

Department for Transport

**Provision of market research for
value of travel time savings and
reliability**

Non-Technical Summary Report

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In Partnership with:



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Executive Summary

The value of travel time (VTT) is an important concept in policy making and investment decisions for the transport sector, since savings in travel time typically account for a large proportion of the benefits of major transport infrastructure. Values of travel time reflect the amount of money a traveller is willing to pay to save time. They are measured in pounds per hour. The Department's current values for non-work travel date back to research from 2003, and the data supporting them date from over two decades ago, while the values used for business travel have come under increasing scrutiny for their underlying assumptions. Over the last five years the Department has undertaken a programme of work including scoping studies and research to better understand the uncertainties around the current values. The Department concluded that it would be appropriate to undertake fresh primary research, to ensure that the values continue to reflect changes in society and people's travel behaviour. Therefore in June 2014 the Department commissioned a comprehensive study.

The overall objective of this study was to recommend, up-to-date national average values for in-vehicle (car and public transport) travel time (in-vehicle refers to the time spent travelling on the specific mode of transport). The study outputs are gathered in the 'Phase 2 Final Report' issued to the Department in May 2015. The following 'Non-Technical Summary Report' has been prepared for a wider audience.

The study was conducted in two phases from June 2014 to June 2015. It involved a pilot phase to test assumptions and methodology, and a phase of qualitative and quantitative research carried out through online and telephone interviews, followed by the modelling of the research outputs and report write-up. The datasets were analysed in a systematic fashion using 'choice modelling' methods, as is standard for national VTT studies worldwide.

Broadly speaking, the VTT is considered from the point of view of those travelling for business, and those travelling for other reasons, known as non-work (which includes commuting). This study also takes account of different ways of travelling, be it by car, train, or bus. Additional factors are incorporated into the model to more completely represent the value of travel time, aspects such as the income of a survey respondent, their type of job, crowding on trains and motorway traffic.

The key findings for non-work and business VTT are presented in the table below. Also included, for the purpose of comparison, are the existing WebTAG values converted to a comparable base (2014 perceived prices). We can read from the table that the figure of £11.21/hr for all modes/distances commute means that, on average, we estimate that travellers would be willing to pay £11.21 in order to save one hour of travel time. This compares with the current WebTAG value of £7.62/hr for the same trip category.

Executive Summary Table: Values of Travel Time Savings

Values of Travel Time Savings	Distance	Commute	Other non-work	Business				
		All modes	All modes	All modes	Car	Bus	'Other PT'	Rail
WebTAG (2014 prices and values)	All	7.62	6.77	25.47	24.43	15.64	24.72	30.07
All modes	All	11.21	5.12	18.23	16.74	-	8.33	27.61
	<20 miles			8.31	8.21	-		10.11
	20 to 100 miles			16.05	15.85	-		28.99
	>=100 miles			28.62	25.74	-		

Notes: All values distance-weighted, non-work VTTs based on all distances and income option 1, business VTT distance-banded based on income option 1 and employers paying, VTT imputed for PT trips with zero cost, VTT taken from SP1 at Δt=10, Tool version 1.1.

The recommendations that result from this extensive study are presented in **Section 6** of this report. These are exactly the same as those to be found in the **Phase 2 Final Report** (the primary deliverable of the study), and are presented with contextual information so as to give insight into their underlying reasoning.

Abbreviations and definition of terms

Term	Abbreviation (N/A where not applicable)	Definition
Blue collar employees	N/A	Manual workers, skilled tradespersons and professional drivers.
Briefcase travellers	N/A	Office-based staff travelling to conduct meetings and similar business activities but not to provide trade services.
Cost Savings Approach	CSA	This is the Department's standard approach for estimating the value of travel time (VTT) for business travel, covering both 'blue collar' and 'briefcase'. The CSA is derived from the wage rate of the business traveller.
Intercept recruitment	N/A	This is a method of survey recruitment where an interviewer approaches potential respondents whilst they are travelling, and asks them if they would like to take part in a survey.
National Travel Survey	NTS	NTS is the primary source of data on personal travel patterns in Great Britain. It is an established household survey which has been running continuously since 1988.
Other public transport	'Other PT'	Other public transport refers to trams, light rail and the London Underground.
Reference cost	N/A	The travel cost of the traveller's current trip, which is used as a basis for designing Stated Preference choices.
Reference time	N/A	The travel time of the traveller's current trip, which is used as a basis for designing Stated Preference choices.
Revealed Preference	RP	This is research technique which involves collecting data on, and analysing, the choices which travellers make in practice.
Size effects	N/A	The propensity for VTT to vary with the size of the time/cost changes offered in the SP experiments.
Sign effects	N/A	The propensity for VTT to vary depending on whether the time/cost changes offered entail gains or losses.
Stated Preference	SP	This is a research technique which involves presenting travellers with hypothetical travel alternatives, and analysing the influence of travel time, cost and other attributes on choices between these alternatives.
Telephone recruitment	N/A	This is a method of survey recruitment where an interviewer approaches potential respondents by dialling publicly available telephone numbers, and asks them if they would like to take part in a survey.
Value of travel time	VTT	The VTT is the value that a traveller places on his/her ability to save travel time and potentially re-allocate this time saving to other productive use, be that work or leisure.
Willingness to Pay	WTP	WTP is an economic concept which represents the maximum amount of money that an individual is willing to pay in order to obtain a good, commodity or service. In the present case, we are interested in valuing the commodity of travel time.

