TAG UNIT 3.10.6

Modelling Smarter Choices

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DRAFT – FOR CONSULTATION

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1.1 Introduction

1.1.1 The report **Smarter Choices – Changing the Way We Travel** (Department for Transport, July 2004) describes ten measures which reduce the need to travel, reduce dependence on private cars and increase physical activity. They may be deployed individually or in combination.

1.1.2 These ten measures have similar objectives, but in order to incorporate these measures in transport models, different techniques are required for different measures.

1.1.3 This Unit provides advice on incorporating the impacts of Smarter Choice initiatives and packages in models which are generally compliant with the advice in **Variable Demand Modelling** (TAG Units 3.10.1 to 3.10.4).

1.1.4 There is currently no WebTAG guidance on the appraisal of certain Smarter Choice measures, in particular 'soft' measures which are intended to affect demand without affecting actual (as opposed to perceived) cost. However, this Unit does provide guidance on including the impacts of such measures as part of the modelling (and hence appraisal) of 'hard' measures.

1.1.5 The structure of the Unit is as follows:

- Smarter Choice initiatives are grouped and distinctions are drawn between 'hard' and 'soft' measures;
- the recommended general approach to modelling Smarter Choice initiatives is explained;
- the evidence of the effects of Smarter Choice initiatives is reviewed and guidance is provided on how impacts may be 'benchmarked';
- Smarter Choice packages often include 'hard' components and guidance is provided on the ways in which these may be modelled;
- guidance is provided on the general ways in which the 'soft' components of Smarter Choice packages may be modelled; and
- the modelling of workplace travel plans, school travel plans and targeted marketing initiatives is considered in more detail.

1.2 Classification of Smarter Choice Initiatives

1.2.1 The report **Smarter Choices – Changing the Way We Travel** (Department for Transport, July 2004) identified ten Smarter Choice measures: workplace travel plans, school travel plans, personalised travel planning, travel awareness campaigns, public transport information and marketing, car clubs, car sharing schemes, teleworking, teleconferencing, and home shopping. Of these, workplace travel plans and school travel plans are the most common in practice.

1.2.2 Personalised travel planning, travel awareness campaigns, and public transport information and marketing share common features of targeted marketing and there are no sharp dividing lines between them. These initiatives are therefore treated together in this guidance under the heading of 'targeted marketing initiatives'.

1.2.3 Currently, there is little evidence about the impacts of car clubs and car sharing schemes and their application is not currently widespread. These initiatives are considered in this guidance as potential components of workplace travel plans.

1.2.4 Teleworking and teleconferencing are now used quite widely, although there is little evidence about their impacts. These initiatives are therefore also treated in this guidance as potential components of workplace travel plans.

1.2.5 Currently, there is little evidence about the impacts of home shopping. However, these initiatives are not part of workplace or school travel plans and are not targeted marketing initiatives either and they have therefore been left on one side in this guidance.

1.2.6 This guidance therefore focuses on three packages of Smarter Choice initiatives: workplace travel plans, school travel plans, and targeted marketing. The first two packages potentially involve both 'hard' and 'soft' measures, while targeted marketing initiatives are, by definition, all 'soft'.

1.2.7 For the purposes of this guidance, 'hard' measures bear directly on the time and money components of generalised cost while 'soft' measures change travellers' response to differences or changes in generalised cost.

1.2.8 It is important to distinguish between 'hard' and 'soft' measures within packages of Smarter Choices, as:

- 'hard' and 'soft' measures are modelled in different ways; and
- the effects of Smarter Choice components should not be double counted by modelling a single measure as both a 'hard' and 'soft' choice.

1.3 General Approach to Modelling Smarter Choice Initiatives

1.3.1 The evidence available from monitoring studies about the effects of Smarter Choice initiatives is currently limited. While there is some evidence about the effects of packages of measures in aggregate, evidence about the effects of individual 'soft' measures, in a form that informs the specification of how these measures may be modelled, is scarce. On the other hand, the 'hard' measures often included in Smarter Choice packages can often be represented in models of the kind specified in **Variable Demand Modelling** (TAG Units 3.10.1 to 3.10.4) in generally conventional ways.

1.3.2 Bearing in mind the current state of knowledge, the following general approach to modelling Smarter Choice initiatives is suggested:

- **benchmark the expected impacts** of the Smarter Choice package, based on the available evidence, taking account of the proposed intensity of application compared with the intensity of application to which the evidence relates. This is discussed further in Section 1.4;
- **model the 'hard' components** of the Smarter Choice packages explicitly (where possible); check that the impacts are less than the benchmark and adjust the model if necessary. This is discussed further in Section 1.5;
- **model the 'soft' components** of the Smarter Choice package by means of assumed adjustments to the model parameters; check that the impacts are plausible in comparison with the benchmark and the impacts of the 'hard' measures and that the combined impacts of the hard and soft measures are consistent with the benchmark. This is discussed further in Section 1.6; and

- **assess traffic impacts** on the road network, especially in terms of congestion, and also assess impacts on public transport patronage and revenues.

