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Productive Use of Rail Travel Time and the Valuation of Travel Time Savings for Rail Business Travellers

Final Report

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Productive Use of Travel Time and Working Time Savings for Rail Business Travellers

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This study has provided for the first time empirical estimates of the amount of time spent working on trains by UK rail business travellers together with estimates of the impact that journey time savings would have on their level of activity during the day, both leisure and productive work, both on and off the train, and the value of these to both the employer and to the employee.

Major implications for current appraisal methodology, with base level business travellers' benefits from travel time savings halved compared to current WebTAG advice.

In viewing the results of the survey it should be understood that they relate to current rail business travellers, their current travel conditions and marginal time savings around those conditions. In keeping with the study brief, longer term impacts are only commented upon in the report, as are some possible implications for forecasting.

The results as reported call for major changes from the guidance currently provided in DfT's WebTAG for 2008 base values for scheme appraisal. If these new values were carried through to forecast values using the current methodology these would reduce the estimated benefits of speeding up the current rail system to this segment of the market by around 50%, changing from a figure of £0.74 per minute saved at 2008 prices as reported in WebTAG to £0.37 per minute saved, as a basis for quantifying benefits[1] *at current values before allowing for income changes over the forecasting period. This difference arises from switching from a theoretical value for time savings (based on premises which we have shown to be unsupportable) to an empirical value based on observation.*

Rail provides for a highly effective business travel environment with much time spent working en route, unaffected by crowding when seated.

However, whilst rail travel time savings are found to be less valuable for working travellers than was thought, substantial benefits are now increasingly afforded by rail as a potential working environment (e.g. allowing the use of IT devices). These may in part help to explain the recent rapid growth in rail demand which is currently unexplained by most demand models

Some 80% of rail business travellers[2] *in the UK are now using travel time to work on the train. Marginal reductions in scheduled travel time (of the order of 10 to 20 minutes) reduce the amount of time they spend working on-train slightly, but this is more than compensated by spending some time working off-train in the minutes saved. However, not everyone works in all the minutes saved, and hence a reduction in journey time does not lead to much extra productive time overall, whether in the 'usual workplace' or elsewhere*[3]*. This affects the value of time savings for the employer.*

The value of time savings to the employee is of particular note. It was found that this was four times the benefit to employers[4]*. This may be contrasted to the current "wage rate plus on-cost" approach of valuing time savings, which assumes 100% of time savings accrue to the employer alone, and none to the traveller*

[1] SPURT report, section 8.12, page 8-14
[2] SPURT report, section 8.3, page 8-6
[3] SPURT report, section 8.5, page 8-10
[4] SPURT report, Table 8.19, page 8-12

Crowding, as measured by % of seats occupied, is not a strong influence on the Value of Time relevant for appraisal, probably because most business travellers secure a seat. However, journey duration does have a significant impact.

1. Introduction

Major personal welfare benefits, which need including in appraisal.

Recent evidence (from the Autumn 2004 National Passenger Survey) has shown that both personal and business travellers are using travel by train as an opportunity to work and conduct business. Market research for train operating companies has led to improved IT support on trains, such as wireless networks and charging points for laptops and mobile telephones, which improves the ability to work productively. The evidence is summarised in the body of the report.

Is time by train used productively by business travellers?

In the UK, the possibility that travel time might be spent productively has hitherto not been taken into account in either the models used for forecasting travel demand, or the methods used for assessing the economic impact of alternative schemes for transport investment. This report is concerned solely with the second aspect, the economic appraisal of transport schemes, though it provides some indications as to the likely effects upon forecasting of rail business travel. A key aspect of transport appraisal is the valuation of travel time savings, on which the UK Department for Transport (DfT) provides guidance through WebTAG. The SPURT surveys provided new evidence that questions some of the assumptions used in the current WegTAG advice with respect to rail business travel.

2. Key Findings

How much time is spent working on trains?

Much higher levels of working on train observed compared to 2004

It was found that the proportion of business travellers working on the train was, in Spring 2008, 82% for an outbound journey, and 77% on the return journey[5], a significantly higher value than the figure of 52% obtained from the National Passenger Survey (NPS) in Autumn 2004, the last comparable dataset. For those that spent some time working, the percentage of journey time spent working was 60% on the outward leg, and 54% on the return leg[6]. For both directions combined, this corresponds to 46% of journey time by all business travellers being spent working.

Levels of on-train working influenced by journey length and occupation of traveller.

The most important factor conditioning both the proportion of travellers working and the percentage of time of those who spend time working was the occupation of the respondent. Journey length affected the proportion working (ranging from 73% overall in the 15-45 minute range to 90% for 2½ hrs or more journey-time[7]), but there was no systematic variation in the percentage of time spent working. The availability of power sockets and of fixed tables appeared to have some influence on the proportion working (for Middle and Professional/Senior Managers) but that might be because some Train Operating Companies give priority to providing these on trains with high proportions of business travellers.

[5] SPURT report, Table 5.13, page 5-13
[6] SPURT report, Table 5.14, page 5-18
[7] SPURT report, Table 8.1, page 8-5

Is working on the train as productive as working at the normal workplace?

Only slight reduction in productivity of work done on train relative to in office rail is a highly productive workplace.

In economic appraisal, if work is done on the train, it has to be appraised in terms of the working time needed were that to be done in the usual office environment. The SPURT surveys showed that some two-thirds (68%) of working business travellers would take "about the same" amount of time, 8% would take "more" time (on average 29 minutes more) and a quarter (24%) would take "less" time (on average 18 minutes less[8]). Across all journey lengths a slight saving of 1.7 minutes per journey[9] would be realised in the usual workplace as compared to the train, this corresponds approximately to a 97% efficiency of working on-train compared with at-workplace.

How much do marginal travel time savings affect business travellers' productive use of travel time?

A reduction in the train's scheduled journey time (which in the SPURT surveys implied earlier arrivals) affects both the amount of time available to work on the train and raises questions as to how the time saved is used off the train.

High maintenance of work activity during the trip

The effect on on-train working was investigated in two ways. The first was by asking respondents to record when they undertook their work during the journey. This showed that the working activity peaks at a point about 30% into the journey, with a high maintenance of work level up until the 80% percentile on the outward leg[10], but with a steeper drop off in working activities on the return leg. This suggested that a shortening of the journey time would not have much effect on reducing the on-train working time.

Reductions in scheduled journey time would only translate into a small reduction of productive time on train.

The second approach quantified the difference, by asking respondents to estimate by how much a given reduction (or increase) in scheduled time (by 10, 15 or 20 minutes, depending on the expected journey length) would change the total amount of time spent working on the train. Some 63% of working business travellers reported that they would have spent "about the same time" working[11]. On average, across all business travellers (whether working or not) the reduction in on-train working time was some 31% of the hypothesised reduction in scheduled time[12] e.g. for a 15 minute time reduction in scheduled journey time the productive working time on the train would be reduced by 4.5 minutes.

Most do no work in the time saved, in contrast to the default assumption in appraisal that everyone works in all the time saved..

The effect on off-train working of a reduction in scheduled time was quantified in a similar manner. On average, across all business travellers, 60% reported that they would do no work in the "saved" time, but the percentage was smaller (55%) for arrival times in the morning and rose to 73% for arrival times after 7pm[13]. This is very different from the usual assumption in transport appraisal in the UK, that 100% of the saved time will be spent working.

[8] SPURT report, section 6.2, page 6-1
[9] SPURT report, Table 8.3, page 8-7
[10] SPURT report, Figure 8.1, page 8-8
[11] SPURT report, Table 8.7, page 8-10
[12] SPURT report – Table 6.10, page 6-10
[13] Spurt REPORT, Table 6.15, page 6-13

Short term productivity effect of time savings on train journey very low at less than 1 minute increase for a 10 minute time saving

On combining these two effects, it was shown that the productivity of 34% of business travellers was unaffected by a reduction in scheduled time; 17% would undertake less work if their scheduled journey time were reduced (that is, they would work less on the train, but not work in the saved travel time); 20% would undertake more work overall; and of the remaining 29% of travellers, where the individual effect was varied, the overall effect was a gain[14].

The combined effect is that a reduction in scheduled journey time by, for example 10 minutes, would increase the average amount of time spent working by all business travellers by just 0.75 minute[15]. It should be noted that this may well be only a short term effect. Another effect of a reduction in scheduled journey time may be to increase the proportion of business travellers who do some work, and to increase the numbers travelling by train. In the longer term, travellers may possibly alter their working day plans to take account of journey time savings.

How does crowding around the traveller affect the productive use of travel time?

Crowding does not affect productivity of those who have a seat all of the time. However, for those who have to stand for some or all of the journey time their level of working was noted to be considerably reduced. with those not seated all the time spending 27% of their time working compared with 46% for those who were seated all the time[16] (the effects of crowding on the productivity of those not seated all the time could not be assessed due to limitations of sample size). Preliminary estimates of the valuation of time savings at different crowding levels suggests a much higher value once some standing occurs (with 90% or more of seats occupied) but due to the limitations of the sample size at this level the estimates obtained must be treated with caution – the survey encountered very low levels of crowded business travellers despite focussing surveys upon situations where crowding would be expected to occur.