1 Introduction

1.1 Overview

This document is a Non-Technical Summary Report of the study ‘**Provision of market research for value of time savings and reliability**’ undertaken by the Arup/ITS Leeds/Accent team for the Department for Transport (the Department).

In the context of transport appraisal, one of the most important concepts is that conventionally referred to as the ‘value of time’. This does *not* refer to the value that might be placed on time spent in travel, but should be seen as shorthand for the ‘value of changes in travel time’, relative to a reference case when investment takes place. These changes may be positive or negative but historically have been referred to as ‘savings’. In this report we have chosen to refer to the ‘value of travel time’ (VTT) to convey this concept.

Travel time savings and improvements in other journey characteristics, such as travel time reliability (i.e. improved punctuality) and reduced crowding, are important factors in evaluating the benefits of transport infrastructure investment and policy-making initiatives. The benefits of quicker, more reliable, less crowded journeys, and the social and economic opportunities which they facilitate, are captured through values of travel time.

Values of travel time are typically quantified in pounds per hour (**Table 5.1**), and these values are then factored up or down to reflect reliability and other aspects of the quality of the journey, for example traffic conditions on the roads or public transport crowding (presented in **Table 5.2**). The valuation of travel time focuses on time spent travelling on the specific mode of transport, known as in-vehicle time.

It is essential for the Department to have up-to-date and well-reasoned guidance for valuing travel time and reliability. Such guidance allows analysts to appraise transport investments and policies in a systematic and consistent manner, and to build robust evidence underpinning the business cases which inform investment funding decisions.

The current values for commuting and other non-work travel are based on results from ‘Values of travel time savings in the UK’ (ITS Leeds and John Bates, 2003), which used survey evidence from ‘The value of travel time on UK roads – 1994’ (AHCG, 1999). Since 2003, these values have been regularly updated to reflect changes in income and prices, and the Department has commissioned further research to quantify the uncertainty around the values and compare them with other evidence. However, they have not been reviewed, with fresh survey evidence, in the light of the significant changes we have witnessed in travel behaviour over the last 20 years.

Furthermore, the 2003 study was focussed on car travel for non-work purposes only, and did not consider other modes and trip purposes. The values of travel time for business travel have come under increasing scrutiny because of concerns

that their underlying assumptions do not reflect changes in working practices and developments in mobile technologies. The Department commissioned a scoping study in this area¹ and responded to its recommendations by committing to investigate alternative methods for estimating values of business travel time.

Therefore, the scope of the present study is larger and more complex than many national VTT studies, because we seek to establish values covering:

- Non-work *and* business travel purposes, for
- *Several* travel modes (car, train, etc.), and
- Covering not only travel time savings *but also* travel time reliability, and several aspects of quality and comfort, including crowding.

1.2 Study aims and objectives

The Department set the following **aims** for the study, all of which have been met, and are covered in **Section 5** of this report:

- Provide recommended, up-to-date national average values of in-vehicle travel time savings, covering business and non-work travel, and based on primary research using modern, innovative methods.
- Investigate the factors which cause variation in the values (e.g. by mode, purpose, income, trip distance or duration, productive use of travel time etc.) and use this to inform recommended segmentation of the values.
- Improve our understanding of the uncertainties around the values, including estimating confidence intervals around the recommended values.
- Consistently estimate values for other journey characteristics for which values are derived from the values of in-vehicle time savings.

The overall **objectives** of the study were to:

- Provide recommended, up-to-date national average values for in-vehicle travel time savings (findings presented in **Section 5.2**).
- Improve understanding of what drives the values of travel time savings and the uncertainty around the values (findings presented in **Section 3.1** and **Section 4**).
- Consistently estimate values for journey characteristics of related factors, e.g. reliability and crowding (findings presented in **Section 5.3**).

1.3 Study deliverables

The study deliverables are:

- Phase 2 Final Report ~400 pages (separate document).
- Non-Technical Summary Report of the Phase 2 Final Report ~20 pages (this document).

¹

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/251997/vtts_for_business_main_report-dft-005.pdf

- All questionnaires (annexed to the Phase 2 Final Report) and raw data gathered during the market research phases.
- Implementation Tool, programmed in 'R', which converts results from 'choice models' to values that can be used in evaluating the benefits of investments, as described in Section 5.1 of this report.

2 Study approach

2.1 Background and process

The Department commissioned this study in two phases.