1.3.3 Whatever changes are made to the model, for the final forecasts, it should be run to convergence in the normal manner so that the induced traffic effects are properly accounted for. However, if the benchmark excludes induced traffic effects, it may be appropriate to adjust the model parameters so that the first iteration results match the benchmark, before running the model to convergence.

1.3.4 Given the uncertain nature of the assumptions necessary for the third step, consideration should be given to conducting sensitivity tests using different assumptions.

1.4 Benchmarking Expected Impacts of Smarter Choice Initiatives

1.4.1 The first of the steps listed above requires information about measured or observed impacts of Smarter Choice measures so that an appropriate benchmark or target car trip reduction can be established for the Smarter Choice package to be modelled.

1.4.2 In order to establish a benchmark, two steps are required:

- first, the limited evidence about the impacts of Smarter Choice measures needs to be understood;
- second, the scale of the impacts indicated by the limited evidence needs to be related to the intensity of the proposed application so that a benchmark of an appropriate scale can be derived. The evidence is considered first, followed by advice on derivation of appropriate benchmarks.

Evidence

1.4.3 Evidence about the effects of Smarter Choice initiatives is limited. Results from a few studies are published on line:

- Smarter Choices: Changing the Way We Travel (Cairns et all 2004)
- the report on “The Effects of Smarter Choice Programmes in the Sustainable Travel Towns”: Full Report (Sloman et al 2010);
- the Smarter Travel Richmond and Smarter Travel Sutton Programmes: http://www.smartertravelrichmond.org, http://www.smartertravelsutton.org

1.4.4 However, the ITM initiatives being monitored in these studies are packages of ‘soft’ and ‘hard’ measures and the monitoring results are presented in terms of aggregate changes in the numbers of trips by mode. Unless the package of Smarter Choice measures to be modelled matches the ITM package implemented and monitored in one of these towns, it will be difficult to make use of the results from these studies in determining a benchmark or target traffic reduction.

1.4.5 Möser and Bamberg (2008) carried out a meta-analysis which may be more useful in setting benchmark trip or traffic reductions. They analysed all the Smarter Choice applications that were reviewed by Cairns et al (2004), along with some more recent cases up to 2005. They provided a critical review of the effects of Smarter Choice measures, using reports of 141 studies in 12 developed countries (of which 93 studies relate to the UK). Their analysis was based on the effects of the measures as reported; no attempts were made to access and re-analyse the primary data collected about the effects of each measure or package of measures.

1.4.6 In summary, Möser and Bamberg concluded that:

- all the studies they reviewed used a weak quasi-experimental 'before and after' survey design which, in their view, severely threatens the internal validity of the reported effects of Smarter Choice interventions;
- most studies did not use statistical tests for rejecting the null hypothesis of no effect;
- the validity of generalising the results to the total population seems to be threatened by the frequent use of samples that are not representative of the total population;
- from a methodological viewpoint, the empirical evidence they reviewed provides no solid basis for the claim that a broad implementation of Smarter Choice measures is an effective strategy for reducing car use; and
- the results may underestimate, but more probably overestimate, the true causal car use reduction effects.

1.4.7 However, they felt that, given the interest in implementing Smarter Choice measures, the main question was not whether to perform research synthesis but whether to perform it in a more or less defensible way.

1.4.8 Möser and Bamberg then presented a meta-analysis using techniques more defensible than those used by existing work, and reported the effects of Smarter Choice measures that they could identify among the 141 studies as shown in Table 1.

Table 1 Effects of Smarter Choice Measures: Summary of the Möser and Bamberg Meta-Analysis Results

Smarter Choice Intervention	Before Application of Smarter Choice Measures	After Application of Smarter Choice Measures	Remarks
Workplace travel plan: % of non-car mode share for employees arriving on a specific day	35%	47%	This includes the effect of public transport improvements, parking restrictions/charging as well as perception/attitude changes
School travel plan: % of non-car mode share for pupils arriving on a specific day	60%	64%	This masks two sub-groups – one of 'best practice schools' achieving good effects, and the other of yellow buses only and poor results
Targeted marketing techniques: % of non-car mode share of all trips made during a day	34%	39%	Möser and Bamberg (2008) suggest that there may be a possibility of reporting bias among the these cases, as the majority of them appear to have similar magnitudes of effects

1.4.9 Although the Möser and Bamberg analysis shows that Smarter Choice measures may be successful in reducing travel by car, there are some important caveats that need to be borne in mind. These include all the issues noted earlier, along with the following.

