, as well as a shift in mode.

The strategies used by the local authorities to engage employers in the process of travel planning included:

- A focus on larger employers (as discussed above).
- All seven authorities used the planning system to require travel plans to be drawn up for new developments. For example, planning conditions in Birmingham require all new developments that will have more than 50 staff to join the council's area-wide Company *TravelWise* scheme. In York, the travel plan officer scrutinised all planning applications, and specified what conditions should be attached to planning permissions.
- Development of networks or clusters of businesses who could support each other in travel planning.
- Offering incentives to businesses to get involved in travel planning, such as grants for specific infrastructure, like cycle parking, and discounted public transport season tickets.

CALCULATING THE POTENTIAL COVERAGE OF EACH SOFT MEASURE AFTER 10 YEARS

The above process described for WTPs was carried out for each soft factor, each resulting in different assumptions and final figures for potential coverage in urban and rural areas (Table 2). Estimates of future potential are based on what is being achieved in the case study areas now, and what case study interviewees felt could be achieved in future. In the case of WTPs, the following assumptions were used for coverage:

- There is an upper level to the proportion of the workforce that can be readily engaged in travel plans. This is *currently* determined principally by the proportion of employees who work for public sector organisations and large companies, although the level might be increased by policies which create incentives for smaller organisations to adopt travel plans.
- Conservatively, we assume that the proportion of the workforce that can be readily engaged is lower in non-urban areas than in urban areas (since employment may be more dispersed and there may be fewer large employers). This is consistent with findings from our case studies.
- In urban areas we assess the potential coverage to be 30-50% of the workforce covered over the next 10 years, and 10-20% in rural areas.

EVIDENCE BASE FOR EFFECTIVENESS OF WORKPLACE TRAVEL PLANS

The literature review suggested that travel plans typically reduced car use by 15-20% with perhaps higher restrictions of 20-25% from plans incorporating measures such as parking management and bus subsidy, and lower reductions of 5-15% for plans that do not incorporate such measures. These were typical findings:

- Good travel plans typically reduce commuter car driving by an average of at least 18%. Plans which include parking management measures achieved a mean average reduction of car driving of >24%, compared with >10% for those that did not. (Cairns *et al.*, 2002a)
- Successful travel plans in the US typically reduce vehicle trips by 19%; Successful travel plans in the Netherlands typically reduce vehicle mileage by 20%. (Organisational Coaching and Shreffler (1996))
- Eight Californian employers offering cash for parking had reduced single occupancy driving by an average of 13% and vehicle miles by 12%. (Shoup 1997)
- 49 US employers with travel plans had achieved an average vehicle trip reduction of 15%. Averages for different types of plans were: 9% if offering commuting alternatives only (such as van pools); 16% if offering financial incentives only (such as bus fare subsidy); 25% if offering financial incentives and services. (TCRP 1994)
- 40 Dutch employers (plus an unspecified number of others from review work) provided information about different types of plans. This suggested average reductions in vehicle kilometres of: 6-10% for plans with 'basic' measures; 15-23% for plans with 'luxury' measures. (Ligtermoet 1998)
- Information from different types of Dutch travel plan suggested average reductions in single occupancy vehicle kilometres of: 8% for plans with 'basic' measures; 20% for plans with 'luxury' measures (Touwen 1999)

For the Dft Project, the 7 local authorities interviewed were asked to provide results on the modal share over time for companies with WTPs. Results were obtained for 26 organisations representing 33 000 employees from different parts of the UK. The weighted average change in cars per 100 staff was a reduction of 17.8%. Not all local authorities had data from more than one company and so it was only possible to derive average reductions from 4 authorities where a number of companies had 'before and after' data. These ranged from -7.5% to -23.5%, partly reflecting whether the authority had gone for breadth or depth and how long they had been engaged in travel planning. Overall we saw that most travel plans achieve cuts in car use of 0-35%, with a few best practice plans achieving cuts of over 40% and some delivering no reduction at all. Data from the case study areas and a preceding study (Cairns *et al.*, 2002a)) suggests the following distribution:

The average reduction (including poor performing, middle range and good performing plans) was 18%. This is consistent with results from the literature, which highlight that even minimalist plans can be expected to have some impact. Therefore, for both the low intensity and high intensity scenarios, in urban and non-urban areas, we assume an average effectiveness of 18%. As with our reported data, this does not mean every travel plan achieving an 18% reduction in car use. Some plans will achieve more and some less. Equally, it does not mean that all areas will achieve the same results. Some flagship towns – for example, compact cities with well-developed traffic restraint policies – may do very well, and others may do less well. Moreover, it assumes that, even under our high intensity scenario, a large number of employers may not be prepared to engage in travel planning at all (representing 50% of employees in urban areas and 80% in non urban areas).

Table 2. Potential coverage of each soft measure after 10 years.