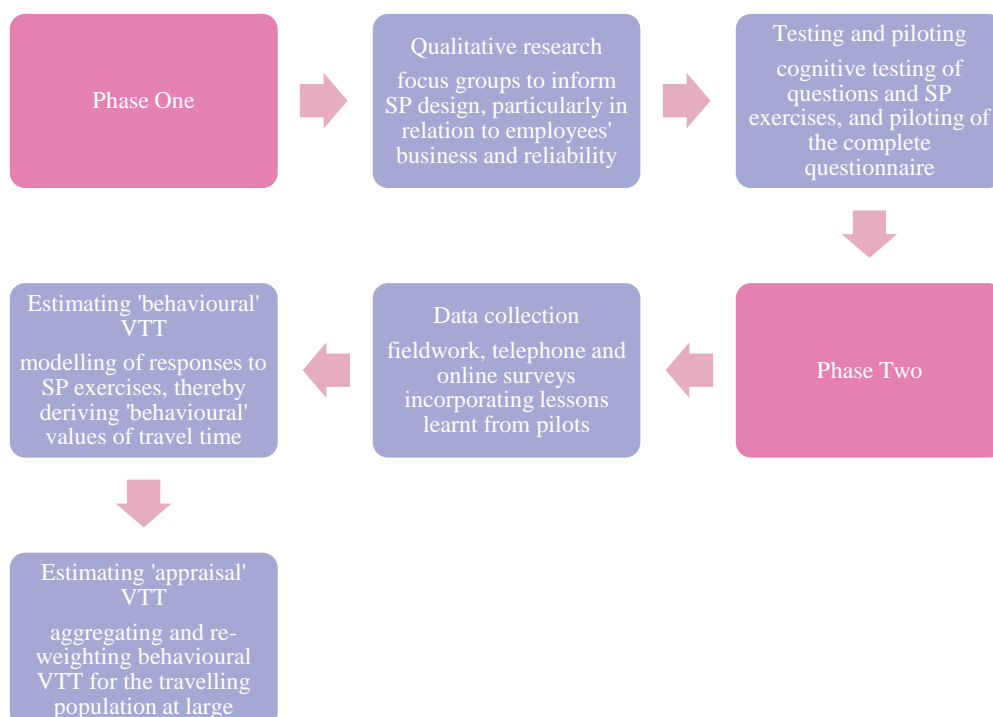
An inception meeting with the Department was held on 3rd June 2014, after which the Department convened and led a workshop with stakeholders potentially affected by revisions to VTT guidance.

Phase 1 of the study, which was undertaken from June to September 2014, involved the development and testing of methods for undertaking the requisite market research. This phase culminated in an extensive pilot survey conducted in two waves, and the estimation of behavioural values on this dataset.

Having reviewed the Phase 1 report, and convened a further workshop with stakeholders, the Department took the decision to proceed to Phase 2, which was undertaken from October 2014 to March 2015. Using the methods developed in Phase 1, Phase 2 involved a substantial field survey and detailed modelling to complete estimation of the values of travel time using the collected data

The study methodology is depicted in the flow chart below (**Figure 2.1**).

Figure 2.1: VTT study methodology



At key milestones, study deliverables and outputs were scrutinised at various levels, as follows:

- The ‘Analytical Challenge Team’ (ACT) comprised leading academics and practitioners from the VTT field, and was positioned at ‘arm’s length’ from the core study team. The ACT independently reviewed all study reports.
- The Department’s Project Board, comprising representatives of key divisions potentially affected by revisions to VTT guidance.
- An independent consortium of national and international experts (under a separate commission from the Department) undertook a comprehensive audit of the study. This audit is reported in a self-standing deliverable.

2.2 Key concepts

Following best-practice in the field, values of travel time and reliability have been estimated using the concept of **willingness-to-pay** (WTP), and have been surveyed using mainly **Stated Preference** (SP) experiments.

WTP is an economic concept which represents the maximum amount of money that an individual is willing to pay in order to obtain a good, commodity or service. In the present case, we are interested in valuing the commodity of travel time.

Broadly speaking, the SP experiments presented travellers with hypothetical choices between a slower/cheaper travel option and a faster/dearer travel option. Travellers were asked to ‘state their preferences’ between the two options, hence the terminology ‘Stated Preference’.

Through analysis of the SP responses from 9,023 interviews, we estimated travellers’ willingness-to-pay money in order to save travel time. Interviews typically took between 20 and 30 minutes, and respondents were offered a monetary incentive of £10 to participate.

Because SP is based on hypothetical choices, we drew upon external sources of evidence in order to corroborate the SP evidence. These external sources included the National Travel Survey (NTS), ticket sales data from across the railway (LENNON), and a Revealed Preference (RP) survey of choices between slower/cheaper and faster/dearer rail trips to London.

The contribution of these external sources of evidence was to provide various insights on actual travel behaviour and valuations that potentially lend support to the hypothetical behaviour and valuations gathered through SP.

We also conducted SP experiments to estimate travellers’ WTP for improvements to reliability, traffic conditions, and crowding on public transport. Following conventional practice, we report the WTP for these various aspects of quality as **multipliers** of the VTT (**Section 5.3**). For example, in the case of public transport reliability, each minute of lateness is valued at X times the value of each minute of scheduled travel time.

2.3 Novel and challenging aspects of the study

Whilst there is a vast evidence base on WTP-based values of travel time for non-work travel, the corresponding evidence base for business travel is more limited. National VTT studies have not always included business VTT within their scope, and even when business has been included, different studies have employed different valuation methods. Against this background, the present study carried out an extensive survey to collect WTP evidence on business VTT from both employers and employees, and then compared these valuations to other external evidence. This is discussed further in **Section 4** below.

The modelling work carried out to derive the estimates of VTT made use of state-of-the-art approaches, and included a number of innovations compared to existing methodology. In particular, the work employed a joint modelling approach across different SP games, simultaneously estimating values of time, reliability and crowding/traffic conditions. This approach, which has not previously been employed in national VTT studies, greatly increases the ability to robustly estimate variations in VTT across different travellers and travel conditions.

2.4 Making sure the surveys work

Given the challenges described above, there was an extensive process of developing, testing and piloting the surveys before they were rolled out. We undertook focus groups and in-depth cognitive interviews to ensure that respondents understood and could respond to questions in the surveys, and piloted them to test the data collection methods.