The productivity of work on the train relative to the office environment has also been analysed relative to reported train crowding levels. Productivity remains high, even in the worst crowding conditions, though where standing is involved productivity does drop somewhat, perhaps due to the inability to undertake work whilst standing or the lack of confidentiality in undertaking one’s work if 'overseen'[17].

In order to obtain more detailed information of the effects of crowding upon rail business travellers, surveys would need to focus on differing levels of standing with respect to productivity of working.

Personal benefits for the rail business traveller

Finally, the study has also provided valuable information on respondents’ perceptions of any form of personal welfare gain they receive from time savings when travelling by train, in addition to potential gains accruing to their employer or business. The Stated Preference (SP) exercise was designed to give business travellers the chance to trade off their personal money against travel time savings, along with questions to address issues of how crowding and mobile phone reception affected these.

[14] SPURT report Table 8.7, page 8-11
[15] SPURT report, Table 8.8, page 8-10
[16] SPURT report, Table 5.29, page 5-32
[17] SPURT report, Table 8.5, page 8-8

Personal welfare benefits to rail business travellers (not currently taken into account in appraisal) are 4 times the size of those to the employer

The results showed the gain to the employee from any reductions in rail journey time to be of the order of four times that to the employer[18], a benefit not currently valued in the present "costs plus" appraisal methodology. Also noted was that personal value of time savings were non-symmetrical with respect to time extensions or savings, with business travellers willing to pay more for time savings than they say they would gain from any time extensions – they clearly value time savings highly for personal benefit.

An additional benefits identified in the study was noted to be the provision of good quality mobile phone coverage with a significant benefit value obtained[19].

3. Implications for Practice

Revision of WebTAG strongly recommended based on SPURT research

It is important to move forward from this research and consider the implications of the study findings on practice in the future. As previously noted, this research has cast doubt on the current guidance contained within WebTAG 3.5.6. This would therefore suggest that this element of the guidance should be revisited with due consideration given to the results of this research.

The research also adds some weight to the case for improvements to be made to all rail services to support the needs of business travellers. Of the various factor considered in this study, the most apparent appears to be the provision of power points and fixed tables, and ensuring that business travellers book a seat in advance.

Improvements on train to improve working environment likely to bring benefits

Finally it must be remembered that this study has considered the implication of the productive use of travel time only for the economic appraisal aspects of transport analysis. A second but complementary study is needed to assess the implications for the demand forecasting aspects.

4. Recommendations for Further Research

Study recommends further investigation into productivity impacts of commuters.

This study has identified the need for a number of pieces of further research to provide greater evidence on the productive use of travel time and its implications. It notes in particular the need for the following[20].

- Further rail data capture, with particular emphasis on commuters as there is evidence (from the 2004 National Passenger Survey data) that they too spend time working productively;
- Further analysis of both the SPURT data and of the 2004 NPS data to more fully correlate the two datasets to allow for better time series analysis of changes in behaviour, and allied to this to seek changes in any on-going surveys such as the NPS or the Omnibus survey, such that changes in the proportion of rail travellers that work on trains and in the amount of time they spend working can be monitored over time;
- Assessment for other forms of business travellers' transport (car drivers, passengers and local public transport users) of the value users would ascribe to time savings, and the impact these would have on their intentions and ability to work during the journey;
- A similar study to SPURT focusing on airport access and air travel as important market segments in their own right;
- Potentially, a focus on inter-metropolitan rail business trips; these form a segment of the SPURT data set, but one not sufficiently large for a focused analysis; and

The major changes in work patterns evident on rail needs to be equally appraised for other modes of business travel

[18] SPURT report, Table 8.9, page 8-12
[19] SPURT report, section 7.4, page 7-11
[20] SPURT report, Chapter 9

- A behavioural study to establish whether and how the ability to spend travel time productively affects traveller's choice of mode and what changes in demand modelling practice may be needed.

Need for a continuing monitoring process of changes in rail business traveller's behaviour over time.

Finally, this study also makes suggestions for revisions to be made to the way certain data on passengers' travel characteristics is collected and analysed. It suggests that the evidence and information contained within this report is shared with key stakeholders both within and beyond the rail industry, who should be invited to discuss ways in which the lessons learnt and ideas developed can be built upon.

5. How the research was conducted

Following a workshop on the productive use of travel time convened by the DfT in April 2007 to review the existing evidence and its potential implications for valuing travel time savings, this study on the "Productive Use of Travel Time and Work Value of Travel Time Saving" was commissioned in December 2007 with a focus on rail business travellers. The study (now referred to as SPURT, in short for "Study of the Productive Use of Rail Travel-time") was undertaken by a consortium, headed by Mott MacDonald, in association with Hugh Gunn (HGA, TRi), Howard Kirby (Transport Research Institute (TRi), Napier University), Mark Bradley (MBRC, California) and Chris Heywood (Accent Market and Research).

The project had as its objective, undertaking a

> *"study of rail business travellers to obtain direct evidence on the productive use of travel time during the course of work and to assess its impact on the work value of marginal travel time savings"* [21].

The scope covered all those travelling by rail in the course of work, not just so called "brief-case travellers".

The research was undertaken by means of a self-completion train-based questionnaire, with return provided via reply paid envelope. The design involved four key areas:

- A **Revealed Preference** section enquiring about the travel choices made at the time of the journey;
- A **Stated Intentions** section asked about the respondent's reaction to time savings/extensions at the margin to the journey being made;
- A set of **Stated Preference** games, involving the trading between time, personal cost, crowding and mobile phone contact; and
- **Socio-economic** questions relating to person type, income, age and gender.

Unusually high levels of survey response obtained from well designed survey

A pilot study demonstrated the viability of the approach and informed the final design. The response rate obtained was high for such a complex questionnaire, with the pilot recording a 33% return rate and the main survey in Spring 2008 a very similar level[22]. In total over 5,000 questionnaires were handed out in the main survey, and a data-set was prepared from the 1,660 valid and checked responses returned. To correct for any sample bias, nationally representative estimates were prepared by grossing up the SPURT data to be consistent with the proportions in each category of occupation, journey-time-band and direction of travel that were observed in the Autumn 2007 National Passenger Survey[23].

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[21] SPURT report, section 1.1, page 1-1
[22] SPURT report, section 4.3, page 4-4
[23] SPURT report, section 4.5

6. Further details

In the first instance any enquiries relating to this report should be addressed to the DfT Project manager Tom Worsley (tom.worsley@dft.gsi.gov.uk) or the Mott MacDonald study Project Manager Robert Fickling (Robert.fickling@mottmac.com).

1 Introduction

1.1 Overview

Mott MacDonald, in association with Hugh Gunn (HGA), Howard Kirby (Transport Research Institute, Edinburgh Napier University, TRi), Mark Bradley and Accent Market Research (the "consortium"), have been commissioned by the Department for Transport (DfT) to undertake a detailed study of the Productive Use of Rail Travel Time and Work Value of Travel Time Saving, with the primary goal being to:

"undertake a stated preference study of rail business travellers to obtain direct evidence on the productive use of travel time during the course of work and to assess its impact on the work value of marginal travel time savings" (Department for Transport, 2007).

As specified in the Invitation to Tender (ITT), the study was expected to cover the following elements of work:

- a) Survey rail business travellers to estimate the productive use of travel time (the percentage of travel time devoted to productive work), disaggregated by factors/journey characteristics which influence productive use of travel time (e.g. length of trip);
- b) Assess the productivity[24] of work done while travelling relative to work done at workplace, which is influenced by the nature of the work undertaken as well as travel conditions (e.g. crowding);
- c) Examine distribution of productive work over the journey time, and assess how marginal travel time savings would impact on business travellers' productive use of travel time (the proportion of travel time saved at the expense of work done while travelling);
- d) In the light of findings in (a), (b) and (c) above, estimate value of travel time saving in business time;
- e) Examine the impact of crowding on productive use of travel time;
- f) Assess if a personal welfare element over and above the productivity impact should and can be identified, and if so, assess business travellers' willingness to pay for reduced levels of crowding;
- g) Survey employers to verify the robustness of the above findings and to assess their willingness to pay for business travel time saving;
- h) In the light of the above findings, assess if and how DfT's current approach on work value of travel time saving should be altered;
- i) In the light of the above, assess if and how DfT's current treatment of crowding benefits for business travellers should be altered;
- j) Examine the possible implications of the new estimates for rail appraisal and policy development; and
- k) Draft appraisal guidance on work value of travel time saving and treatment of crowding for In Work Time (IWT) travellers.

Prior to the award of the study to the "consortium", DfT asked for a reduction in bid price and as part of this process activity k) was removed from the study scope. Activity g), the employers survey, was also reduced to that of a stakeholder consultation process rather than a survey.

[24] See Appendix F for definitions and usage of the term "productivity", which can be different in different contexts.

1.2 Terminology in Report

Throughout this report the acronym used for the study will be SPURT 2008, standing for SPURT = Study of the Productive Use of Rail Travel-time.

1.3 Structure of Report

The remainder of this report has the following structure:

- Chapter Two – a review of background evidence base for this new research work;
- Chapter Three – design and planning of the surveys;
- Chapter Four – high level results from the survey process;
- Chapter Five - analysis of the survey Revealed Preference questions;
- Chapter Six – examination of the Stated Intentions responses;
- Chapter Seven – analysis of the Stated Preference surveys;
- Chapter Eight – conclusions to the study and an assessment of the application of the results from the preceding Chapter, and how they relate to current WegTag/DfT guidance and the extended Hensher approach;
- Chapter Nine –recommendations for further research work; and
- Chapter Ten - provides a list a list of key references used in the report.