Soft Measure	Unit of measurement	Urban	Rural	Factors used in calculation
Workplace Travel Plans (WTP)	% of workforce covered by travel plans after 10 years	30-50%	10-20%	So far 'active' city authorities have typically managed to engage with organisations representing 30% of the workforce and rural authorities 10% There is an upper limit to the proportion of the workforce that can be readily engaged in travel plans – currently determined by the proportion of employees working for public sector organisations and large companies experience of working with small organisations is slow to develop there is lower engagement in rural than urban authorities Assume that even under high intensity scenario, a large number of employers may not be prepared to engage in travel planning at all (representing 50% of employees in urban areas and 80% in non-urban areas)
School Travel Plans (STP)	Percentage of pupils covered by travel plans after 10 years	30-95%	30-95%	Some authorities expect to reach nearly all the schools in their authority in the next 10 years Evidence suggests coverage is likely to be similar in urban and non-urban areas UK Dept. for Education and DfT have a joint target that *all* schools should have an active STP by the end of the decade
Personalised Travel Planning (PTP)	Proportion of the population targeted	15-30%	1-3%	Case studies suggested that it is feasible to develop large-scale PTP programmes covering between 10k and 30k people p.a. (representing between 3% and 20% of the population) In the high intensity scenario, 30% urban coverage is assumed, although some cities will do more than this and others less In the low intensity scenario, half this level of implementation is assumed
Public T'port Information and Marketing (PTIM)	Annual increase in local bus trips attributable to PTIM	5-20% non London- 32% London	2-9%	PTIM has delivered clearly recorded increases in bus use – 0.7% - 2.5% per year Assume that on average public transport quality is sufficient to allow PTIM to take place
Travel Awareness	% of car users reacting to a campaign	1.5-6%	1.5-6%	Based on general area-wide campaigns Data is difficult to collect In one UK city (York), between 3% and 12% of drivers have probably reduced their travel as a result of the campaign – but assume half this proportion either because programmes will not be implemented everywhere or because they are implemented at lower intensity
Car Clubs	Car Club members as a % of the population	0.1-0.2% (up to 10% longer term)	0 (up to 10% longer term)	If organisational hurdles can be overcome, car clubs already established could be self financing and could grow at a more rapid rate than at present There will also be growth from car clubs in cities where they are not currently operating Growth would result in non-linear growth in membership (but not exponential)
Car Sharing	% of car commuters who begin sharing (as a % of all car commuters)	1-10%	1-10%	Lower and upper figure is based on linear projections for two case studies (Buckinghamshire and Milton Keynes) Car sharing may also be important for business and some leisure trips – but not included here
Teleworking (TW)	Increase in % of workforce teleworking since 2003	10-20%	10-20%	About 64% of the workforce are currently employed in occupations with significant levels of TW At present at least 7% of the workforce teleworks some of the time If growth continues at current rates, around 30% of the workforce may TW in a decade
Tele-conferencing (TC)	% companies having readily available TC facilities in next 10 yrs and use it as part of mainstream practice	25-60%	25-60%	Evidence suggests that there is great potential for more widespread use of teleconferencing, but public sector promotion may be needed The entire impact is concentrated on business trips - assumes business travel by car reduces in the same proportion as business travel by other modes
Home shopping	% of UK grocery sales by value	5-15%	5-15%	The home shopping literature review suggest that home delivery has the greatest potential impact on car use in the grocery sector – this accounts for 40% of personal shopping mileage by car

CALCULATING THE POTENTIAL EFFECTIVENESS OF EACH SOFT MEASURE AFTER 10 YEARS

Similarly, estimations of *effectiveness* required a different set of assumptions for each soft measure as follows:

Calculation of Impact for each journey purpose

As described above, impact was the product of coverage and effectiveness. For each soft factor, impact was calculated for

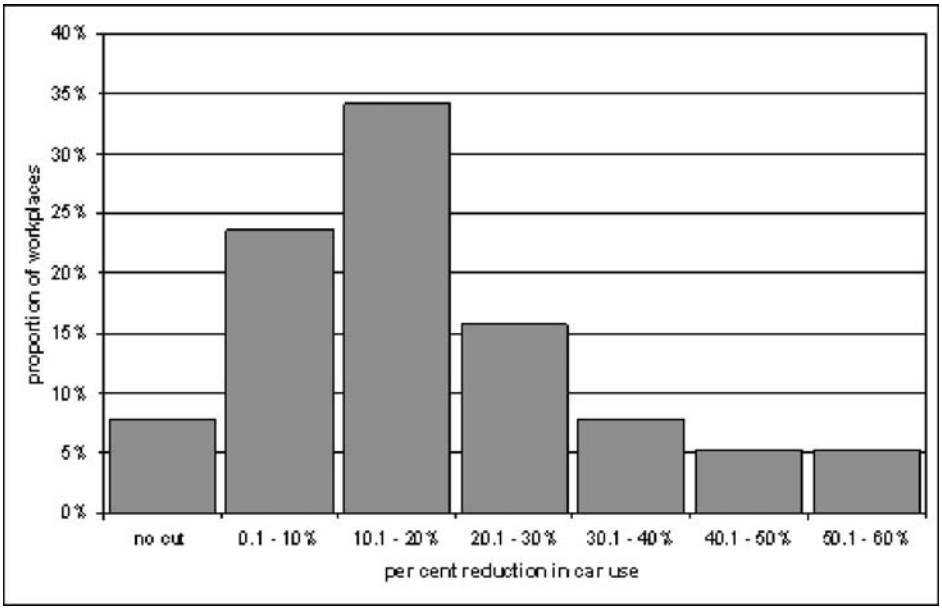

Figure 1. *The distribution of effectiveness of WTPs.*
(Source: re-drawn from data in Cairns et al., 2004 and Cairns et al., 2002a)

urban and rural areas for both the high and low intensity scenarios. Once again, WTPs can be used to illustrate how this was done – combining the assumptions in Tables 2 and 3 for WTPs, the reduction in car commuter trips would be 5% or 9% in urban areas, and 2% or 4% in non-urban areas:

Impact is expressed as a percentage reduction in car *mileage* for the relevant journey purposes for car clubs, car sharing, home shopping for groceries and local collection points. For all other measures, the impact is expressed as a percentage reduction in car *trips* for the relevant journey purposes, and it is suggested that these figures are also applied to car mileage, as there is no information from either the literature or the case studies that would enable the reliable calculation of different figures for mileage. In addition, it must be noted that for soft factors which affect multiple journey purposes, the impact is expressed relative to *all* car travel. For soft factors which affect only one journey purpose, it is expressed relative to car travel *for that purpose*. Thus the figures quoted for different soft factors are not immediately comparable at this stage, until brought together and applied to data reflecting the size of the different traffic segments.

A further point of clarification refers to *double counting* – that is the incorrect assumption that several soft factors acting together will each reduce car travel by an independent percentage, when in fact the target market of people willing or receptive to respond to each of them overlaps. This means that car trips removed as a result of one soft initiative may not then be available to be removed by another initiative. For most trip purposes, this is not likely to be an issue. However, the journey to work can be influenced by six or possibly seven soft factors, of which three (workplace travel plans, car sharing and teleworking) could each have a substantial impact. Here, there does seem to be some risk of double counting and adjustments are made as explained on page 349 of the main report. The opposite effect of '*synergy*' – whereby the impact of several soft factors working in combination is greater than the sum of their parts, is discussed in the main report (p371). However, the calculations were not adjusted for synergistic effects (and may therefore be conservative as a result).

Table 5 utilises the figures from the 'coverage' and 'effectiveness' tables, in some cases combined with additional information from UK National Transport Statistics, to derive the impact estimates[3].

Calculation of the Impact on National Traffic

The calculations above produced a set of low figures corresponding with a low intensity scenario, and a set of higher figures for a high intensity scenario. The DfT asked for the potential impact of soft factors on national traffic levels – this included all road traffic including goods traffic. In order to calculate the overall effects of soft factors on UK national traffic in different contexts:

1. A table of traffic data was defined that was consistent with the dimensions of discrimination possible from the research results, *and* the data used in the National Transport Model for the year 2000 (e.g. journey purpose, time of day, urban/ non-urban roads).

2. The percentage changes to appropriate subsets of traffic that would be caused by different soft factors were calculated, at a level of intensity corresponding to the high intensity and low intensity scenarios built up over a ten year period.

3. All the figures and assumptions used to derive these figures are not include in this paper in the interests of brevity. The main report, (Cairns et al Chapter 11) details the calculations for each soft factor.

Table 3. Potential effectiveness of each soft measure after 10 years.

Soft Measure	Unit of measurement	Urban	Rural	Factors used in calculation
Workplace Travel Plans (WTP)	Average reduction in car use	18%	18%	Most travel plans achieve cuts in car use of 0-35% with a few best practice plans achieving cuts of over 40% and some delivering no reduction at all
School Travel Plans (STP)	The proportion of STPs with % cut in car escort trips to/from school: 0% cut (none): 10% cut (average): 25% cut (high):	 0.05-0.2 0.2-0.5 0.75-0.3	 0.05-0.2 0.2-0.5 0.75-0.3	Low scenario is based on the 'average' current level of engagement, and assumes that 20% of plans have no impact on traffic, 50% have an average impact and 30% are high performers. High scenario assumes that, as local authority work in this area increases, they will be able to engage with a much greater proportion of schools on an intensive basis - 5% of plans have no impact, 20% have an average impact and 75% have high impact. Effectiveness in urban and rural is assumed similar
Personalised Journey Planning (PTP)	Reduction in car driver trips per person	7-15%	2-6%	High intensity scenario figures are at the upper end of the range of research results. Low intensity scenario figures are at the lower end of the range of reported results
Public Transport Information and Marketing (PTIM)	Proportion of public transport trips transferred from car as driver	0.19	0.19	Based on findings, it is assumed that 30% of patronage increases may be attributed to former car users, made up of 19% former car drivers and 11% former car passengers (in line with average car occupancy levels).
Travel Awareness	Reduction in car use amongst those car users who change their behaviour	5-20%	5-20%	Assume reduction in car use for those people who respond to travel awareness campaigns might be 5% (as a minimum that would be noticeable), through to 20% (as a maximum, perhaps equivalent to say, foregoing car use approximately one day a week.
Car Clubs	Reduction in average car mileage of each member	30%	30%	Based on international studies, assume the net effect of car club membership is to reduce average car mileage of all members by about a third. This allows for the fact that some car club members will make much larger cuts in their car use, while others (especially former non-car owners) may make little change or even increase their car use.
Car Sharing	Average car occupancy in car-sharing vehicles Average journey distance to work for car sharers relative to average for all car trips to work	2-2.5 1-1.5	2-2.5 1-1.5	Lower car occupancy figure is equivalent to driver plus one passenger (i.e. the minimum possible) although some car-sharing schemes specifically encourage three or more people per car. 1999/01 National Travel Survey data suggests average car occupancy of 2.4 amongst commuters who already car share. Assume the journey to work distance for car sharers is 1 – 1.5 times the average journey distance for people driving alone. This is based on indications from the case studies that car sharing appeals more to people who have further to travel.
Teleworking (TW)	Overall proportion of teleworker's time working at home	30-60%	30-60%	High intensity scenario assumes 30% of the workforce engaged in teleworking to some extent (consistent with linear growth at current rates), and working at home an average of 3 days per week. This average would certainly include some relatively intensive teleworkers, and some that are less intensive. Low intensity assumes teleworkers are, on average, based at home 1.5 days per week, being the lower estimate of current practice, (derived from 2001 Labour Force Survey).
Tele-conferencing (TC)	Reduction in business travel in companies using TC facilities	10-30%	10-30%	Derived from case study/ literature review
Home shopping	Vehicle mileage saved per shopping load amongst those using delivery services	70%	70%	Drawing mainly upon a detailed report about a pilot project taking place between the Royal Mail and Nottingham City Council and a literature review