Ultimately this effort paid off – tests of the main survey results showed that the vast majority of respondents engaged with the SP games by trading between time and cost, and agreed that the hypothetical choices were realistic and easy to understand. For example, around 76% of respondents found it ‘easy to choose between the options’ they were presented with.

2.5 Putting the surveys into practice

Fieldwork interviews took place between 24 October and 15 December 2014. There were three distinct surveys, as outlined below.

- **General public Stated Preference (SP) research:** a ‘mixed’ method was used comprising a target of 80% intercept and 20% telephone recruitment. Intercept locations were designed to cover car, rail, bus and other public transport users across England with some cross-border flows into Wales and some coverage in Scotland.
- **Revealed Preference (RP) research:** this was recruited entirely through an intercept approach and comprised users of the following stations who were travelling to London: Birmingham New Street, Birmingham Moor Street, Birmingham Snow Hill, Stoke, Stafford, Rugby and Peterborough.
- **Employers’ business SP research:** this involved surveying persons responsible for travel policy and/or planning within a company, subject to

quotas on company size, industry grouping and region. The survey was undertaken by telephone, and focussed upon ‘briefcase’ business travel by the company’s employees

The achieved sample sizes for the general public SP survey, which was by far the largest of the three surveys, are shown in **Table 2.1**.

Table 2.1: Total SP interviews by mode and purpose

	Employees’ business	Commute	Other non-work	Total
Car	956	1,032	1,037	3,025
Bus	N/A	371	672	1,043
Rail	1,010	998	1,128	3,136
‘Other PT’	265	614	540	1,419
Totals	2,231	3,015	3,377	8,623

In addition to the general public SP survey, we also collected over 2,500 responses to the rail RP survey and interviewed 400 businesses for the employers’ business SP research. In total, this generated over 11,500 completed survey responses across the different elements of the study. The combined intercept and telephone approach was implemented for reasons of practicality, and it was fully accepted that the sample would not be representative of the travelling population. In **Section 5** of this report, we discuss the process of correcting valuations of travel time and other factors for representativeness using the NTS.

The number of interviews exceeded both the overall target, and most of the mode/purpose segment targets. The shortfall for some targets, particularly ‘other PT’ employees’ business and bus commuting, was due to a shortage of business/commute travellers at the survey locations identified for those modes. Overall, the dataset was deemed to be acceptable in terms of scale, scope and quality.

3 Developing the model

The SP and RP datasets were analysed using ‘choice modelling’ methods, as is standard in national VTT studies.

This involves using mathematical models to analyse the choices between faster/slower and cheaper/more expensive alternatives in the SP and RP experiments, in particular to determine:

- The willingness of travellers to pay money to save travel time (i.e. thereby estimating VTT).
- The multipliers of VTT that apply to different levels of reliability, traffic, and public transport crowding.
- The extent to which valuations (and multipliers) vary by characteristics of the traveller (e.g. income) and trip (e.g. mode, purpose and distance).

The modelling methods made use of state-of-the-art techniques, and advanced these techniques further in some areas, in response to the scale and scope of the dataset.

3.1 Investigating variation in the values

Having estimated choice models in the manner described above, another area of interest is the extent to which estimates of VTT are influenced by features of the traveller and/or trip; such as a traveller's income or the length of the trip.

In the course of the present study, we conducted an extensive search for factors causing variation in the values, involving a large number of traveller/trip features collected in the course of the RP and SP surveys.

We present a brief discussion below of some key results which arose from that search.

3.1.1 Income, time, cost and distance

As has consistently been found in other national studies, we found significant evidence of VTT increasing with income. This relationship was found in all mode/purpose segments except for bus and 'other PT' commuting.

We also found that VTT varied with the travel time and cost of the trip. As both of these factors are closely related to distance, the implications of these results are that VTT increases with trip distance.

3.1.2 Other factors

We tested the influence of a wide range of factors on VTT, and it is interesting to note that, all else equal, the following factors had little or no effect:

- time use (i.e. the traveller's ability to do something else whilst travelling, to work or surf the net)
- geography (i.e. area, urban/rural)
- current journey conditions and current road types

The result relating to time use is of particular interest. One of the criticisms of the Department's current values for business travel is that they fail to reflect the increasing opportunities for people to work while travelling. By contrast, WTP-based values should reflect how travel time is used, given current travelling conditions and opportunities to use that time. Whilst the results show that VTT did not vary with time use, this is not to say that time use is unimportant – the results could have been different if the opportunities to use travel time productively had been substantively different.

3.1.3 Size and sign effects

'Size effects' refer to the propensity for VTT to vary with the size of the time/cost changes offered in the SP experiments. 'Sign effects' refer to the propensity for

VTT to vary depending on whether the time/cost changes offered entail gains or losses. These effects are sometimes referred to as ‘reference dependent’, as they require a reference point against which to judge the size or sign of a change.

In general, we found evidence of size and sign effects, although these varied in nature and strength across modes, games and attributes (i.e. time and cost). However, transport investments have long-lived effects – as travel conditions and the people travelling change over time, a given reference point may become less relevant. Therefore, to evaluate the benefits of investments we ideally want ‘reference free’ VTT. To this end, the modelling work sought to identify the prevalence of size and sign effects, before estimating VTTs which ‘neutralised’ these effects.