A series of Appendices are also attached covering:

- Appendix A - Main Survey Questionnaire;
- Appendix B - Main Survey Train Rosters;
- Appendix C - Survey Data Validation;
- Appendix D - Data Expansion Process;
- Appendix E - Relationship between Occupation and Income;
- Appendix F - Definition of ‘Productivity’; and
- Appendix G - Consistency of Marginal and Average Estimates of the Time Spent Working on Trains.

2 Background to research

2.1 Introduction

In this section of the report we have reviewed the evidence base for valuing the Productive Use of Travel Time and the implications for assessing the Work Value of Travel Time Savings, drawing upon both UK and overseas research work (this has already been reported in the study Inception Report of January 2008, but is repeated below for completeness). For our perspective on Value of Time concepts in the context of the current study see Chapter 8 with its Preamble to the "Conclusions" chapter.

Also included in this chapter is a reflection upon the current UK practice, and why and how our recommendations may differ from those in WebTag.

Whilst our study focuses on rail passengers, the issues discussed could also apply to all modes of travel, including air and road.

2.2 Review of background reports and research

The possibility that productive work done whilst travelling will have increased due to advances in information technology has been highlighted in a number of recent studies. Of those that consider the implications for evaluation, the key reports of direct relevance to the new study are:

- 'Value-of-Time for Evaluation Purposes' (Hague Consulting Group, 1985);
- 'The Netherlands 'Value of Time' Study: Final Report' (Hague Consulting Group, 1990);
- 'Further Analyses of the Netherlands 'Value of Time' Study' (Hague Consulting Group, 1990);
- 'Further Applications and Validation of the Netherlands Value of Time Study' (Hague Consulting Group, 1991);
- 'Value of Dutch Travel Time Savings in 1997' (Gunn, Tuinenga, Cheung and Klein, 1998);
- 'Exploring the relative costs of travelling by train and by car - Final Report to Virgin Trains' (Kirby, Smyth and Carreno, 2006, 2007);
- 'How to Value in-work-time crowding' (Oxera, 2007)

This study was commissioned by DfT in order to obtain empirical evidence of the productive use of travel time by rail travellers in the course of work (which for convenience we abbreviate to "business travellers" elsewhere in this report, though not implying only "brief-case travellers") and to assess its implications for the valuation of business travel time savings; including assessing the appropriateness of adopting the general theoretical approach which is now known as the 'Hensher Approach' (Hensher, 1977, 1989). This approach involves building up the implications of "In Working Time" travel time savings by considering the separate implications for employer and employee. The central questions for this study concern the evidence for change and the practicality of any such approach (e.g. the measurability and reliability of the various components of Value of Time - VOT).

2.2.1 'Value-of-Time for Evaluation Purposes' (1985)

The issues of whether time spent travelling could be productive and how this changed over time was foreseen in the original review study carried out for the Dutch Rijkswaterstaat in 1985, which actually addressed both leisure and "In Working Time" (IWT) travel time savings evaluation for all land-based travel modes. In the background to this study were two major national research studies:

- The UK based National VOT Study undertaken by MVA, ITS and TSU (1987); and
- The Netherlands National Model study, which developed multi-modal behavioural models of travel behaviour, in which travel time and cost were two of the most important considerations.

The UK VOT study had led to the questioning of the then-current UK evaluation approach which set business traveller's IWT time savings at wage-rate plus on-costs (with further research being undertaken by Institute for Transport Studies, Leeds - ITS). Some evidence was produced, but the final advice was to remain with this assumption.

In The Netherlands, the Dutch National Model (LMS) offered detailed multi-modal forecasts at a national level, and provided models in which time and cost effects were estimated directly on the mode/destination choice data. In principle, these models could have been used to establish rates of time/cost trading, replacing 'indirect' VOTs from (for example) Stated Preference experiments. In practice, the models were not linear in cost: a log(cost) specification was found to outperform a linear model form, so that the implied VOT was not constant with journey duration.

The study also came at a time when economists were challenging the Dutch evaluation approach which, for valuing IWT savings, was based on analyses of historic changes in productivity experienced after changes in the length of the working week. The Hague Consulting Group (HCG) report (1985) summarised and discussed the position. In brief, both the Cost Savings Approach underlying the use of the wage rate, and the Productivity Gain approach underlying the Dutch assumptions, were open to criticism on the grounds that:

- not all saved travel IWT is returned to work by the business traveller;
- not all travel time is unproductive; and
- time savings affect the welfare of the business traveller as well as the cost of accomplishing the work.

From the first two bullet points, the implication was that the 'productive' value of a time saving should be less than the wage rate; from the last bullet point there should be an extra welfare component added for evaluation purposes, taking the sum back towards or perhaps even beyond the wage rate. Questions raised in the report addressed not just the feasibility of implementing the Hensher Approach, but the need for it if the answer is similar to the wage rate.

It is worth considering further the suggestion that the welfare element should be included in the benefits for business travellers, should these be significant and measurable. The basic counter-argument that was posed then (and had been resurrected at various times since) was that Employees were indifferent to time at work and travel time, and that saved travel time would all be returned to work. Hence the 'productive resource' released by a travel-time saving could be measured by the wage rate alone (plus on-costs).

Whilst this argument is plausible for those employed in providing transport (bus, train, lorry drivers), and is certainly convenient, by the mid-eighties it was being challenged for business travellers, based upon the three main reasons set out in the bullet points above.

A second strand of the argument against the inclusion of welfare benefits was that, even if employees did take value out of travel-time savings, they were *eventually* recompensed by their wages – in other words, if a job involving travel became more attractive because travel became less of a burden, wages would fall (with corresponding reverse effects if travel became more of a burden). In either case, the in-work traveller would be left no better or worse off.

This effect is plausible, in that it would be likely to happen to some extent, some of the time – but it is just the same effect that is accepted in the treatment of leisure time savings (and is explained as such in the Department for Transport's "Transport Analysis Guidance", at www.webtag.org.uk (WebTAG). Where a particular location is made more accessible (e.g. through travel time savings) it is likely that land prices / rents will rise, clawing back some of the gains to the travellers by increasing their expenditure on housing. However, this is essentially a distributional effect, not the removal or destruction of the benefits of providing the accessibility. Total effects are calculated by the immediate benefits to the traveller.

There were a further series of points made in the 1985 Dutch report, for example:

- the results obtained may have been similar to the wage rate at the time, but trends in societal time use and technology could change this in the future;
- the values seemed very likely to vary, perhaps substantially, between travellers, contexts and modes, giving obvious policy implications; and
- whilst current cost-benefit studies add welfare benefits (leisure time savings) to money differences (operating costs and working time), this practice was open to criticism. Tracing benefits back to actual money and additional welfare, presented separately, could provide a useful additional guide to policy-makers in the future.

2.2.2 'The Netherlands Value of Time Study: Final Report' (1990)

The Final Report of the Netherlands Value of Time Study summarised the experiment conducted in 1988, and contains examples of the Stated Preference (SP) questionnaires that were distributed. The full analysis of the IWT values was completed in 1990, and is described in the following section.

In the instructions for the completion of the SP questionnaire, respondents were asked to consider a current journey, and examine two possible changes to the times and costs (with no change being sometimes offered for one of these). Car-drivers were asked to imagine three background contexts:

- that time changes would come from either road improvements, changes in congestion or finding a new route;
- that cost changes would come from running costs, such as petrol or parking; and
- if they were travelling IWT, that they consider the choices AS IF they were making the exact same journey in their leisure time at their own cost.

For public transport users, time and cost differences were easier to present through timetabling and fare changes, but IWT travellers were also asked to 'imagine' that they were themselves to pay for/save from time changes at their own expense.

Further questions were asked about:

- possibilities for using travel time (none/work/eating/conversation/relaxation/other to be specified);
- if work was being done, how long was spent;
- if work was being done, how long would it have taken in the office; and
- if time was saved or lost, which activity/activities would be affected (from the list above in the first bullet point)?

The Final Report went on to describe the analysis of the SP data in detail, providing an estimate of 'Employee's Value'.

2.2.3 'Further Application and Validation of the Netherlands Value of Time Study' (1991)

The extension of the research to include 'Employer's Value' of time savings was reported in this later paper, summarising an internal HCG report.

The simplified 'Hensher' formula used for the Employer's Value, to be added to the Employee's value, may be written as:

Employer Value = PVWT x (%W - %TW x %PTW)

Where:

- PVWT = the productive value of an hour of work;
- %W = the percentage of travel time savings diverted back to work;
- %TW = the percentage of travel time used for work; and
- %PTW = the relative productivity of work during travel.

PVWT was estimated at the hourly wage rate plus on-costs, calculated separately for each respondent.

Note that in the scenario of the Employee's Value being zero, and if %W turned out to be 100% and either or both of %TW and %PTW turned out to be zero, the adapted Hensher formula would collapse to the conventional 'cost-saving' value. Indeed, these are the explicit assumptions of the conventional approach. The key question of the new DfT study is how plausible is such a collapse of the Hensher model nowadays?

Table 2.1 sets out the various components of Employer's Values that were found in the Dutch experiment (but note, the mean value was calculated by applying the equation separately for each respondent, so does not correspond exactly to a calculation using the averages).