- The indicator of modal shift used in this work is the modal share expressed in terms of trips made by people directly targeted by the Smarter Choice measures, and there is no indication of changes in either trip-km or the vehicle-km of road traffic.

- The average non-car mode shares before application of Smarter Choices measures in the meta-analysis may differ from the existing non-car mode shares in the model study area. This would need to be borne in mind when extrapolating the results to the wider population. It should be noted that the base non-car mode share for targeted marketing measures is similar to the average GB level for all trips.

- It is well known that meta-analysis is likely to overstate the effects because studies with no significant or negative effects are much less likely to be published or to become accessible for retrieval. The effects revealed by Möser and Bamberg are therefore likely to be close to the upper limit in the possible range of impacts.

1.4.10 However, even bearing in mind the above caveats, the results still give some idea about the average levels of impact.

- For **workplace travel plans**, the effects are the combined effects of both 'soft' and associated 'hard' measures (e.g. public transport improvements and parking measures). The analysis suggests that workplace travel plans would increase the overall non-car mode share by 12%. Given the base mode share, this implies an increase in the number of non-car trips by 34%, or a reduction in the number of car trips by 18% on the assumption that the total number of trips stays unchanged.

- For **school travel plans**, the sample reviewed by Möser and Bamberg could be divided into a small group of six best-practice schools where a lot had been achieved, and the rest, where the impacts were marginal, perhaps due to the lack of intensity of application or coordination with the 'hard' measures involved (in those cases the 'hard' measures were 'Yellow' buses). This means that the average increase in the number of non-car trips of 7% (as suggested in Table 1), or the implied reduction in the number of car trips of 10%, would have under-estimated the best-practice examples, but over-estimated the others in the school travel sample.

- For **targeted marketing**, the analysis suggests that predominantly information and promotional campaigns would increase the overall non-car mode share by 5%. Given the base mode share, this implies an increase in the number of non-car trips by 14%, or a reduction in the number of car trips by 8%.

1.4.11 The Möser and Bamberg paper does not provide any information about effects on traffic or induced traffic. Indeed, it has been a common feature of the Smarter Choice studies to examine the impacts on a limited group of the targeted travellers, rather than the road network as a whole.

Benchmarking

1.4.12 The Möser and Bamberg evidence is not sufficient to enable a benchmark trip reduction to be calculated or estimated in a systematic manner. The benchmark trip reduction should be developed by means of reasoned argument from the Möser and Bamberg results.

1.4.13 The Möser and Bamberg results may be summarised as follows.

Table 2 Summary of Smarter Choice Impacts		
Smarter Choice Measure	**Reduction in Car Trips**	**Increase in Non-Car Trips**
Workplace Travel Plan	18%	34%
School Travel Plan	10%	7%
Targeted Marketing	8%	14%

1.4.14 As noted above, given the nature of meta-analysis, these impacts are likely to be close to the upper limit in the possible range of impacts, especially as they take no account of induced traffic effects. These levels of impact should therefore be taken as **upper limits**. Benchmarks should be derived as proportions of these upper limits by considering the intensity of application. For example, if it is proposed that workplace travel plans are to apply to 50% of the workforce in the study area, the benchmark would be a 9% reduction in car trips and a 17% increase in non-car trips. Similarly, if it is proposed that school travel plans are to apply to 75% of school students in the study area, the benchmark would be a 7.5% reduction in car trips and a 5% increase in non-car trips. In the case of targeted marketing initiatives, calculations of this nature are much more difficult and it is recommended that benchmarks be set using judgement based, as far as possible, on reasoned arguments. These reasoned arguments and the evidence supporting them should be fully documented.

1.4.15 In some cases it may be appropriate to use lower levels of impact for the benchmark for reasons other than intensity of application (for example, where only limited measures are introduced). These reasons need to be documented, along with reasoned arguments and evidence supporting the assumptions actually used.

1.4.16 Benchmarks derived in the above manner will exclude the effects of induced traffic and therefore the out-turn effects shown in fully converged runs should be lower. This implies that the adjustment of the model to achieve the benchmark should be based on an initial run of the demand model and not a fully converged model run.

1.5 Modelling the 'Hard' Components of Smarter Choice Packages

1.5.1 Having benchmarked the effects of the Smarter Choice package to be modelled, the next step is to model the 'hard' components of the package.