3. These percentage were applied to changes to the traffic figures created above.

For each of the journey purpose categories, 'work', 'business' and 'other', two *journey change factors* were derived, based on summation of the impacts of the relevant soft factors (adjusting for double counting for work journeys) and representing the high and low scenarios. These express the proportion of traffic that remains after the projected reductions are applied[4] and the detailed calculation should be reviewed in Chapter 13 of the main report. The result of applying the journey change factors to the national data can be seen in Table 6 and can be summarised as follows:

Table 4. Coverage and effectiveness of Workplace Travel Plans.

	Coverage Percentage of workforce covered by travel plans after ten years	***Effectiveness*** Proportion of travel plans with:					***Impact*** Implied reduction in car commuting trips	
		no effect*	low effect*	medium effect*	high effect*	very high effect *	Expressed as % of car trips to work in companies with travel plans	Expressed as % of all car journeys to work in area
Urban areas	30 – 50%	0.1	0.2	0.35	0.25	0.1	18%	***5 or 9%***
Non-urban areas	10 – 20%	0.1	0.2	0.35	0.25	0.1	18%	***2 or 4%***

** 'low' means a >0-10% cut in car commuting trips; 'medium' = >10-25% cut; 'high' = >25-35% cut; 'very high' = over 35% cut.*

Table 5. Summary of impacts of different types of soft factor.

Journey purpose	Soft factor	Impact: Non-urban	Impact: Urban
Journey to work	Workplace travel plans	2 or 4%	5 or 9%
	Car sharing	0.6 or 11%	0.6 or 11%
	Teleworking	3 or 12%	3 or 12%
Combined impact of workplace travel plans, car sharing and teleworking, allowing for double counting		*5 or 24%*	*8 or 26%*
Journey to school	School travel plans	4 or 20%	4 or 20%
Business journeys	Tele-conferencing	2.5 or 18%	2.5 or 18%
Shopping trips	Home shopping for groceries	1 or 4%	1 or 4%
Personal business trips	Local collection points	1.5%	1.5%
Multiple journey purposes	Personalised travel planning	<1%	1 or 3%
	Public transport information and marketing	0.1 or 0.3%	0.3 or 1.1%
	Travel awareness campaigns	0.1 or 1%	0.1 or 1%
	Car clubs		0.03% - 0.06% (up to 3% long term)

Table 6. Impacts of soft factors on future traffic levels (2000-2010) – all vehicles.

Impact on…	Low intensity scenario	High intensity scenario
National traffic – all vehicles	2%	11%
Peak-time national traffic – all vehicles	4%	17%
Off-peak national traffic – all vehicles	2%	10%
Urban traffic	3%	14%
Peak-time urban traffic	5%	21%
Off-peak urban traffic	3%	13%
Non-urban traffic	2%	8%
Peak-time non-urban traffic	3%	14%
Off-peak non-urban traffic	1%	7%

Note that these figures apply to all traffic as this was requested by the UK DfT. The equivalent impacts on car traffic only would be greater. Also, it should be noted that no account was made of mode switching from, say, car to public transport – so the overall effect on traffic could be slightly less than reported.

- Under the 'high intensity' scenario, traffic in urban areas could be cut by 14% overall, and 21% at peak times. Traffic in non-urban areas could be cut by 8% overall, and 14% at peak times. Nationally (that is, across both urban and non-urban areas), traffic could be cut by 11% overall, and 17% at peak times.
- Under the 'low intensity' scenario, traffic in urban areas could be cut by 3% overall, and 5% at peak times. Traffic in non-urban areas could be cut by 2% overall, and 3% at peak times. Nationally, traffic could be cut by 2-3% overall, and 4% at peak times.