Table 2.1: Components of Employer's Values (1991 prices)

Mode	No. of observations	PVWT (Dfl/hr)	%W	%TW	%PTW	Employer VoT (Dfl/hr)
Car	390	44.69	66.5%	1.7%	89.7%	30.37
Train	59	36.52	46.6%	11.0%	88.7%	15.70
Bus	20	28.46	52.5%	2.9%	93.3%	11.78
All modes	469	42.97	63.4%	2.9%	89.4%	27.73

Source: Further Application and Validation of the Netherlands 'Value of Time' Study (HCG, 1991)

The study was multi-modal, covering all travel purposes, so clearly IWT public transport sample sizes were small, but the trends in the data were interesting. For rail, PVWT indicates that incomes were between those for car and bus, but final Employer's Value for rail was much closer to bus than car. This came about mainly as a result of a low %W (opportunities for rail travellers to return to work possibly being lower) and a high %TW (opportunities to work on the train being higher than the other modes).

From the same report, Table 2.2 below shows the values of PVWT, Employee's Value, Employer's Value and Total VOT.

Table 2.2: Components of Employer's Values (Dfl/hr, 1991 prices)

Mode	PVWT	Employee	Employer	Total
Car	44.69	21.1	30.4	51.5
Train	36.52	14.0	15.7	29.7
Bus	28.46	11.2	11.8	23.0

Source: Further Application and Validation of the Netherlands 'Value of Time' Study (HCG, 1991)

The broad picture is that Employer and Employee Values were similar. The net effect of adopting the Hensher Approach as was undertaken was to increase Car IWT VOT (over the conventional approach, which would assume PVWT) by around 15%, and to decrease Rail IWT VOT by around 19%, once again relative to PVWT. This was based upon a higher level of productive work time being available to such travellers compared to the Hensher/costs-plus assumption of no valuable working time available on train.

2.2.4 'Value of Dutch Travel Time Savings in 1997' (1998)

The 1988 Dutch experiment was repeated ten years later, replicating the questionnaire used in the 1988 survey with inflation adjustments, and it returned a rather higher sample size (more than twice as large for IWT than in 1988). Some new effects were studied, for example the impact of cell-phones, on Car-driver VOT).

The key results for this study are shown below in Figure 2.1 and Figure 2.2

Figure 2.1: Percentage of saved time used for working, split by mode

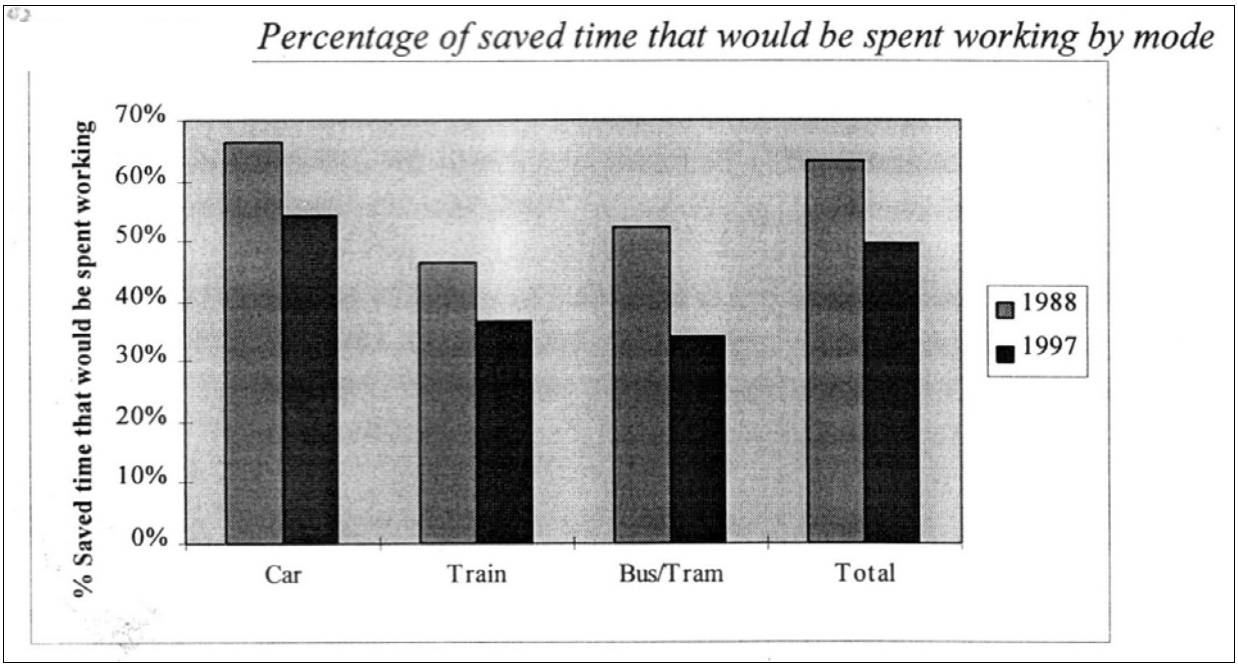
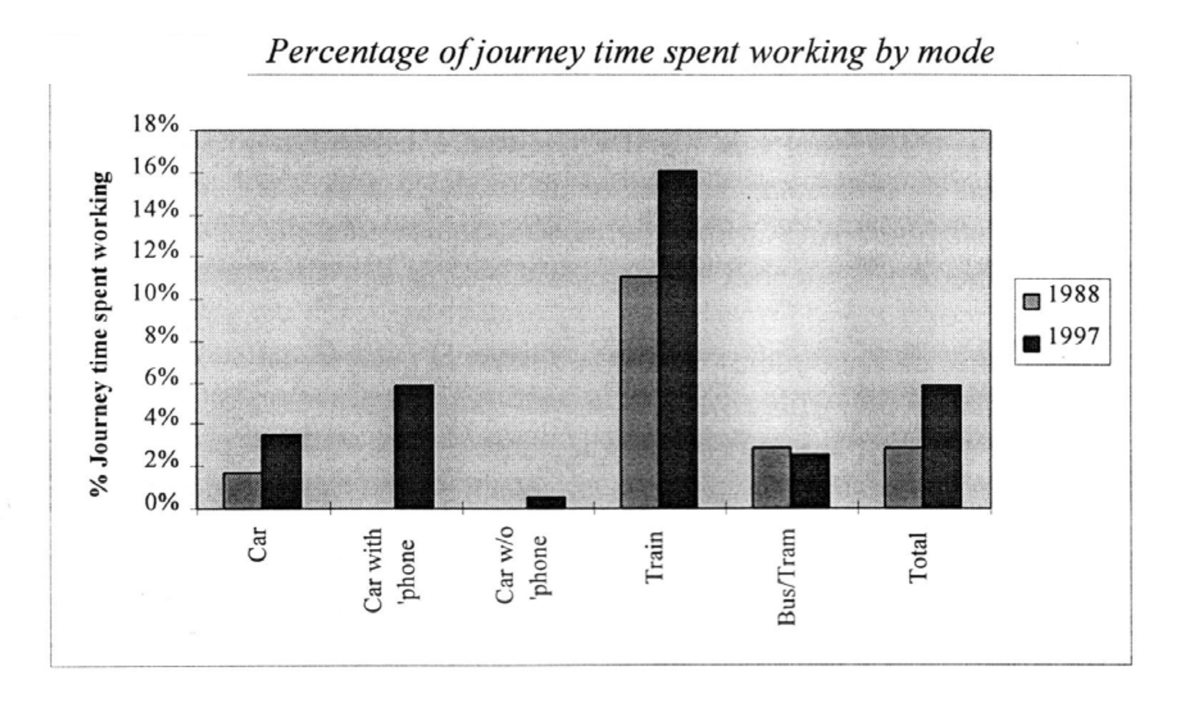


Figure 2.2: Percentage of journey time spent working, split by mode



With some variations between the years, the later experiment confirmed that only about a third of saved time on business rail journeys would be returned to work (shown in Figure 2.1). Train and bus were the modes with the lowest percentages. As for working during the journey (see Figure 2.2), the train passengers reported far higher percentages of 'useful' time in both experiments. Both of these effects tended to decrease the Employer's Value of saved train times.

2.2.5 'Exploring the relative costs of travelling by train and by car' (2006)

This research was undertaken by the Transport Research Institute (TRi) at Edinburgh Napier University on behalf of Virgin Trains. The study was based upon three core elements:

- assessing the time involved in travelling between locations by train and car;
- assessing the time that individuals could spend productively, that is, doing work for their employer whilst on these journeys; and
- assessing the costs and benefits of such time to the employer.

The third element involved deducing cost differences for key movements, based on the results from the preceding elements, and hence derived estimates for the saving in employer's costs when sending business travellers by rail rather than by road. The key movements and associated journey times were based upon the use of 30 randomly generated door-to-door journeys between the postcode areas of each of three pairs of cities:

- Manchester to London;
- Birmingham to London; and
- Manchester to Birmingham.