1.5.2 A transport model developed in accordance with the advice on **Variable Demand Modelling** (TAG Unit 3.10) and in **Road Traffic and Public Transport Assignment Modelling** (TAG Unit 3.11.2) will be capable of modelling the effects of many of the 'hard' components of Smarter Choice packages. If the transport model to be used cannot represent all the 'hard' measure components of the package, consideration should be given to enhancing the model so that it models as many of the 'hard' components as possible and in as realistic a manner as possible.

1.5.3 The following two particular aspects of conventional models may need general enhancement for Smarter Choice modelling:

- treatment of walk and cycle; and
- modelling parking policies.

For advice on the treatment of walk and cycle, reference should be made to **Variable Demand Modelling - Key Processes** (TAG Unit 3.10.3). Advice on the treatment of parking policies, including park-and-ride, can be found in **Modelling Parking and Park-and-Ride (TAG Unit 3.10.7)**.

1.5.4 It may not be possible to model directly some 'hard' components because the necessary data and techniques will not always be available. Where they cannot be properly modelled, one of two approaches will need to be followed:

- use of network model parameters such as public transport walk, wait and fare adjustments as proxies; and
- inclusion of the impact of these 'hard' measures within the 'behavioural change' adjustments discussed in the next section.

1.5.5 Further advice about how the 'hard' components of Smarter Choice packages should be modelled is provided in Sections 1.7 and 1.8 below. All assumptions made in modelling 'hard' components of Smarter Choice packages should be fully documented.

1.5.6 When the model has been set up to estimate the effects of as many as possible of the 'hard' components of the Smarter Choice package, an initial model run should be carried out to assess the impacts of the hard measures on modal shift. The model should be fully converged so that the induced traffic effects are properly modelled.

1.5.7 Logically, the impacts of the 'hard' measures modelled explicitly should be less than the benchmarks established at the outset from the empirical evidence. If this is not the case, further consideration should be given to both the appropriateness of the benchmarks and the realism with which the 'hard' measures have been modelled. The temptation only to revise the benchmarks upwards should be resisted and upward revisions to the benchmarks should be accompanied by clearly reasoned arguments. It is more likely that some aspect of the ways in which the measures are represented in the model requires adjustment so that the impacts of the 'hard' measures are forecast to be more realistic. The temptation to adjust model parameters in a way that may affect the realism test results adversely and materially should be resisted.

1.6 Modelling 'Soft' Components of Smarter Choice Packages

1.6.1 In principle, the impacts of the 'soft' components of Smarter Choice packages may be approximated by modifications to one or more of the following features of established models:

- commuting trip rates; and/or
- values of time for the various travel stages (walk, wait, in-vehicle, and interchange); and/or
- mode constants; and/or
- mode choice sensitivity parameters.

1.6.2 It may be necessary to use more than one of these approaches to model the effects of the various measures which may constitute the Smarter Choice package being considered. For instance, one measure may be better modelled using one of the modifications while others may be better dealt with by other modifications. If more than one modification is used, great care should be taken to ensure that the responses to any one measure are not modelled more than once.

1.6.3 Each of the approaches is discussed in turn below. In none of the approaches is there much evidence for the possible modifications that may be made and some are more problematic than others. The approaches therefore would all require some exploration by means of tests of alternative values to assess the scale of the modifications which would

yield plausible effects in relation to the effects of the 'hard' components and the benchmark car trip reductions. These exploratory tests should be fully documented.

Modifications to Commuting Trip Rates

1.6.4 Certain 'soft' measures, such as teleworking or a compressed working week, should logically reduce the average weekday commuting trip rates used in transport models.

1.6.5 In theory, the impacts of teleworking or a compressed working week could be more complex than a common global reduction in demand. In particular, it is possible that workers with longer commutes may be more likely to work from home on some days or work a compressed week, as they have a greater incentive to do so. However, reflecting such nuances is unlikely to be practical and simpler approaches should generally be adopted.

1.6.6 Such measures may be modelled approximately by modifications to either trip rates or the trip frequency parameter value.

1.6.7 Estimates of the percentage reductions to apply to trip rates may be made by making assumptions about the numbers of workers who might work some of the time from home and the average number of days they would do so. While the impacts may vary by type of employment, given the approximate nature of Smarter Choice modelling, it is likely to be sufficient to derive and apply average reductions for the employment groups already represented in the model rather than increasing the segmentation specifically for the purpose of modelling Smarter Choice measures.

1.6.8 Trip rate modifications may be applied on an area-wide basis or to individual zones. An alternative approach for area-wide application is to modify the trip frequency parameter value, taking care not to increase it to the extent that the choice hierarchy would be changed. The appropriate scale of the parameter value change would need to be determined by experimentation, with the preferred value being selected by comparing modelled out-turns with expected reductions.