It is important to note that whilst this study suggests that car use can be reduced by up to 21% at the level of individual choices, convert-

4. The contribution of two soft factors, namely school travel plans and shopping home delivery / local collection points, proved more difficult. This is because the proportion of 'cars other' mileage was for escort education, shopping or personal business is not known. To enable calculations for these soft factors, an approximate breakdown based on 1999/2001 National Travel Survey data was used.

ing these individual choices into the equivalent effect on traffic at the aggregate level depends on supportive other policies in particular to avoid induced traffic by other individuals filling the available road space. This was a strongly emphasised conclusion in the analysis.

Therefore it must be emphasised that these are projections of what *could* happen. Achieving these reductions in traffic (especially those in the 'high intensity' scenario) will depend on the priority and support accorded to soft factors, and the extent to which their benefits are *locked in* by other measures to control induced traffic. This is dependent on the surrounding policy context in which an expansion of soft policies might take place. In the interests of brevity for this paper, suffice to say that, in order not to confuse the analysis, it was assumed that *sufficient* supportive 'locking in' measures are introduced at just sufficient intensity to maintain the changes brought about by soft measures, but not more. This is a convenient neutral assumption for the analysis, and no attempt was made to define exactly what package of supportive measures would be capable of producing such a result in practice: its purpose was only to allow the potential impact of soft measures to be defined in themselves. Hence, the behavioural responses were not adjusted in either direction, neither allowing for erosion due to induced traffic, nor enhancement of soft factor effects due to the measures to prevent induced traffic such as pricing or reallocation of road capacity

Value for Money

The individual case study analyses used data on current levels of spending and impact for each soft factor to derive a cost-impact ratio: that is, an estimate of the current cost for each car kilometre taken off the road to the public sector. The detailed calculations are documented in the main report. To the extent that the rather different nature of each of the soft measures allows, a common evaluation framework was adopted for each type of measure, usually including treatment of build-up and decay rates of spending and effects over time, and discount rates for annualisation of capital costs in line with UK Treasury guidance on public sector investment appraisal. Additional external benefits (such as time savings, accident reductions, health and environmental impacts, social inclusion gains etc.) were briefly noted where evidence existed, but not monetised nor included in a social cost-benefit appraisal. Instead, the calculation concentrated on congestion reduction because figures for valuing congestion are the most established in the UK context. Also, this gives a conservative estimate of benefits – the figures are less likely to be exaggerated if the values afforded to congested are accepted as accurate.

For the different soft factors, the cost of facilitating choices by individuals to reduce their car use in most cases ranged from about 0.1 pence to 10 pence (0.014 to 0.14 Euro) per vehicle kilometre saved. The study calculations suggest that it is reasonable to take a public expenditure cost of 1.5 pence per vehicle kilometre saved as an indicative figure for a well-designed package of different soft initiatives, i.e. £15 (*22* Euro) for removing each 1000 vehicle kilometres of traffic.

Current official practice calculates the benefit of reduced traffic congestion, on average, to be about 15p per car kilometre removed, and more than three times this level in congested urban conditions (SRA 2003). Thus, on average, every £1 (1.44 Euro) spent on well-designed soft measures could bring about £10 of benefit in reduced congestion alone, more in the most congested conditions, and with further potential gains from environmental improvements and other effects, provided that the tendency of induced traffic to erode such benefits is controlled. There are also opportunities for private business expenditure on some soft measures, which can result in offsetting cost savings.

There are reasons for expecting the relationship between cost and impact not to be linear. There may be economies of scale which reduce the unit costs of large initiatives; the development of better methods which increase the effectiveness of soft measures; and there may be diminishing returns especially as the achievable limits to behavioural change are approached and higher (and additional) costs are involved once highly involved people have been reached. The first and second of these would lead to unit costs becoming lower as a programme of soft measures is built up, and the third would lead to the unit costs becoming higher. A sensible hypothesis might be that, in the early stages of extensive soft factor implementation, unit costs will fall, and, at later stages, as saturation of effect is approached, they will increase. Although available data do not yet allow these hypotheses to be fully checked, there are some indications that, currently, in some situations, the unit costs of implementing soft factors are falling, consistent with the reality that most soft factors interventions have so far only been implemented in a relatively small scale way. Within the time scale and assumptions of the high intensity scenario, we would not expect that diminishing returns are likely to set in.

Impact on National Carbon Emissions

The transport sector is the third largest source of carbon emissions in the UK and is the only sector in which emissions are expected to be higher in 2020 than in 1990 (SDC 2003). Hence, transport has a potentially vital role to play in achieving reduction targets.

Currently, UK transport policy aims to reduce emissions of GHGs from transport by 5.6MtC below trend by 2010 (Bristow *et al.*, 2004a). This figure reflects the voluntary agreement between the European Commissions and European car manufacturers to reduce average carbon dioxide emissions from new cars to 25% below 1995 levels by 2005 (ACEA/EC 1998) which is expected to deliver a 4MtC reduction. The remaining 1.6MtC is to be achieved by measures in the Government's 10 Year Plan for Transport (DETR 2000b). This plan included policies such as road user charging, workplace parking levies and the ability of the rail network to provide the capability for a 50% growth in passenger numbers. However, these policies are not on target to deliver these savings and as a result of this, the UK government has been forced to admit that it cannot reach its own target of a 20% reduction of CO_2 emissions below 1990 levels by 2010 (DEFRA 2004).