4 Applying the model to different trip purposes

4.1 Non-work trip purposes

A ‘non-work’ trip may be the daily commute, or a trip for leisure, for example to visit a family member or to go shopping. As noted above, values of travel time for non-work travel are underpinned by a comprehensive body of survey evidence, and there is broad support for the use of SP-based values in this context.

From modelling the SP data for non-work, we found that, even after controlling for all other effects (e.g. income, distance), the average VTT for ‘other’ non-work (leisure etc.) is significantly lower than the average commuting value. This is a good reason for following the current convention of segmenting non-work values into commute and ‘other’. The outputs from this study for non-work values of travel time are reported in **Section 5**.

4.2 Business trip purpose

The general public SP research captured a wide range of different occupational types, including service engineers and others who use a vehicle as a tool of their trade. By contrast, the employers’ business SP research focussed upon ‘briefcase’ travellers, which refer to office-based staff travelling to conduct meetings and similar business activities but not to provide trade services.

Unlike non-work VTT, there is limited survey evidence on business VTT, and less consensus on methods. Against this background, we employed a mixed methods approach to estimate business VTT. We drew upon several alternative sources of evidence, acknowledging the strengths and weakness of each. In the following sections, we describe the process of reconciling the evidence on business VTT, before identifying a preferred source of evidence to be used for deriving appraisal values for business travel in **Section 5**.

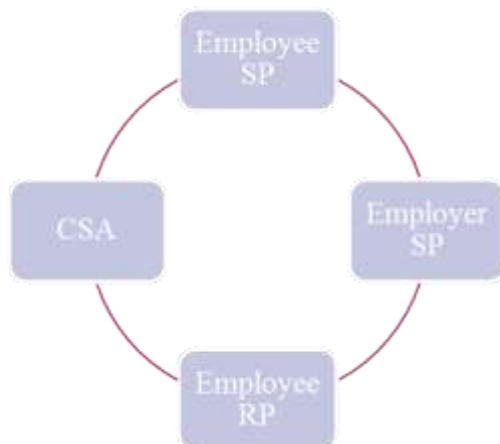
4.2.1 Process of reconciling the business values

Business VTT was investigated from three alternative perspectives, namely:

- Employers’ SP exercise
- Employees’ SP exercise
- Employees’ RP exercise

The information collected in our surveys on income and working hours also enabled comparison with the Cost Savings Approach (CSA, the approach used to calculate the Department’s current values), as well as with the wage rate of respondents. Conceptually speaking, the CSA is closely linked to the wage rate.

Figure 4.1: Sources of evidence on business VTT



By drawing upon these four components, we were able to identify areas of corroboration between the different approaches, whilst also mitigating the risks of relying on any single approach (**Table 4.1**).

Table 4.1: Strengths and weaknesses of different approaches for valuing business travel time

Approach	Strengths	Weaknesses
Employee SP	Data collection is easier, and indeed this is the usual method for collecting data on business VTT. In the present study, we have collected a substantial quantity of employee data.	If the employee is to be an acceptable proxy for the employer, then we need employees to respond in accordance with the company’s interests as opposed to their own private interests.
Employer SP	In principle, the employer is the agent who we are interested in.	Data collection is expensive, and there are significant challenges involved in achieving a representative sample of travel using employers and identifying relevant decision makers within the firm. In the present study, we have a limited quantity of employer data available.
Employee RP	It is grounded in actual rather than hypothetical behaviour.	The same issues as employee SP arise, and an additional challenge with RP is that data collection can be difficult. This is because of the need to identify locations where there exists a genuine trade-off between time and cost, and

Approach	Strengths	Weaknesses
		where travellers have knowledge of the available travel alternatives.
CSA	This is the method presently used by the Department, and by most transport ministries across the world.	This is a theoretically-driven method which rests on several strong assumptions. These assumptions have been increasingly exposed to challenge by behavioural evidence.

4.2.2 Business values of travel time: outputs

This section draws together estimates of business VTT from the various sources at our disposal, namely employee SP, employer SP, employee RP, as well as the CSA. These values cover car, bus and ‘other PT’ (noting that bus was out of scope for business travel).

In what follows, we are primarily interested in the **relativities** between the various estimates of business VTT. **It should be stressed that the SP and RP based estimates reported in this section are modelled values and are not appropriate for direct usage in appraisal.** This is because the values have not – at this stage – been adjusted in order to be representative of the travelling population. This adjustment is made in **Section 5** to follow.

4.2.2.1 Car values of travel time for business travel

Table 4.2 brings together the car values, which are based entirely on SP. The VTT is broadly in line with the CSA for employee SP blue collar, and somewhat less than the CSA for the other segments. The relatively low values for self-employed is possibly explained by the ‘blurring’ between work and leisure for this occupational type.

Table 4.2: Car values of travel time £/hr

	Employer SP Briefcase	Employee SP Briefcase	Employee SP Blue Collar	Self Emp SP Briefcase	Self Emp SP Blue Collar
VTT	14.05	20.43	17.45	13.03	8.55
CSA	23.94	26.98	17.27	27.82	16.15

4.2.2.2 Rail values of travel time for business travel

The rail context brings the RP evidence into play and, whilst these values are not sufficiently robust or extensive to be directly used in appraisals, they were used to validate results from the SP. Comparing against SP evidence from a similar sample and context (choosing between train operators with different fares and travel times), we observed RP and SP values within a similar range.