It is the second element that is of prime interest to the present study. For this, data was available on the activities undertaken by passengers whilst on a train. This had been collected as a one-off additional part of the Autumn 2004 wave of the National (Rail) Passenger Survey (NPS) of the then Strategic Rail Authority. The additional questions had been arranged as a contribution to a study funded by the Engineering and Physical Sciences Research Council (EPSRC) undertaken by the University of West of England and University of Lancaster on "Travel time use in the information age" (Lyons, Jain and Holley, 2007; Holley, Jain and Lyons 2008). The survey covered 26,000 passengers, and achieved a 24% response rate. The pertinent questions were those on the number of activities that people spent some time on, and the one activity on which they spent most time. Although empirical data on the time spent working was not collected, it was important to the Virgin Trains study to find a way of estimating it.

Hitherto, time spent travelling for business had been deemed to be a means to an end, implying that nothing productive can be achieved until the end destination is reached. The second element of the Edinburgh Napier University study showed that this is a major misconception, as illustrated by the following key results.

(i) The proportion of business travellers that spend some time working

For train journeys of 1-3 hours in length, the NPS 2004 data showed that nearly seven out of ten business travellers (69%) were shown to be doing some valuable work (e.g. working on documents or studying) whilst on the train; and for two out of every five business travellers (41%), it was the one activity on which they spent most time. Data on mobile phone usage for work purposes available in the NPS study were not used, since no data on mobile phone use by car drivers were available, and it was important that the study ensured compatibility across the two modes being compared.

(ii) The percentage of journey time that business travellers spend working

Although the NPS questionnaire did not include a question about the amount of time spent working, the combination of the questions on the number of different activities, and the one activity on which most time was spent, allowed this to be estimated. The method developed by Edinburgh Napier University was a statistical process based upon geometrical probability, that of estimating the largest interval on a line when a line is divided into n parts (Kendall and Moran, 1963). This was applied to the NPS data and showed that, for journeys in the 1-3 hour range, 30% of the journey time was spent working by all business travellers (43% by those who spent some time working).

In contrast with the above approach, the survey conducted for the present study has obtained direct empirical estimates of the time spent working.

(iii) Impact on the net costs and benefits of the time spent travelling

Up until the Edinburgh Napier University study, the value (to the employer) of the productive use of travelling time had not been generally known, due to insufficient data and a lack of research in this area. A surprising finding from that study was that for the routes assessed the savings to the employer due to the productive use of time on trains in many cases cancelled out the cost of the train fares and other associated travel costs. This is illustrated as follows (where the travel costs quoted are for the public transport only option; a park-and-ride alternative showed similar benefits of productivity).

- Manchester-London, First Class: £85 fares cost became £9 net benefit; Standard Class: £36 fares cost became £19 net benefit
- Birmingham-London, First Class: £77 fares cost became £20 net cost; Standard Class: £30 fares cost became £4 net benefit; and for
- Manchester-Birmingham, First Class: £48 fares cost became £11 net benefit; Standard Class. £18 fares cost became £16 net benefit. (Source: Kirby et al, 2006, Table 25)

(Productivity gains obtained by employees using mobile phones were not estimated, in order to ensure equivalence of treatment with car drivers, for whom appropriate information on mobile phone usage was not available.)

Such an impact, if perceived by those making the modal choice decision, could affect modal choice and this would imply some changes in the way that demand forecasting is modelled. Such issues were however outside the scope of the present study.

2.2.6 'How to Value in-work-time crowding' (2007)

This study was undertaken for DfT by Oxera during 2006/7, reporting in January 2007. The study undertook a review of evidence of a number of research works, some of which have already been reviewed in this Chapter, but also including the use of the Passenger Demand Forecasting Handbook (PDFH). The study had a primary focus upon crowding, but did provide direct advice about value of working time on trains. It is interesting to note that the earlier Dutch studies do not appear to have been identified by Oxera, despite the HCG results being known and quoted.

In particular Oxera made the following summary and recommendations with relevance to our new study:

"crowding is important to IWT travellers, who value personal space and experience discomfort and impacts of their productivity on board the train, and at their destination following a crowded journey" (postulating that crowding effects may erode productivity at the workplace); and

"the current zero on-board productivity assumption and the cost-saving approach are flawed. They ignore personal welfare impacts and how these are reflected in wage bargaining".

Implicit in this latter remark is the implication that changes in transport facilities could result in changes in wage costs. This would in turn affect changes in industry profitability. Oxera do not mention this, but the obvious consequence would be that these should be taken into account in evaluating the benefits of the transport intervention.

The Oxera study concluded that a market research exercise was required to address the issues of the IWT valuation in particular of crowding. They suggested an SP based exercise, with a strong recommendation towards a pilot survey, which has been taken on board for this new DfT study.

2.3 Overview of reasons for a changed methodology

Given the above review of evidence, it is clear that there is considerable support for the need to review the current appraisal advice as contained in WebTAG unit 3.5.6. The current advice in the UK is based on the cost-saving approach, with cost calculated on a factor-cost basis (which is to say net of indirect taxation) and assumed to be represented by the wage of the traveller (plus on-costs such as pensions). This current approach is broadly that which was rejected in The Netherlands in the mid-80s, this being based on evidence derived from aggregate statistics based on national productivity changes in moving from a six-day working week to a five-day working week. The principles, however, were the same, it being assumed that travel was unproductive, that time saved from travel was returned to work, and that there was no reason to consider benefits to the travelling employee.

The Dutch experiment, repeated after ten years in 1997, confirmed that some travel time WAS productive (varying considerably between modes), that travel time reductions were NOT all returned to work, and that employee benefits could be measured using SP techniques, and were NOT negligible. The Dutch work made an advance by replacing the weakest parts of the original Hensher method with a new SP experiment, and thereby developed a practicable measurement tool. We would not expect the Dutch results to translate directly to the UK circumstance for a variety of reasons (details of the definitions of a 'business' trip and journey length distributions being very different), but we would expect the measurement methodology to be transferable.

Whilst extensions of the Hensher approach had been proposed and developed by HCG in the 80s, the present study extends these yet again. This follows suggestions made in the interim period, concerning the need to identify marginal productivity effects of changes in travel time, and of the impact of crowding.

Ultimately, the new DfT study should seek to replace the existing WebTAG advice with a set of practicable rules for calculating the costs/benefits of travel time lost/saved in rail journeys by non-commuters, non transport-workers, travelling 'in the course of work'. In the meantime, however, the existing WebTAG advice raises certain key issues, which are considered in the following sections.

2.3.1 WebTAG Comment 1: Definitions

The current advice that we are reviewing refers to “journeys made in the course of work”, excluding commuting. Those professionally engaged in the provision of transport, e.g. drivers of vehicles, are also excluded. However, the term “in the course of work” is of itself in need of elaboration, particularly given the flexibility in work hours that is now typical of business travellers. The idea of a fixed working day is now irrelevant; in the surveys we have chosen to identify those travelling “in the course of work” by whether or not the cost of the rail journey is either paid for or can be claimed from the employer/business. However, many of these trips are outside any normal historical working day, and many start or end at home. In taking this definition, we hope to be consistent with most of the forecasting models which would be providing scenarios and associated trip matrices to evaluate.

2.3.2 WebTAG Comment 2: Presentation of Cost-Benefit Results

It has been remarked above that one of the issues identified for consideration at the outset of the Dutch work was the advisability of reducing the impacts of transport interventions to the single unit of money – that is, questioning whether "value of time" might actually be more of a hindrance than a help to decision making. On this, we would note that there could be possible mis-representation of the costs/benefits of transport schemes by comparing figures obtained by multiplying time savings or losses by assumed VOTs, with GDP, as frequently occurs in transport appraisal. The issue is that time savings/losses are not convertible to money that can be spent on other items, they are purely a welfare effect. The 'cost-saving' approach to valuing IWT savings implied that, for this market at least, there was a solid economic impact to expected; actual productive resource would be released, real productive gains could be expected. The Dutch work, which has influenced the present study, suggests that IWT savings, like savings of time in leisure travel, have a large component of personal welfare gain. The argument for presenting money impacts and welfare impacts separately is reinforced by this.

2.3.3 WebTAG Comment 3: Commuters

The study reported here has multiple objectives, but the main one concerns the productive use made of train journeys. We note in passing that it is not just IWT travellers who make productive use of train travel time – many commuters also work during their journeys, as shown in the TRi study for Virgin Trains. This is not a focus for the SPURT project, but the impact this practice has on the evaluation of interventions should be considered further.

2.3.4 WebTAG Comment 4: Mode Specific VOT

It is considered that Section 1.2.6 of TAG Unit 3.5.6 may need to be reviewed in the light of the review of the background research. As it stands it is correct, being based upon the cost-saving approach, with the traveller indifferent between work and travel time. However, it would not be correct where the traveller experiences personal welfare gains/losses from the travel experience. It is quite obvious that the willingness of a traveller to pay for a travel time saving depends on the nature of the travel experience from which time is to be saved – and that that experience often varies between travel modes. People do not 'have' values of time. VOT is an artificial construct, useful to 'explain' choices in situations where time and money costs vary, but time is not actually saved or lost, it is just transferred from one activity to another. The VOT that can be inferred by observing choices depends on the relative marginal utilities of the activities involved in the transfer, and on the marginal utility of money to that traveller. There is every reason to expect, and ample evidence to prove, that the marginal (dis-) utility of travel differs between modes. The decisions of any rational traveller would exhibit a different VOT after switching modes, even if the marginal utility of the time saved was identical.