1.6.9 Whichever approach is adopted, the results should be consistent with evidence from local sources, such as household interview or travel diary surveys or staff travel to work surveys often conducted in the early stages of developing a workplace travel plan. The evidence and the consequent assumptions should be fully documented.

Modifications to Values of Time

1.6.10 A number of Smarter Choice measures impact on specific parts of a journey. For example:

- a programme of improved vehicles and customer care by drivers could lead to a reduction in perceived in-vehicle time for bus users;
- although facilities for cyclists frequently do not lead to faster journey times, perceptions of safety and comfort could improve markedly and this could be represented as a reduced weight on travel time (thus making the benefit of the measures increase with distance travelled); and
- easy access to real time public transport information at workplaces could reduce waiting time, in both absolute terms and in terms of the sub-conscious weight attached to this stage of the journey. In this case, it could be argued that there are 'hard' and 'soft' aspects to the measure, with the absolute reduction in waiting time being the 'hard' element (and represented by a change in the wait time component of the generalised cost) and the change in the value of weighting attached to wait time being the 'soft'

element. It is important that the effects of this kind of measure are not over-stated if the 'hard' and 'soft' elements are treated separately.

1.6.11 Adjustments to values of time could be introduced as modified weights applied to the individual components of travel time within the supply model.

1.6.12 Forthcoming guidance on **Journey Quality Impacts** and **Guidance on the appraisal of walking and cycling schemes** (TAG Unit 3.14.1) may provide some numerical values for these adjustments, but reasoned arguments should be made for using or adapting these values.

1.6.13 Any modifications to the modelled values of time (or elements of generalised cost in certain cases) should be fully documented along with supporting evidence and/or reasoned argument.

Modifications to Mode Constants

1.6.14 A primary goal of a Smarter Choices package is to change the perception of car travel relative to other modes. A straightforward way to represent this in models is to change the mode constants. Such changes should be targeted at the mode affected by the marketing, for example:

- measures aimed specifically at reducing car travel should be incorporated by increasing the mode constant for car mode only, thereby making car less attractive; and
- measures aimed specifically at increasing travel by another mode (for example, cycling) should be incorporated by reducing the mode constant for the targeted mode only (eg making cycling more attractive).

1.6.15 All such changes must be reported. The change in mode constant should be expressed in generalised cost minutes (by dividing the change in mode constant by the sensitivity parameter).

1.6.16 Changing the mode constants for a forecast run will automatically bring about changes in choices in respect of all demand responses in the model, not just choice of mode. Changes in distribution and hence average trip lengths (across all modes) are also likely to result from reduced congestion and may be more apparent than modal transfers if mode choice is less sensitive than destination choice (as in the case of the default choice hierarchy recommended in **Variable Demand Modelling – Key Processes** (TAG Unit 3.10.3). It should not be necessary to change the parameters in the trip distribution model to represent the relative attractiveness of each zone.

1.6.17 From the above, it can be seen that an approach involving a mode constant change achieves consistency in the modelling process. There is a causal link between trips removed from car and trips that appear on other modes (to the same or alternative destinations). Trips which are forecast to transfer from car to bus will be most likely to do so where bus services are a reasonable alternative.

1.6.18 Most fully-specified transport demand/supply models treat public transport as a single mode, with sub-mode split being carried out by the assignment process. This means the same mode constant adjustment in the demand model would affect all public transport modes equally. Some assignment models permit mode-specific constants to be applied, and these may then be reflected in the costs input to the demand model. With other assignment models, it may be necessary to proxy a mode constant using a boarding penalty or an in-vehicle time adjustment.

1.6.19 In principle, it is possible to modify mode constants in order to achieve a benchmark or target change in trips by mode. This is straightforward with a single target (such as a

specified reduction in car use) but may become problematic with multiple targets (such as a 10% reduction in car use combined with a 25% increase in public transport use). Where changes in non-car mode trips or travel form part of the benchmark, some experimentation with mode constant values may be required.

1.6.20 An alternative to using the target mode changes (especially where targets are not available for the specific schemes under consideration) would be to estimate the required change in the mode constant by methods which are independent of the model. An example methodology using an 'experts panel' approach would involve the following stages:

- identify the scale of the mode constants (against car alternative by comparison with car) implied by the costs and mode shares within the base year model;
- identify the likely components of the mode constant;
- assess the relative importance of each component of the mode constant;
- assess the ability to address each component through Smarter Choice measures (perhaps with a range of assumptions about available funding); and
- derive changes to mode constants which can then be applied in the model.

1.6.21 The advantage of this approach is that the modeller explicitly addresses the links between the Smarter Choice measures and the way they might impact upon perceptions of alternative modes.