Focussing now on the SP evidence collated in **Table 4.3**, we are reassured that the employer and employee values are broadly consistent – although it should be borne in mind that the employer sample was relatively modest in size, and that the employee sample is larger and therefore more robust. The evidence again suggests

that the CSA is appropriate for blue collar employees. The VTTs for the self-employed again appear somewhat lower than employees for a given income level.

Table 4.3: Rail values £/hr

	Employer SP Briefcase	Employee SP Briefcase	Employee SP Blue Collar	Self Emp SP Briefcase	Self Emp SP Blue Collar
VTT	21.31	29.93	19.48	15.28	5.91
CSA	33.06	30.79	19.10	38.37	12.43

4.2.2.3 ‘Other PT’ values of travel time for business travel

The ‘other PT’ values are reported in **Table 4.4**. The values are all, to some extent, lower than the CSA and very much in line with personal values. We speculate that there are background issues at play here, such as blending of trips for different purposes (i.e. a business trip combined with a non-work trip). Similarly, we speculate that there may be issues surrounding the claiming of minor travel expenses, such that trips are essentially being covered out of personal income or through travelcards.

Table 4.4: ‘Other PT’ values £/hr

	Employee SP Briefcase	Employee SP Blue Collar	Self Emp SP Briefcase	Self Emp SP Blue Collar
VTT	10.33	8.22	8.72	5.89
CSA	39.35	15.59	36.13	29.14

4.3 Conclusions regarding business values

Our overall view is that the employer and employee SP values are sufficiently close that we can take the employee-based valuations to be representative of employers’ willingness to pay money to save time (which in principle is what we require for appraisal purposes). The preference for the employee dataset over the employer reflects its greater size and robustness.

We also find it reassuring, with regard to the validity of the SP employee based approach, that the VTTs for **employed blue collar** workers are broadly in line with the CSA. The Department’s business scoping study² concluded that there seemed to be little justification in principle for not using the CSA for this segment, and this result can be confirmed by the evidence here.

² <https://www.gov.uk/government/publications/values-of-travel-time-savings-for-business-travellers>

5 Values of travel time for use in appraisal

5.1 Generating values for appraisal

The choice models described in **Section 4** above are estimated from a sample which is not nationally representative. These models cannot, without further information, provide appropriate estimates of VTT for aggregations of the travelling population, as would be required for establishing recommended values for appraisal.

In order to provide maximum flexibility, an ‘Implementation Tool’ was constructed permitting the calculation of VTT for different segments and based on a variety of income and trip/distance weighting options. This Tool is a series of algorithms with a user interface, allowing suitably qualified and experienced analysts to vary the input assumptions and thereby generate variants of VTT applicable to specific policy and practical interests.

The workings of the Tool and validity of the outputs it generates have been independently verified. The Department has been trained on the use of the Tool and supporting documentation provided.

5.2 VTT values for use in appraisal

Before presenting our recommended values of travel time from the Implementation Tool, it is appropriate to issue some recommendations regarding their usage in appraisal:

- VTT should continue to be distance-weighted but, certainly in the case of business, should be disaggregated into distance bands. This is because, having controlled for other factors related to distance (such as travel cost), there is evidence of a ‘residual’ distance effect. Further work is necessary to determine the optimal distance bands and whether non-work VTTs should be disaggregated by distance bands.
- For the majority of appraisals, the use of standard national VTTs is proportionate and appropriate. For larger schemes, strategies and projects where the ‘user pays’, this should be complemented with analysis using more segmented and scheme-specific VTTs.
- Non-work VTT should continue to be averaged across modes due to values reflecting some self-selectivity between modes, whereas business VTT should be mode-specific as we interpret differences between modes to be real differences.
- Non-work VTT should continue to segment by commuting and other non-work purposes, as there is a significant difference in the valuations for these purposes.

We have illustrated these recommendations for a routine appraisal in **Table 5.1** based on certain technical assumptions noted below the table (detailed explanation of these assumptions can be found in the Phase 2 Final Report). This table also

presents, for purposes of comparison, the existing WebTAG values converted to a comparable base (2014 perceived prices).

For example, the figure of £11.21/hr for all modes/distances commute means that, on average, we estimate that travellers would be willing to pay £11.21 in order to save one hour of travel time. This compares with the current WebTAG value of £7.62/hr for the same trip category.

Table 5.1: VTTs for routine appraisals with illustrative distance bands (2014 perceived prices, £/hr)

Mode	Distance	Commute	Other non-work	Employees' business				
		All modes	All modes	All modes	Car	Bus	'Other PT'	Rail
WebTAG (2014 prices and values)	All	7.62	6.77	25.47	24.43	15.64	24.72	30.07
All modes	All	11.21	5.12	18.23	16.74	-	8.33	27.61
	<20 miles			8.31	8.21	-		10.11
	20 to 100 miles			16.05	15.85	-		28.99
	>=100 miles			28.62	25.74	-		

Notes: All values distance-weighted, non-work VTTs based on all distances and income option 1, business VTT distance-banded based on income option 1 and employers paying, VTT imputed for PT trips with zero cost, VTT taken from SP1 at $\Delta t=10$, Tool version 1.1.

5.3 VTT multipliers

In addition to the overall values, we also make some recommendations for adjustments for different types of time, and we present these as multipliers of VTT (**Table 5.2**).

For example, for car commute trips, we estimate that variability in travel time is valued at one third (i.e. multiplier of 0.33) the value of average travel time.