2.3.5 WebTAG Comment 5: Walking and Waiting Time

The same problem as in Comment 4 re-occurs in section 1.2.9 of TAG Unit 3.5.6. The current study has not been set up to look at walking and waiting time values, but in as much as IWT travellers experience personal welfare effects, differences between changes in in-vehicle time and walk/wait time can be expected.

2.4 Conclusions

The current approach to valuing IWT travel time savings/losses depends crucially on the cost-saving approach being correct. In turn, the cost-saving approach depends on key input assumptions:

- all saved travel IWT is returned to work by the business traveller;
- all travel time is unproductive (or that any productive travel time is so small as to be unaffected by any savings in travel time); and
- time savings do not affect the welfare of the business traveller or the cost of accomplishing the work.

These assumptions have been challenged before by experiments in The Netherlands, and again in the UK (the latter in the case of road-users, see Accent and Hague Consulting Group (AHCG), 1999). This new DfT study provides evidence that challenges them again, for the case of rail business travellers. If the cost-savings approach is shown to be no longer appropriate, much of WebTAG 3.5.6 would need to be re-written, and would also impact upon other modes of travel. One option would be to revisit the AHCG Report for information on car-drivers, and other studies be considered to provide some information on air travellers. The consequences of switching to the AHCG recommended values of VOT, based on the extended Hensher formula developed by HCG, are explored in Gunn and Worsley (1999)

3 Design and planning of surveys

3.1 Introduction

This chapter sets out the design process involved in defining a questionnaire able to meet the key requirements of the study brief.

3.2 Methodology of capture

At an early stage in the study process it was decided that the most efficient process for capture of respondents was to be by means of a self-completion train based questionnaire, with return provided via reply paid envelopes. Given that the main purpose of the survey was to enquire about activities being undertaken on the current trip, it was essential that the questionnaires did not actually affect the activity being undertaken, so it was planned that the questionnaire was completed after the journey.

Initially for the pilot surveys two forms of questionnaire were envisaged:

- those asking about the journey being made at the time of being handed the questionnaire; and
- those handed out to those on their return leg asking about the outward leg and hence able to be filled in whilst on the train.

The two different methodologies were planned to test for different responses as to how well data was retained after the trip was completed as opposed to completion on the train.

From experience gained during the pilot surveys very little evidence existed for a difference in behaviour, and given the fact that the two different forms involved twice as many questionnaire designs for the main surveys only the former type of questionnaire was used.

3.3 Distance bands

In order to reflect different travel conditions realistically, it was decided to adopt four different time bands for the SP surveys. These were based in part on evidence from the National Passenger Surveys (NPS). The bands adopted were:

- Less than 45 minute
- 45 minutes to 89 minutes
- 90 minutes to 149 minutes; and
- 150 minutes and more.

3.4 On-train scoping questions

In allocating the appropriate questionnaire to the respondent a set of scoping questions were asked covering:

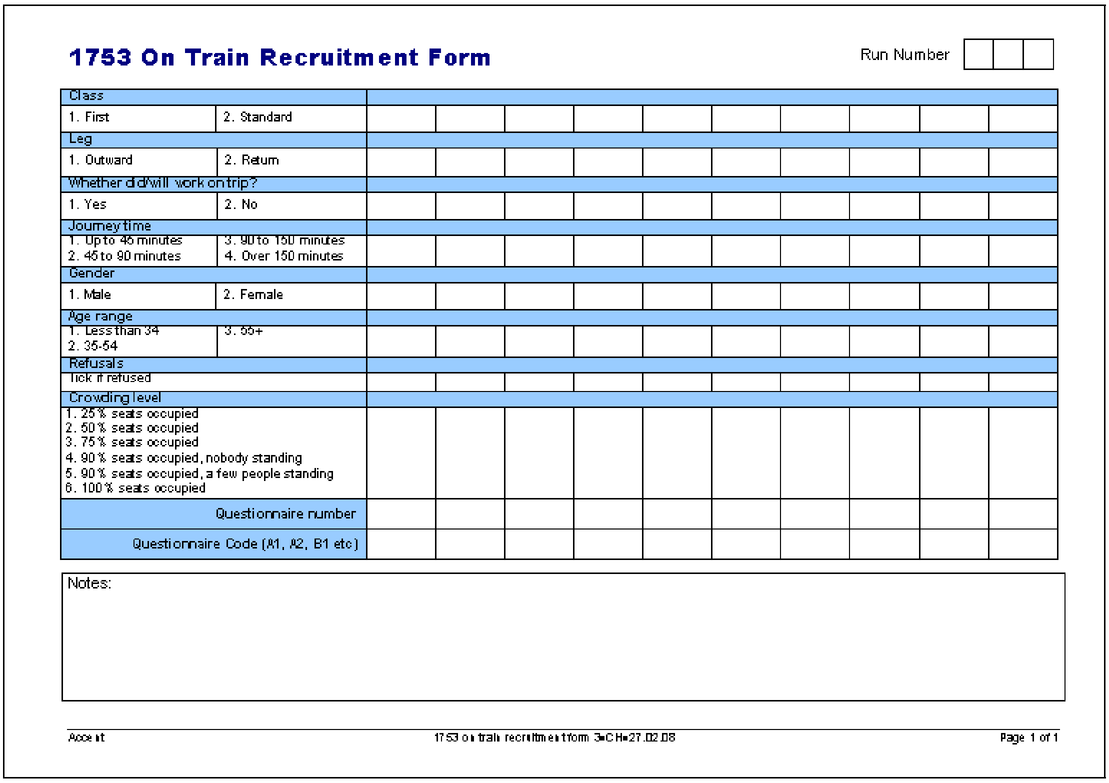
- class of travel;
- leg of journey;
- whether the respondent did/will work on trip;
- journey time on train;
- age (estimate);
- gender; and

- level of crowding.

These details were collected for all questionnaires distributed, and thus available to check for any bias between those who responded and those who did not.

A copy of the scoping questionnaire (or Recruitment Form), is shown below as Figure 3.1.

Figure 3.1: Recruitment Form



1753 On Train Recruitment Form

Run Number

Class											
1. First	2. Standard										
Leg											
1. Outward	2. Return										
Whether did/will work on trip?											
1. Yes	2. No										
Journey time											
1. Up to 45 minutes 2. 45 to 90 minutes	3. 90 to 150 minutes 4. Over 150 minutes										
Gender											
1. Male	2. Female										
Age range											
1. Less than 34 2. 35-54	3. 55+										
Refusals											
Tick if refused											
Crowding level											
1. 25 % seats occupied 2. 50 % seats occupied 3. 75 % seats occupied 4. 90 % seats occupied, nobody standing 5. 90 % seats occupied, a few people standing 6. 100 % seats occupied											
Questionnaire number											
Questionnaire Code (A1, A2, B1 etc)											

Notes:

Accent 1753 on train recruitment form 3=CH=27.02.08 Page 1 of 1

3.5 Format of questionnaire

The four different journey-length-based questionnaires were allocated the codes A to D. For each code there was further disaggregation to reflect the need to reduce the number of different SP games given to respondents. This lead to a total of 8 different questionnaire designs, as shown in Table 3.1:

Table 3.1: Questionnaire Design Codes

Design Code	Design length of trip
A1	Less than 45 minutes
A2	Less than 45 minutes
B1	45 to 89 minutes
B2	45 to 89 minutes
C1	90 to 149 minutes
C2	90 to 149 minutes
D1	150 minutes and more
D2	150 minutes and more

Each questionnaire was split into four sections, being:

- **Revealed Preference** section enquiring about the journey being made, including length of journey and levels of business related activities undertaken en-route;
- **Stated Intentions** section asking the respondent about the likely behaviour with respect to changes in train arrival/departure timings and extensions or reductions in the rail journey time;
- **Stated Preference** section posing scenarios regarding the personal benefits to be gained from time savings in the course of business travel, but also including valuations of crowding and mobile phone contact; and finally
- **Socio-economic** section enquiring about characteristics of the respondents, including employment category, occupation, age group, gender, car availability and personal and household income.

An example of the questionnaire as used is attached as Appendix A.

3.6 Revealed Preference Survey Design

In designing the revealed preference questions a key aspect was to ensure compatibility with the NPS in two respects. The first was to ensure that the sample could be expanded to reflect the main body of business rail travellers, this expansion being based on the Autumn 2007 wave of the survey. The second was to enable some comparison over time with the activity questions that had been included only in the Autumn 2004 NPS. Both sets of data were obtained from Passenger Focus. It should be noted that the results from the Spring 2008 wave of the NPS only became available in late July/early August 2008, as this report was being finalised, and therefore have not been taken into account in this study.

In addition, compatibility in terms of the terminology relating to the description of crowding was ensured relative to the concurrent MVA Crowding Research Study for DfT, this being achieved following a face to face meeting with MVA in December 2007.

3.6.1 Revealed Preference Survey design

This element of the questionnaire enquired about the key details of the rail journey just undertaken covering:

- Origin and destination station;
- Origin and destination purpose;
- Time of travel;
- Mode of access and egress;
- Journey cost;
- Who paid for the journey; and
- Group size.

Further questions were then asked about issues of crowding and ability to work en-route, along with which activities are carried out. The crowding questions used similar wording as in the MVA crowding study, but with some aggregation for situations where crowding was over 100% to reduce the length of the questionnaire.