Modifications to Sensitivity Parameters

1.6.22 The available evidence suggests that 'soft' Smarter Choice measures might make the choice of mode of travel more sensitive than is currently the case. It may be possible to represent this in modelling by making mode choice more sensitive; however, potentially implausible results could arise if the car mode were also to experience declining costs, for example, through a fuel cost reduction, as then the transfer to car use would be larger than would have been the case with unchanged choice parameters. Moreover, the application of the higher sensitivity **only** in cases where costs for the non-car modes are improving more rapidly than for the car mode does not seem to be either practical or theoretically consistent. On balance, therefore, the approach of adjusting demand model choice parameters to represent Smarter Choice measures is **not** recommended.

1.7 Modelling Workplace Travel Plans

1.7.1 A workplace travel plan is a package of measures implemented at a workplace designed to:

- encourage commuting by the more environmentally benign modes;
- reduce commuting by car, particularly by driving without passengers (single occupant car commuting) through encouraging teleworking, improving access to services such as childcare, banking at work, etc.;
- reduce car use for business trips through encouraging teleconferencing,; and
- reduce the visitor travel by car, especially single occupant cars.

1.7.2 A workplace travel plan will often consist of a number of 'hard' and 'soft' measures. At the present time, there is insufficient evidence about the effects of the individual 'soft' measures for them to be modelled explicitly. Some of the 'hard' measures, however, can

be represented in more or less standard models in a straightforward and conventional manner, while other 'hard' measures can be modelled using more advanced techniques.

1.7.3 The potential components of workplace travel plans may be classified as follows.

- 'Hard' measures that can be modelled using WebTAG compliant models:
    - new conventional bus or rail services which serve the workplace;
    - 'works buses' between the workplace and the town centre which can be used by any traveller, that is, their use is not restricted to employees at the workplace only;
    - dedicated 'works buses' between the workplace and the town centre which can only be used by employees at the workplace;
    - subsidised public transport fares and interest-free season ticket loans;
    - special deals which reduce the cost of commuting by bus and/or rail;
    - parking 'cash out', that is, payments made to employees on days when they do not commute by car.
- 'Hard' measures that can be modelled using models which include the functionality to model parking policies:
    - car parking restricted to essential users; and
    - increased parking charges.
- 'Hard' measures that can be modelled using more advanced techniques:
    - car sharing schemes;
    - preferential parking for car sharers; and
    - demand activated bus services.
- 'Soft' measures, most of which cannot be modelled explicitly:
    - car clubs;
    - providing information about public transport services to all staff;
    - offering personalised journey plans to all staff;
    - providing secure cycle parking
    - providing changing and showering facilities at the workplace;
    - providing a business cycle mileage allowance;
    - providing services on site in order to reduce the need to travel off-site, such as cafeteria, convenience shopping, cash dispenser
    - encouraging teleworking; and
    - permitting flexible working hours or compressed working weeks.

Each of these is now discussed in turn.

1.7.4 In the case of all the 'hard' measures, changes may be made either to the networks from which generalised costs would be skimmed or to the generalised costs directly. In either case, the resulting changes in costs should be fed into the demand model so that the demand changes can be forecast. In the case of network changes, re-assignment effects may also be of interest.

1.7.5 The advice which is offered here is not intended to be prescriptive in all details and the modeller will need to consider the implementation of the advice in the context of their own models. Also, it should not be inferred that the methods here are the only feasible methods which could be used; other methods may be feasible in certain circumstances.

New conventional bus and rail services and non-dedicated 'works buses'

1.7.6 These measures can be modelled by amendments to the coding of the public transport network in the standard manner.

Dedicated 'works buses'

1.7.7 For this measure, the workplaces served by the dedicated services would need to be represented as separate zones with no other development included, and only those zones should be connected to the services at the workplace ends. The number of workplaces which could be treated in this way would depend on the number of zones in the model and the increased run times which would result from the additional zones. For large models with many zones, whose run times are long, it may be necessary to restrict application of this approach to large workplaces only.

1.7.8 An alternative approach to adding additional zones would be to introduce additional user classes which would be the only ones permitted to use the dedicated services.

Subsidised public transport fares, interest-free season ticket loans, and special deals which reduce the cost of commuting by bus and/or rail

1.7.9 Fares modelling in transport models is generally not well specified – see **Road Traffic and Public Transport Assignment Modelling** (TAG Unit 3.11.2). Models often do not distinguish between tickets purchased by different means and different prices (for example, cash, pre-paid, stored value card purchases) or passengers who are members of a travel concession scheme. It may therefore not be straightforward to distinguish employer-based subsidised fares in an appropriate manner.