Taking another example, for rail commute trips, we estimate that the VTT in the travel conditions 'seated 1 pass per m2 category' is worth 9% more (i.e. multiplier of 1.09) than the 'base' category of 'seated 100% load'.

Table 5.2: VTT multipliers

Trip mode	Multiplier Type	Commute	Employees' business	Other non-work
Car	Reliability ratio	0.33	0.42	0.35
	Free-flow	0.51	0.42	0.47
	Light congestion	0.72	0.68	0.83
	Heavy congestion	1.37	1.26	1.89
Bus	Value of early	-2.69	-	-3.20

Trip mode	Multiplier Type	Commute	Employees' business	Other non-work
	Value of late	2.88	-	2.52
	Plenty of seats free and did not have to sit next to anyone.	0.85	-	0.83
	A few seats free but had to sit next to someone/could not sit with people travelling with.	0.89	-	0.84
	A few seats free but had to sit next to someone/could not sit with people travelling with. Some standing.	1.00	-	1.00
	No seats free – a few others standing.	1.24	-	1.30
	No seats free – densely packed.	2.14	-	2.32
	Value of free-flow	0.99	-	1.22
	Value of slow down	1.39	-	1.36
	Value of dwell time	0.68	-	1.57
	Value of headway	1.68	-	1.60
'Other PT'	Value of early	-2.40	-1.66	-2.98
	Value of late	1.75	1.95	2.24
	Plenty of seats free and did not have to sit next to anyone.	0.95	1.00	1.00
	A few seats free but had to sit next to someone/could not sit with people travelling with.	0.97	1.00	1.00
	A few seats free but had to sit next to someone/could not sit with people travelling with. Some standing.	1.00	1.00	1.00
	No seats free – a few others standing.	1.13	1.17	1.10
	No seats free – densely packed.	1.70	1.78	1.87
Rail	Value of Early	-1.77	-1.55	-2.34
	Value of Late	2.86	2.76	3.21
	seated 50% load	0.73	0.75	0.72
	seated 75% load	0.79	0.76	0.72
	seated 100% load	1.00	1.00	1.00
	seated 1 pass per m2	1.09	1.13	1.14
	seated 3 pass per m2	1.31	1.36	1.39
	standing 0.5 pass per m2	1.16	1.29	1.21
	standing 1 pass per m2	1.19	1.38	1.27
	standing 2 pass per m2	1.32	1.56	1.57
	standing 3 pass per m2	1.57	1.61	1.79
	standing 4 pass per m2	1.86	2.03	2.17

6 Recommendations

This section is reproduced verbatim from the **Phase 2 Final Report**. The recommendations are complemented by a narrative, so as to give insight as to the underlying reasoning. We begin by offering some generic findings and recommendations, then identify other recommendations which apply to specific parts of the brief.

6.1 Generic issues

We have found that there are significant differences between the VTT of different trip purposes, even after controlling for the characteristics of the trip and traveller.

R1: We recommend that values of travel time (VTT) savings should continue to be distinguished by business, commute and other non-work purposes.

We have found clear evidence of values of reliability and of variation in VTT with traffic conditions and crowding. In this context, it is appropriate to note that current WebTAG guidance on VTT incorporates reliability multipliers, but not multipliers for traffic conditions and crowding.

R2: We recommend that the Department should undertake work to examine the case for extending the scope of VTT guidance to include multipliers for traffic conditions and crowding.

As part of this study, we have developed an Implementation Tool, as a means of translating modelled values of travel time savings into appraisal values (in perceived prices) at whatever level of aggregation is required.

R3: We recommend that the Implementation Tool should be used by the Department to generate appraisal values for scheme appraisal.

We have estimated VTT using three different SP games (SP1: time vs. cost; SP2: time vs. cost vs. reliability; SP3: time vs. cost vs. crowding/congestion).

R4: In the immediate term, we would recommend the values from SP1 as the basis for the 'headline' VTT, since these provide the closest comparator to the 2003 game, and most readily lend themselves to implementation in appraisal. It should be clarified that we interpret VTT from SP1 as referring to 'average' travel conditions, rather than free-flow or uncrowded conditions.

If however crowding/congestion data at an appropriate level of detail can be sourced, then there is a case for basing 'headline' VTT on appropriately weighted values from SP3 – instead of SP1.

R5: We recommend that the Department should undertake further work to examine the viability of using SP3, and its relative advantages/disadvantages against SP1.

Our behavioural model, which forms a key input to the Tool, accommodates size effects within its specification. To neutralise this effect in appraisal values, it is

necessary to calculate the values for a given “size”. When applying the Tool to generate appraisal values, we examined the sensitivity of values to different assumptions regarding the appropriate “size” to use, and found that 10 minutes produced the most representative values. We note that 10 minutes is an assumption employed in other recent European national VTT studies, and our own analysis therefore supports this convention.

R6: We recommend that all time savings are assigned a constant unit value calculated for a change in travel time of 10 minutes.

In moving from modelled values estimated on the behavioural sample to standard average values based on the population (i.e. NTS), two issues arise, namely the method of (re)weighting and the treatment of income.

We reviewed the conceptual arguments for distance vs. trip weighting of VTT, and tested the empirical divergence between the resulting valuations, finding this divergence to be modest if valuations are segmented by distance.

R7: We recommend the retention of distance weighting. This is for the conceptual reason that the probability of a trip benefitting from the scheme being appraised is proportional to trip length within each distance band.