Various scenario studies provide an indication of the role that transport is expected to play (for a review see Bristow *et al.*, 2004a). These studies acknowledge the difficulty in predicting future change in the transport sector and in developing measures that will impact on current emissions trends.

All, however, recognise the need for substantial change. Many studies are fairly pessimistic about the ability of the transport sector to deliver significant reductions in emissions relative to other sectors. Indeed, the UK Department for Trade and Industry (DTI 2003b) indicates that transport carbon savings are among the higher cost options compared to other sectors (and hence it is to be expected that transport's carbon contribution may end up higher than it is now). This is also reflected in work for the EC (Blok *et al.*, 2001, cited in Bristow *et al.*, 2004a) suggesting that the transport sector will play a limited role in meeting the Kyoto targets as reductions in other sectors are more cost effective.

In almost every case, however, most emphasis is placed on the role of technology to deliver emissions reductions through improved efficiency and alternative fuel sources. However, in the face of continued growth in mobility, the absence of significant technological advances including the development of carbon neutral sources of energy and the potential 'rebound' effect that technology may introduce by reducing the cost of travel and leading to further increases in trip making, there are severe doubts over the ability of technology to secure the emissions reductions required in order for transport to 'pull its weight'. Hence, in order to examine how targets may be achieved, we need to gain a clear idea of the possible contribution of individual categories of measures. This includes soft factor interventions.

Table 6, above (The Impacts of Soft Factors on Future Traffic Levels) pertains to *all surface road traffic*. This includes light and heavy goods vehicles and passenger service vehicles[5]. However, in order to calculate potential savings in carbon emissions from soft factor interventions, this section will concentrate on the impact of soft factors on *car* traffic only. Table 7 shows the percentage reduction in car kilometres (and emissions – see below) for three amalgamated journey purposes (work, business and 'other') as well as for all for these purposes combined. These figures are again derived from the DfT study evidence using the calculation methods outlined above.

The figures in Table 7 are higher than those in Table 6 due to their use of a smaller subset of overall traffic levels (i.e. minus goods traffic). Here, soft factors could potentially reduce car traffic levels by 15% by 2010 for all journey purposes combined in all geographical areas if the high intensity scenario is achieved.

For the purposes of this paper, only a crude estimate of emissions savings has been attempted. Due to being linked directly to vehicle kilometres, the percentage reductions for kilometres and emissions are identical (Table 7). In its current format, the data for the DfT study on soft factors does not allow a disaggregation of the traffic reduction figures in a way that is consistent with the dimensions of discrimination available from vehicle emissions inventories (e.g. The National Atmospheric Emissions Inventory (NAEI)). For example, the study was not able to allocate the traffic savings to different road types, nor calculate the proportion of journeys/ distance undertaken under two miles (for cold start emissions). Hence a crude estimate has been calculated using the total traffic reduction estimates for each journey purpose and applying average emissions factors for 2010 using the 2000 baseline traffic figures from above (calculated from the NAIE). Table 8 displays the results of the calculation.

From this table it can be seen that soft factor interventions have the potential to save 2.76MtC (10 $MtCO_2$) if the high intensity scenario is realised and the assumptions are correct. The majority (58%) of these savings come from policies related to the journey to work. This is a substantial

Table 7. Potential impact of soft factors on future UK car traffic levels (percentage reduction) 2000-2010.

	% Reduction (vehicle kilometres and emissions) by 2010					
	urban		rural		Total	
	high	low	high	low	high	Low
all journeys	18%	4%	12%	2%	15%	3%
work	33%	9%	25%	5%	29%	7%
business	25%	4%	19%	3%	21%	3%
other	8%	2%	3%	10%	6%	2%

Derived using tables 13.10 and the journey change factors in the main report.

Table 8. Potential impact of soft factors on future Carbon emissions between 2000-2010 in the UK.

	MtC Saved					
	urban		rural		Total	
	high	low	high	low	high	Low
all journeys	1.68	0.42	1.09	0.22	**2.76**	0.64
work	0.98	0.27	0.63	0.13	**1.61**	0.39
business	0.26	0.04	0.30	0.05	**0.56**	0.09
other	0.44	0.11	0.15	0.05	**0.60**	0.16

To get CO_2 multiply by 3.6667 or 44 (CO_2) over 12(C)

5. The passenger car is adopted as the standard unit using the standard factors applied by the DfT and other vehicles are assessed in terms of passenger car units (pcus)

saving especially given that transport (excluding aviation) is expected to account for around 39MtC in 2010 (DEFRA 2004).The 2.76MtC saving therefore amounts to 7% of this total. It is also just under half of the projected savings from transport by 2010 estimated to come from the voluntary agreements and other sustainable transport policies (5.6 MtC as cited above).