1.7.10 In principle, however, these measures can all be modelled by reducing the fare component of the public transport generalised costs. As they would apply to travel to and from specified workplaces only, the workplaces concerned would need to be treated as separate zones in which no other development is included, and only those zones should be connected to the services at the workplace end to which the reduced fares apply. For large models with many zones, whose run times are long, it may be necessary to restrict application of this approach to large workplaces only.

1.7.11 Alternatively, additional user classes would need to be introduced to represent workers at the specific workplaces served by the public transport services.

1.7.12 In cases where fares do not influence route choice and are not therefore included in the generalised times used in the assignment, fares matrices input to the demand model may be manipulated to account for these Smarter Choice measures.

Parking cash-out

1.7.13 This measure can be modelled either as a money decrease in the public transport generalised cost or a money increase in the car generalised cost for commuting travel to the workplace zones where the measure would apply. The workplaces concerned would need to be treated as separate zones in which no other development is included. For large models with many zones, whose run times are long, it may be necessary to restrict application of this approach to large workplaces only.

1.7.14 Alternatively, additional user classes would need to be introduced to represent workers at the specific workplaces where this measure was applied.

Car parking restricted to essential users and increased parking charges

1.7.15 In order to model car parking restrictions, the essential users would need to be treated separately in the model. Faced with either a reduction in spaces or an increase in parking charges, not only would non-essential users be faced with the usual choices of change of mode but they would also have the option, in principle, of changing their parking location to publicly available spaces near to the workplace (both on-street and off-street) or using park-and-ride (if available). In order to model these policies realistically, a more sophisticated approach to modelling parking is required than is normally possible with a model which has been developed in accordance with **Variable Demand Modelling** (TAG Unit 3.10). Advice on such approaches can be found in **Modelling Parking and Park-and-Ride (TAG Unit 3.10.7).**.

Car sharing schemes and preferential parking for car sharers

1.7.16 Car sharing schemes require a distinction to be made between single occupant cars and shared cars. For some large workplaces, such as Stansted Airport, models have been created which allocate trips between three modes: single occupant car, shared car, and public transport (see Sinclair Knight Merz (2008)). The creation of models of this kind require a survey of employees' travel to and from work to obtain information on home location, mode of travel (including car passenger), time of travel and car availability. Once such models have been estimated and validated, they can be used to forecast the effects of car sharing schemes. The usual preferences given car sharers are that: (a) they are allocated parking spaces whereas spaces may not be available for single occupant cars; or (b) they are allocated spaces nearer to the workplace itself than the spaces for single occupant cars; or (c) they pay reduced charges compared to the charges levied on single occupant cars. Once a mode share model of the kind described above has been established, forecasts of the effects of policies of this kind are straightforward.

Demand activated bus services

1.7.17 In order to model a bus service, it is necessary to know its route, the time taken to walk to a service stop from the person's trip origin, the time spent waiting for the service, the in-vehicle journey time, the fare paid, and the time spent walking from a service stop to the person's trip destination. In the case of a demand activated bus service, the walk times from the origin and to the destination may be small or zero if the service is door-to-door, and the waiting time may also be small or zero (although some allowance would need to be made for the impact of low frequencies on peoples choice of travel time, even if the waiting is spent in the home or at the attractor). In addition, the weight normally applied to waiting time may also be lower. It may also be appropriate to use car travel times as a proxy for the bus in-vehicle time, factored appropriately to reflect stop time and indirect routeing. One other factor is necessary and that is the mode constant which would reflect the inherent attractiveness of the service compared with conventional bus. This mode constant

may be coded as a service boarding penalty. Values for the mode constant, and the weight to be applied to the waiting time, may be derived from stated preference surveys.

'Soft' measures

1.7.18 Insufficient is known about the 'soft' measures which might form components of workplace travel place for their explicit representation in a transport model. Their effects should therefore be modelled using one or more of the general approaches outlined in Section 1.6.

1.8 Modelling School Travel Plans

1.8.1 A school travel plan is a package of measures implemented at a school designed to:

- reduce traffic congestion caused by school runs;
- improve safety;
- improve health and welfare of pupils; and
- support pupils who are already travelling by sustainable modes.

In other words, school travel plans are established to make it more attractive for pupils to get to school by walking, cycling, public transport or car sharing.

1.8.2 A school travel plan will often consist of a number of 'hard' and 'soft' measures. At the present time, there is insufficient evidence about the effects of the individual 'soft' measures for them to be modelled explicitly. Some of the 'hard' measures, however, can be represented in more or less standard models in a straightforward and conventional manner, while other 'hard' measures can be modelled using more advanced techniques.