Much thought was paid as to the best way of obtaining details about activities undertaken en-route, and where exactly in the journey they occurred. The solution adopted, which was proven to work during the pilot survey, was that of a timeline with respondents able to draw bars to show what part of the journey they worked on the train.

Further questions probed the work activities, with the question asked in a number of different manners to best recover the information. In particular a list of the main activities undertaken en-route and the activity undertaken more than anything else was based on the same format as that in the 2004 NPS to allow for comparison.

3.6.2 Stated Intentions section

This section of the questionnaire (Questions 33-36) was targeted to obtain information from the interviewee relating to behaviour were the train to be faster or slower – how much of this time saving/extension would translate into lost or gained working time on the train? The form of these questions was related to questions on the actual time spent working on this train, presented in a simplified format. The actual time variations offered depended on the actual journey duration, so for the shorter distance journeys decreases or increases of 10 minutes were presented, increasing to 20 minutes for the longest trips.

3.6.3 Stated Preference section

This section of the questionnaire was designed to establish the amount of welfare benefit to IWT travellers from journey time savings, and from travelling in different crowding conditions. The format adopted was that of the business traveller having an amount of money made available from a company with the traveller able to choose between spending this in total, or to save or pay money to achieve journey time extensions/reductions. In addition, varying degrees of crowding and quality of mobile phone contact were included in the design.

The stated preference survey itself was designed to cover the following variables with the listed levels of variation/choice:

- Cost – 4 levels of choices;
- Time – 4 levels of choices;
- Crowding – 4 levels of choices (expressed as % of seats taken);
- mobile phone contact – 2 choices being clear/poor for mobile phone; and
- Time and cost gains vs. losses: 4 levels of choice, as shown below.

A full orthogonal design was developed which produced 16 games per SP design. To reduce this to more manageable numbers for the questionnaire this required that the games were split into two separate groups of eight games, this leading to the need for 2 different questionnaires per SP design. The split was made so that each block of 8 is as internally orthogonal as possible. The order of the eight scenarios in each block was shuffled randomly. Also, for each scenario, the determination of which design alternative was designated as Option A (left side of the page) and which was Option B (right side of the page) was done randomly, so that any order-related bias (e.g. people tend to choose Option A because they read it first going from left to right) was not correlated with the attribute levels. The resulting designs are shown in Table 3.2 below.

Table 3.2: SP design permutations

Level	Fare A	Time A	Fare B	Time B
1	Current	Current	More expensive	Savings
2	Current	Current	Less expensive	Loss
3	Current	Savings	Less expensive	Current
4	Current	Loss	More expensive	Current

The questionnaire wording for the SP instructions was fairly standard, with one exception. In order to measure respondents' own valuations, it was necessary to stress that any cost savings or losses would accrue to them and not their employer. Respondents were therefore instructed to imagine that they had a travel allowance (a different level was used for each distance band), and that any fare difference above that would come out of their pockets, but that they could keep any fare savings below that. Such an arrangement may not be typical, but it is nevertheless quite easy to imagine and understand, and was proven to be understood in the pilot surveys.

To ensure a degree of relevance of the values presented in the SP games to that reported in the RP element of the questionnaire, four different SP designs were generated, covering the following rail journey time bands:

- Less than 45 minute;
- 45 minutes to 89 minutes;
- 90 minutes to 149 minutes; and
- 150 minutes and more.

Therefore, in total 8 different questionnaire designs (4 journey times x 2 groups of games per design) were required, covering design codes A1 through to D2. The different designs were administered by virtue of a clear colour coding system, each interviewer having packs of questionnaires personalised to the services which they were covering.

The inclusion of mobile telephone contact in the SP survey contact was made to help make for a more realistic selection of train facilities for business travellers. The exact need to value such contact was not certain, however the pilot showed a slight valuation of this and therefore it was carried through to the main SP design.

3.6.4 Socio-economic section

This final section of the questionnaire enquired about key salient details of the respondent covering:

- Employment category;
- Type of occupation;
- Age group;
- Gender;
- Car availability; and
- Personal and household income.

3.7 Selection of train services

The selection of train services to be surveyed was based upon a consideration of meeting a representative distribution of train services across the four different journey length bands, as well as differing geographical locations. In total thirteen different train operating companies were involved, which led to complex planning of surveys and obtaining permissions for each operator in turn. The exact routes and train operators are shown below in Table 3.3.

Table 3.3: Train surveys covered

Train Operator	Route	Nature of route
First Scotrail	Glasgow-Edinburgh/Dundee	Inter-urban
National Express East Coast	Newcastle/York/Leeds-London	Inter-City
First TPE & Cross Country	York-Newcastle	Inter-City
First Trans-Pennine Express	Manchester-Leeds	Inter-urban
First Trans-Pennine Express	Manchester-Preston-Blackpool/Barrow/Windermere/Scotland	Inter-urban
Northern	Manchester-Preston/Blackpool	Urban
Virgin Trains	Preston/Liverpool/Manchester-London	Inter-City
Cross Country	Bristol-Cheltenham-Birmingham	Inter-City
East Midlands Trains	London-Nottingham/Derby/Sheffield	Inter-City
First Great Western	London-Oxford	Outer-suburban
First Great Western	London-Bristol/Cardiff	Inter-City
National Express East Anglia	London-Harwich/Clacton/Norwich	Outer-suburban/Inter-City
Chiltern	London-Banbury-Birmingham	Outer-suburban
Southern	London-Brighton/Lewes	Outer-suburban
South West Trains	London-Southampton/Poole/Weymouth	Outer-suburban
First Capital Connect	London-Brighton	Outer-suburban

The selection process included assessing the likelihood of encountering crowding on train services used by business travellers, as well as aiming for a mix of short, medium and long distance journey possibilities. Given the crowding which exists when ticket conditions restrict when one can go into or out of London, train services were targeted where business travellers would be likely to be forced to stand. Examples of this were surveying trains immediately before the 15:30 saver ticket ban out of Euston on weekdays, as well as the post 11:00 arrivals into Euston from the north. Similar crowding occurs at Kings Cross and Paddington, where walk-on fare business travellers face crowding problems without seats being reserved, and so services were targeted from these stations as well.

A second set of selection criteria covered the likely peak demand services for business trips, with again popular times of arrival into London key. As such, services arriving close to the 10:00 peak time were targeted for surveys, as well as the mid afternoon return services.

3.8 Prize draw

To assist in achieving a good level of response to what was a potentially complex questionnaire a prize draw was attached with a single prize of £500. As will be observed in the next chapter, the response rate obtained was beyond that originally envisaged, no doubt assisted by the inclusion of this inducement.

3.9 Conclusions

The design and planning of the surveys and questionnaires was a highly detailed process involving liaising with a multitude of train operators as well as a design of complex survey split into four distinct sections. A detailed design process was undertaken for the different sections, with a major pilot survey undertaken to test and improve upon the design. Lessons were learnt from this pilot stage, which were then translated into the main survey design, including that of simplifying the format of the questionnaires handed out and removing the different designs by outward or return leg.

The exact question wording for the Stated Intensions and Stated Preference sections, key elements of input to this study, were thought through in detail to check that they would generate the outputs required to address the study questions. The pilot surveys again proved that the methods adopted were successful.

4 Execution of Surveys

4.1 Introduction

This Chapter describes the detailed process of undertaking the main data collection exercise, and provides a brief review of the execution of the pilot surveys.

4.2 Pilot surveys

The pilot surveys were planned to generate a minimum of 100 completed questionnaires, which when based upon the assumed return rate of 25% (as specified in the original study proposal), required a total of 400 questionnaires to be distributed.

At the planning stage it was assumed, based upon experience of similar surveys, that it would be possible to distribute between 48 and 62 questionnaires per shift, giving a total of 528 questionnaires distributed over 10 shifts. In practice 623 questionnaires were distributed over the 3 days and 10 shifts.

The Interim Study report (March 2008) provided full details of the results from the pilot surveys, but a summary of these are presented in Table 4.1 below for completeness.

Table 4.1: Distributed pilot questionnaires

TOC	Shift No.	Target	Achieved
First Great Western	1	62	57
	2	53	56
	3	61	65
	4	48	71
	Sum	*224*	*249*
Trans-Pennine Express	1	49	62
	2	49	60
	Sum	*98*	*122*
South West Trains	1	52	64
	2	51	54
	3	52	93
	4	51	41
	Sum	*206*	*252*

4.2.1 Survey Response Rates

As of 7th March 2008, a total of 204 questionnaires had been returned from the total of 623 distributed, representing a response rate of 33%, much better than the 25% expected. A breakdown of the totals returned is shown in Table 4.2, which shows that 83% of the questionnaires were received within 4 working days after the last survey (13th February 2008).