However, some caution must be exercised when considering these results. In order to calculate these savings, the following assumptions were used:

- Traffic was assumed to grow by 20% from 2000 levels reflecting the *lower* end of the estimates from the UK DfT (DfT 2002). This increase was applied equally to all journey purposes.
- The NAEI road transport emissions projections were used to calculate an average emissions factor for carbon applied to car kilometres from petrol and diesel cars on urban and rural roads (Petrol cars (g of C per km): 43.07 (urban) and 40.42 (rural); Diesel cars (g of C per km): 41.38 (urban) and 37.60 (rural).
- Diesel vehicles are expected to comprise almost 18% of the UK car vehicle fleet in 2010, compared to 13% in 2000.
- The average emissions factors in urban and rural conditions were applied to the respective urban and rural savings found in the soft factors study. Urban conditions assume an average speed of 40 kph and rural 77kph.
- NAEI base projections are for an evolutionary 'do minimum' scenario where vehicle emissions and fuel quality legislation is the main driver. This takes into account projections for each vehicle type conforming to the different emissions standards based on the implementation dates of new emissions standards and data on the early penetration of sales, fleet turnover model and estimates of current and future sales of new vehicles. This assumes full implementation of the ACEA/ EC (1998) agreement to achieve average new vehicle emissions of 140g/CO_2/km by 2008. No account is taken of the penetration of alternative fuels and vehicle technologies in the fleet which would accelerate the rate of decrease in emissions.
- The emissions factors are end source emissions. Well to Wheel adds approximately 20% (Centre for Transportation Research 2001)
- The factors used refer to 'ultimate CO_2' from all the carbon in the fuel emitted at the tailpipe as CO_2, CO, unburned hydrocarbons and particulate matter, which ultimately have the potential in forming CO_2 (NAEI)

As mentioned above, the emission calculation was a basic one due to a lack of data in suitable detail pertaining to average speeds, mode switching, cold starts etc. In addition, the reported emissions savings are not *net* savings. No attempt has been made here to estimate the proportion of car miles that have been transferred to non carbon neutral modes or activities as a result of the soft factor interventions. Equally, there are positive interactions and omissions from the calculations that may have lead to an underestimation or overestimation of the potential for soft measures. The following Table provides a list of factors that should be taken into account when considering the results:

Despite these complexities and the need to undertake a more detailed assessment of the potential for soft factors to contribute to the overall targets for GHG emissions, it is clear that soft factor interventions may represent a set of polices which (i) are quicker to implement than technological solutions and (ii) will be complementary to technological so-

Table 9. Factors leading to under or overestimation of carbon savings from soft measures.

Reasons whey the emissions savings may be overestimated	Reasons why the emissions savings may be underestimated
1. Up to half of foregone car trips may be reallocated to bus travel in some circumstances (e.g. workplace travel plans) 2. Telecommunications facilitates home working but also a home location more distant from work, utilisation of energy in the home and the replacement of commuter trips by leisure or shopping trips 3. Teleshopping may increase they number of journeys undertaken by delivery vehicles 4. Car based initiatives such as car clubs or car sharing are intented to encourage a less car based lifestyle, but they may have the oppostite effect for some people, subtracting from public transport, walking or cycling 5. cold start and motorway speeds are not represented in the emission factors used 6. if soft instruments succeed in reducing car use conditions of congestion sufficiently to have a noticeable effect on that congestion, induced traffic effects must become important. If so, soft measures may have large effects on individual behaviour, but small or zero eventual net effects on traffic levels. Consequently, demand management measures aimed at avoiding induced traffic offsetting the results of soft measures are a key requirement to achieving their full potential.	1. a significant proportion of aviation miles may be saved on business trips substituted by telecommuting 2. many of the journeys saved may be less than 2 miles – the most polluting miles 3. the extent of carbon reduction from congestion mitigation is not estimated 4. In practice, savings would be apportioned across each of years 1-10 and the appropriate emissions factors for these years would be used. If anything, this leads to an underestimate as more favourable emissions factors and vehicle fleet mix for 2010 are applied to all the vehicle savings 5. Soft factor interventions offer potential synergies with 'harder' policies making them more politically acceptable and therefore more likely to be introduced. **As a result**, some soft factors may have the effect of shortening the behavioural response period of hard measures by making information available and alternatives worth considering

lutions and be a necessary addition given their focus on the amount of travel which is something that vehicle technology is unable to tackle. What is more, these results are consistent with other evidence from transport practice and research showing that around a 20% reduction in individual car journeys can be encouraged in a supportive policy environment. For example, a study if car dependence in the UK showed that around 20% of trips are not locked in to car use (Goodwin *et al.*, 1995). Studies of attitudes to travel and different modes of transport have consistently shown that around 30% of people are willing to reduce their car use if good quality alternatives existed (Anable 2005; Stradling 2002). A comprehensive study of what happens when road space is reallocated reported an average 18% of traffic went 'missing' from the road network (Cairns *et al.*, 2002b); and the London Congestion Charge has shown a reduction in traffic levels of at least 15%. Whilst not all examples of soft policies, they are all indicative of empirically measured changes in actual behaviour that have taken place without the use of technology. Other authors (Shipper 2001) have acknowledged that total travel per capita and modal share contribute more to overall differences in emissions per capita than differences in fuel economy and others have emphasised the necessity for behavioural changes alongside technological change in order to meet carbon reduction targets from this sector (Bristow *et al.*, 2004b, AEA Technology 2003).