R8: In combination with R7, we recommend that the Department should disaggregate VTT by distance or some geography typology (e.g. urban/inter-urban) that reflects differences in distance. This will require further work to identify appropriate distance disaggregations. Such work would involve the use of distance profiles from real scheme appraisals, to explore the full implications of the approximations to the ‘real’ VTT of the distance-weighted VTT under different distance disaggregations.

We have considered a range of income weighting options³, built them into our Implementation Tool, and provided the comparative results. Such weighting removes the direct effect of income differences on the standard value of time, while retaining the differences due to trip length, geography etc. Our recommendations concerning income weighting differ according to the scheme level, and the level of disaggregation in VTT, as follows.

R9: For business VTT, we recommend income option (1), basing the average value on observed variations in income by person and trip. For non-work VTT, the appropriate treatment of income depends on the level of segmentation in the values. Where VTT is disaggregated by purpose (i.e. commute and other non-work) income option (1) should be used. With further segmentation (e.g. by mode, distance and/or geography) we recommend income option (2), based upon the average income of motorised travellers. For larger schemes, strategies and “user pays” projects, we recommend use of income option (1), irrespective of the level of disaggregation.

³ Option (1) = Averaging over income, but not segmenting by income. Option (2) = Calculating values at ‘average’ income.

While we think there is some argument in favour of the 1980s recommendation to adjust car VTT for group size, we conclude that we have not produced sufficient evidence to justify departure from the current convention.

R10: We recommend that driver values should be treated as representative of all occupants in the car, and should be applied separately to each occupant. Separate vehicle occupancy values should be used for the different purposes.

In our preferred behavioural models, on which the reported VTTs are based, we have used household income as the income variable for commuting and other non-work and personal income for business. This position is informed by empirical tests of alternative income variables within the behavioural model.

R11: We recommend that appraisal values for non-work should be based on household income, whilst business values should be based on personal income.

6.2 Business travel

Recalling that professional drivers were outside the scope of the present study, it is appropriate to comment on how we anticipate this segment being treated for appraisal purposes.

R12: We recommend the continued use of the Cost Saving Approach (CSA) for professional drivers. It follows from this that for these categories, separate appraisal values for goods vehicle drivers, light van drivers, bus and coach drivers etc. based on their gross wage plus on costs will continue to be required.

For briefcase travellers, we found a fair degree of correspondence between the values from the employers SP survey and the much larger employees SP survey. This gives confidence that the employee values can stand proxy for the benefits of changes in business travel time. More generally, we found that the employee values, when controlled to NTS incomes and trip lengths amongst other things for business travellers, are on average around 60% of the values in the CSA; this rises to 72% if this is restricted to travellers who are reimbursed for their trip. Longer distance trips yield VTT close to the CSA while short distance trips VTT are well below.

R13: We recommend that the Department reviews the respective merits of continuing with the CSA or moving to WTP values based on the employee survey. Within the option of moving to WTP values, the Department should, with reference to R2, explore the practicalities of incorporating reliability ratios and congestion/crowding multipliers.

We found that VTT for car and rail from the employees' business survey are quite different. We are also mindful that the majority of the benefits from business travel time savings percolate through the economic system, and do not necessarily end with the travellers themselves. Therefore:

R14: The Department should continue to use mode specific values for trips in the course of business.

The business values that we estimated cover a wide range, and are sensitive to certain assumptions concerning the classification of business trips/travellers.

R15: Attention should be paid in the NTS and other data sources to ensure that trips in the course of business are carefully categorised. Specifically we recommend that business trips are restricted to those trips where the employer is paying or could legitimately pay for the trip costs (though not necessarily the time), whether directly by providing a vehicle or tickets or through reimbursement to the employee.

If the Department decides to move to WTP values for business travellers, then it will require suitably segmented values by variables of interest such as income and trip length.

R16: We recommend that the Department undertakes work to explore alternative banding options for business VTT by income and trip length.

Whilst our scope did not include specific research on business VTT over time, we reviewed the Department's current approach in this regard.

R17: With regards to changes in business VTT over time, we believe that the most appropriate recommendation at this point is to retain the status quo of applying a unit elasticity to forecast changes in GDP/capita. Periodic adjustment will be required to account for the difference between forecast and out-turn.

6.3 Non-work travel

For non-work trip purposes, the evidence is that the average VTT for 'other' non-work is significantly lower than the average commuting value, all else equal.

R18: We recommend that the Department should maintain its distinction between commuting and 'other' non-work trip purposes.

We found that the differences in values across modes cannot be explained solely by comfort differentials.

R19: We recommend a weighted average of non-work VTT by modal share.

Assuming that the Department wishes to maintain its current policy of having segmented values available for use in some types of analysis and appraisal, the question arises as to the appropriate definition of the segments. Clearly these should include income and trip length and possibly geography.

R20: We recommend that the Department undertakes analysis with suitable scheme data, together with the values and elasticities from the behavioural model and Implementation Tool, to explore the most appropriate form of segmentation.

Whilst our scope did not include specific research on non-work VTT over time, we reviewed the arguments for the treatment of income growth over time.

- R21:** We recommend an interim position of retaining the existing method of applying a unit elasticity to GDP/capita.
- R22:** In conjunction with R21, we recommend that further review is carried out. This would cover the results of the present study, and how they cohere with meta-analysis data. This review should also take into account further evidence on temporal stability from the recent studies in Denmark, Norway, Sweden and the Netherlands.