1.8.3 The potential components of school travel plans may be classified as follows.

- 'Hard' measures that can be modelled using WebTAG compliant models:
    - public transport fare reduction;
    - special school buses; and
    - physical changes to the streets around the school, such as 20 mile/h speed limits, traffic calming, pedestrian crossings and cycle lanes.
- 'Soft' measures, most of which cannot be modelled explicitly:
    - car sharing schemes for families living in the same neighbourhood;
    - special walking or cycling promotion days;
    - programme of pedestrian and cycle training for children;
    - cycle parking;
    - promotion of sustainable travel within the curriculum;
    - involvement of children in the development of the school travel plan; and
    - setting out the school's travel policy in the school prospectus and home/school agreement.

Each of these is now discussed in turn.

1.8.4 In the case of all the 'hard' measures, changes may be made either to the networks from which generalised costs would be skimmed or to the generalised costs directly. In either case, the resulting changes in costs should be fed into the demand model so that the demand changes can be forecast. In the case of network changes, re-assignment effects may also be of interest.

Public transport fare reduction

1.8.5 Reduced public transport fares can be modelled by amending the public transport generalised costs for education travel, using the guidance given in **Road Traffic and Public Assignment Modelling** (TAG Unit 3.11.2) regarding the modelling of public transport fares. As it is likely that such a policy would apply to all schools and not selectively, there would be no need to amend the zoning system (as would be necessary for a similar policy applied as part of workplace travel plans).

Special school buses

1.8.6 For this measure, the schools served by the special services would need to be represented as separate zones with no other development included, and only those zones should be connected to the services at the school ends. The number of schools which could be treated in this way would depend on the number of zones in the model and the increased run times which would result from the additional zones. For large models with many zones, whose run times are long, it may be necessary to restrict application of this approach to large schools only.

1.8.7 Alternatively, additional user classes would need to be introduced to represent students at the schools served by the special services.

Physical changes to the streets around the school

1.8.8 20 mile/h speed limits, traffic calming and pedestrian crossings would reduce the speeds at which traffic travels. Transport models represent mean traffic speeds and therefore the effects of these measures on mean speeds would need to be established, most likely by means of judgement. Cycle lanes would only affect road traffic if they were created by reallocating road capacity from general traffic to the sole use by cyclists. In these instances, it is generally straightforward to amend the coding of the road network to reflect the reduced capacity available to general traffic.

'Soft' measures

1.8.9 Insufficient is known about the 'soft' measures which might form components of school travel place for their explicit representation in a transport model. Their effects should therefore be modelled using one or more of the general approaches outlined in Section 1.6.

1.9 Modelling Targeted Marketing Initiatives

1.9.1 Targeted marketing initiatives include: personalised travel planning; travel awareness campaigns; and public transport marketing and information. They provide travel advice and information largely based on a good understanding of the particular travel patterns and needs. They also provide encouragement for those who are already adopting, to various degrees, sustainable means of travel.

1.9.2 Examples of targeted marketing initiatives include the following:

- easy-to-use public transport timetables;

- delivery of targeted (local or site-specific) personal travel plan information directly to households to help them make sustainable travel choices;
- limited number of free trial public transport tickets for people who do not already use public transport;
- offer of a visit from someone who can provide personal travel advice;
- maps of walking and cycling routes; and
- loans for the purchase of bicycles.

1.9.3 Insufficient is known about the effects of these for their explicit representation in a transport model. Their effects should therefore be modelled using one or more of the general approaches outlined in Section 1.6.

1.10 Reporting Requirements

1.10.1 It will be evident from this Unit that modelling Smarter Choice measures will often require **assumptions** to be made of one kind or another. All such assumptions made should be fully documented and supported by reasoned arguments and/or evidence, preferably local to the area concerned.

1.10.2 In addition to the normal requirements for documenting model development and forecasting, the modelling of Smarter Choice measures should be fully documented and should include:

- the measures being modelled;
- the benchmark impacts, along with the evidence for such benchmarks;
- the adopted methods of modelling the measures;
- the assumptions made in modelling the measures;
- the reasoned arguments and/or evidence to support the assumptions, including the results of any exploratory tests undertaken in order to determine appropriate model adjustments;
- the forecasts with the 'hard' components but without the 'soft' components;
- the forecasts with both 'hard' and 'soft' components; and
- commentary on the plausibility of the forecast impacts of both 'hard' and 'soft' measures.

2 Further Information

The following documents provide information that follows on directly from the key topics covered in this TAG Unit.

For information on:	**See:**	**Link:**
Variable demand modelling	Variable Demand Modelling	3.10
Public transport modelling	Road Traffic and Public Transport Assignment Modelling	3.11.2

3 References

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4 Document Provenance

This is a new TAG Unit.