Barriers and opportunities for implementation

All the literature reviewed, and the case study interviews, stressed the importance of the policy context of soft factor interventions, and also discussed various problems, constraints, barriers to successful implementation, and 'wish-lists' of improvements that would make implementation easier. At local level, officials concerned with developing soft measures often feel that their work is still not recognised as being of central importance in transport strategy, which is affecting resources, political support, career expectations and profile. There is also a perception that the relevant professional skills are not widely available or given sufficient importance.

There is a range of views and a consensus has not yet been reached. Chapter 14 in the report addresses some of the main barriers and opportunities for implementation in specific detail. The issues identified from the interviews and publish literature suggest the following main policy arguments:

- There could be greater use of specific practical applications in which hard measures (a) create a greater demand for the new opportunities given by soft measures, and (b) 'lock in' their benefits so they are not eroded by induced traffic. This would arise naturally from traffic reduction targets where a long term strategy for an area would be implemented by coherent use of available policy instruments. Local traffic reduction could be supported by national guidelines, information and advice on how soft measures might contribute to this goal: there is a widespread local view that national support can help to give credibility, demonstrating both that traffic reduction is an officially approved policy objective, and that soft measures can make a valuable and concrete contribution to this.
- Most soft measures are funded via local authority revenue budgets, and most specific initiatives are locally designed and launched. If soft measures are to be applied more intensively and extensively than at present, greater flexibility in funding them via capital programmes would be required, or alternative revenue sources would need to be found. This is particularly true to avoid short term contracts, and associated rapid turnover, of staff with the skills to implement soft factors.
- Most importantly, there is a need for other local policies which support soft measures. In particular, there is a need to reallocate road capacity, parking restraint, congestion charging and workplace parking levies were all felt to be important in order to 'lock in' the benefits of soft measures; to motivate organisations to become involved in travel planning; and to provide the space necessary for high quality public transport, walking and cycling provision.

Conclusions

Although 'soft factors' still remains, in part, a label of convenience rather than being coherently and rigorously defined, there is nevertheless a growing body of practical experience and understanding of the role for such measures in transport policy. Soft factor interventions provide a number of different ways of giving more reliable information, better informed traveller attitudes, and more benign or efficient ways of travelling.

It is true that the results of this study have challenged the expectations of transport specialists (including those of the research team themselves). The question is – are these results credible, and if not, what is the difficulty? A recent conference presenting a decade of seminal transport research by Phil Goodwin and his team (Changing Travel Behaviour, 2004) offered an answer to this: they noted that the amount of inherent variability in individuals' behaviour is already at the sort of levels reported (ca. 20%), even without policy intervention, but this was little known and appreciated because of the dominance of surveys and the models which emphasise *average* or normal behaviour rather than the variability in behaviour. Once the present amount of 'churn', and the need for associated supportive measures are factored into the expectations, such large numbers do not seem out of line in real life.

In the light of emissions targets for the reduction of greenhouse gases, major changes will be required over the coming years both in terms of the nature of transport infrastructure and the way it is used and perceived by individuals and organisations. There is much doubt over how much technology can be relied upon to ensure that these changes take place. In addition, other strategies such as national congestion charging, land use changes and even a more holistic approach such as personal carbon allowances require substantial innovation in terms of design and how they are 'sold' to the public and as a consequence are a long way into the future. Influencing mode choice, the amount of travel and the acceptability of more restrictive transport policies by changing opportunities, attitudes and perceptions (mobility management or travel demand management) is an often underestimated approach and one with the advantages of both greater political deliverability and the potential to be implemented over a much shorter timescale than fiscal levers or substantial technological change.

Another advantage is the potential for synergy in introducing measures that may both reduce other transport related externalities such as congestion and social exclusion and may speed up the implementation and effectiveness of other 'harder' transport policies. Soft measures would be more effective in a policy environment which incentivises behaviour change, alters the pricing structure and locks in the benefits of soft policy programmes. Likewise, the potential of 'harder' policies could be optimised through the promotion of information, awareness and acceptability provided by a variety of soft measures.

This study has shown that these soft measures, in a favourable wider policy context, could be sufficiently effective in reducing traffic that they merit serious consideration for an important role in transport strategy for the foreseeable future, prima facie offering very good value for money, and few disadvantages. It must be stressed that the substantial future traffic reduction identified here should be seen as the potential that soft factor interventions offer, not a forecast of probable impacts. Particular attention would be needed to ensure the benefits from soft factor interventions are 'locked in', via demand management measures to control induced traffic. Such measures, if well designed, could also have further beneficial effects on travel choices and traffic conditions in their own right. This study did not take any of these further effects into account. It is important to include the impact of soft measures in national modelling and forecasting exercises, though it cannot be concluded that this can be done simply by subtracting a certain percentage of traffic, whatever figure that may be. The effects of soft policies will depend on the scale of implementation chosen as an act of policy by central and local government, associated, and interacting, with other policies being assessed, including prices, service improvements, traffic control and management and infrastructure changes.

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