Table 4.2: Returned response rate (Pilot survey)

Date Received	Received A - D	Received E – H	Running Total
06-Feb-08	19	7	26
07-Feb-08	25	12	63
08-Feb-08	24	15	102
11-Feb-08	24	13	139
12-Feb-08	13	4	156
13-Feb-08	10	3	169
14-Feb-08	5	1	175
15-Feb-08	4	1	180
18-Feb-08	3	2	185
20-Feb-08	2	0	187
21-Feb-08	4	0	191
22-Feb-08	2	0	193
25-Feb-08	1	0	194
26-Feb-08	3	1	198
28-Feb-08	1	0	199
29-Feb-08	2	0	201
05-Mar-08	1	0	202
07-Mar-08	2	0	204

Note: surveys undertaken on 5th, 6th and 7th February 2008

The breakdown of responses by questionnaire type are shown in Table 4.3:

Table 4.3: Returned questionnaires by type (Pilot survey)

Survey type	Type of questionnaire	Length of trip (mins)	No.
A	Current leg of trip	Less than 45	29
B	Current leg of trip	45 to 89	59
C	Current leg of trip	90 to 149	41
D	Current leg of trip	150 and more	16
E	Outward leg on return	Less than 45	14
F	Outward leg on return	45 to 89	22
G	Outward leg on return	90 to 149	18
H	Outward leg on return	150 and more	5
Total			204

4.2.2 Refusal rate

Only three per cent of potential recruits refused to take a questionnaire.

4.3 Main surveys

The main surveys were undertaken between 18th and 19th March 2008 and then, following Easter, between 7th and 25th April 2008. In total, 91 shifts were scheduled covering 380 weekday trains. The rosters of trains covered are included as Appendix B.

The methodology involved the distribution of self-completion questionnaires to business travellers in First and Standard Class. Interviewers started at either end of the train and approached a random sample of respondents in the carriage (i.e. every 4th passenger on one side of a carriage if busy or every 2nd passenger if quiet). They swapped sides when they entered the next carriage. On longer trips (i.e. one hour or more) not all the self completion questionnaires were handed out in one go. A half or a third were distributed at the beginning of the trip and then another half or third later on, so that passengers at intermediate stations had a chance of being sampled. Interviews did not take place in restaurant cars.

Potential respondents were asked what the main purpose of their rail journey was. If it was between their home and usual place of work, for leisure or any other non work purpose the interviewer thanked them and moved on to the next potential respondent.

If they were on employer's business (including self employed) they were then asked about the leg of journey, whether they were planning to work on the journey and the scheduled journey time on train. This information was recorded on a Recruitment Form (see Figure 4.1). The interviewer also recorded the crowding level of the carriage, the gender and an estimate the age of the respondent. The respondent was then offered a questionnaire based on their journey time. If they refused this was recorded. If they agreed, the pre-printed questionnaire number and the questionnaire code (i.e. A1, A2, B1 etc) was also recorded on the Recruitment Form.

Figure 4.1: Recruitment Form

1753 On Train Recruitment Form

Run Number

Class											
1. First	2. Standard										
Leg											
1. Outward	2. Return										
Whether did/will work on trip?											
1. Yes	2. No										
Journey time											
1. Up to 45 minutes 2. 45 to 90 minutes	3. 90 to 150 minutes 4. Over 150 minutes										
Gender											
1. Male	2. Female										
Age range											
1. Less than 34 2. 35-54	3. 55+										
Refusals											
Tick if refused											
Crowding level											
1. 25% seats occupied 2. 50% seats occupied 3. 75% seats occupied 4. 90% seats occupied, nobody standing 5. 90% seats occupied, a few people standing 6. 100% seats occupied											
	Questionnaire number										
	Questionnaire Code (A1, A2, B1 etc)										

Notes:

Accent 1753 on train recruitment form 3=CH=27.02.08 Page 1 of 1

Interviewers distributed 5,035[25] questionnaires on-train, with a total of 1,660 returned by the cut off date of 30th April 2008. Since that date a further 104 questionnaires were received (up to 15th May 2008), giving an overall response rate of 35%.

Table 4.4: Returned response rate (Main survey)

Date Received	Received	Running Total
19-Mar-08	9	9
20-Mar-08	37	46
25-Mar-08	54	100
26-Mar-08	21	121
27-Mar-08	8	129
28-Mar-08	8	137
31-Mar-08	2	139
01-Apr-08	8	147
02-Apr-08	2	149
03-Apr-08	1	150
04-Apr-08	2	152
07-Apr-08	2	154
08-Apr-08	10	164
09-Apr-08	29	193
10-Apr-08	54	247
11-Apr-08	62	309
14-Apr-08	80	389
15-Apr-08	70	459
16-Apr-08	109	568
17-Apr-08	114	682
18-Apr-08	136	818
21-Apr-08	139	957
22-Apr-08	130	1,087
23-Apr-08	110	1,197
24-Apr-08	117	1,314
25-Apr-08	75	1,389
28-Apr-08	137	1,526
29-Apr-08	90	1,616
30-Apr-08	44	1,660

The breakdown of responses by questionnaire type are shown in Table 4.5.

[25] The recruitment sheets from two shifts were lost in the post. The number of questionnaires received from those two shifts is 9 implying that about 30 were handed out. Therefore, we estimate that the overall number of questionnaires handed out was about 5,065

Table 4.5: Returned questionnaires by type (Main survey)

Survey type	Length of trip (mins)	No.	%
A	Less than 45	233	14
B	45 to 89	777	47
C	90 to 149	475	29
D	150 and more	175	11
Total		1,660	100

The response rate by distance band shows a clear correlation between the response rate and the time on train:

- A (less than 45 minutes) 29%
- B (45-89 minutes) 34%
- C (90-149 minutes) 37%
- D (150 minutes and more) 40%

4.3.1 Recruitment Data

On two of the 91 shifts (covering six trains) the recruitment sheet was not returned. From the data received there were 5,693 potential respondents. There were 240 refusals (4%) and on some shifts interviewers ran out of the appropriate distance band questionnaire and therefore could not hand out a questionnaire. In total 431 (8%) in scope respondents could not be given a questionnaire (4 Type A, 90 Type B, 188 Type C and 149 Type D). Removal of these records provides the total available dataset for analysis formed of 5,035 records.

A comparison between the data for those who were handed questionnaires[26] based upon details of 5,035 questionnaires distributed and the data from the 1,660 returned questionnaires is shown in Table 4.6.

[26] Except for two shifts where we did not receive the recruitment data

Table 4.6: Comparison between handed out and returned questionnaires

Segmentation	Distributed (%)	Returned (%)
Class of travel		
First	22	23
Standard	78	77
Leg of journey		
Outward	51	50
Return	49	50
Did/Will Work		
Yes	59	81
No	41	19
Journey Time		
Less than 45 minutes (design A)	17	14
45 to 89 minutes (design B)	46	47
90 to 149 minutes (design C)	27	29
150 minutes and more (design D)	10	11
Gender		
Male	70	71
Female	30	29
Age		
Less than 34	24	20
35-54	59	59
55+	16	21
Crowding (compared to crowding when respondent boarded)		
25% seats occupied	30	30
50% seats occupied	23	26
75% seats occupied	19	20
90% of seats occupied nobody standing	13	13
90% of seats occupied a few people standing	7	4
100% of seats occupied	9	8

Reviewing the results shown in this table it can be seen that there was a very good match between the questionnaires handed out and those returned by the characteristics collected. In particular, there were very close matches between class, gender, leg of trip and crowding. There were less close matches with respect to age and distance travelled: the oldest age group were most likely to respond and those on longer journey times were more likely to respond.

However, there may be seen to be a major difference with respect to working on train. It seems that those who worked on the train were much more likely to respond than those who didn't. An analysis of the recruitment data compared to the questionnaires returned for 1,470 matched records showed that 51% who said that they would work did in fact work (as recorded in Q30 of the questionnaire) and a further 7% who said they would not work, did in fact not work. However, 31% who said they would **not** work, did in fact work and 12% said they would work did not do so in practice. Further discussion about the definition of work undertaken on the train is provided in Chapter 5; and section 5.4.1 resolves the question raised here about the difference between respondents and non-respondent.

4.4 Data validation

This survey was unusually rich in the variety of questions that could be used to test internal self consistency. Therefore a number of validation tests were undertaken that went beyond those routinely carried out by in analysis. These included the following tests:

- Journey time estimates;
- Activities undertaken during journey; and
- Amount of work undertaken.

Full detail of the data validation undertaken is described in Appendix C to this report.

4.5 Data Expansion to National Passenger Survey data

4.5.1 Initial comparisons with Autumn 2007 NPS data

As already shown in Table 4.6, the questionnaires returned corresponded well with the distribution of questionnaires to answers, with only a small difference evident for the age group responses and an obvious disparity for those saying that they did/will work on the train (the latter issue has already been commented upon). However, as a prelude to expanding the data to be representative of national rail travel for business purposes, checks were carried out to see whether the selection of rail services and passengers interviewed corresponded well with those in the NPS dataset for business travellers. The Wave 17 (Autumn 2007) dataset was analysed over certain key headings and compared to the proportions obtained from the Value of Working Time returned surveys, with the results shown in Table 4.7.

Table 4.7: Pre-expansion comparison with 2007 National Passenger Survey data

	Percent of those on employer's business or self-employed	
Segmentation	SPURT 2008 (%)	NPS 2007 (%)
Leg of journey		
Outward	50	56
Return	50	44
Journey Time (for bands used in the survey design)		
Less than 45 minutes	14	51
45 to 89 minutes	47	31
90 to 149 minutes	29	16
150 minutes and over	11	2
Gender		
Male	71	61
Female	29	39
Age		
Less than 34	20	19
35-55	59	57
55+	21	24

4.5.2 Expansion process

The comparisons made in Table 4.7 showed the need to develop expansion factors to enable the expanded data to be more representative of national travel. Had this been a scientific experiment, statistically controlled, the principles for developing the weights used would have been entirely determined by the sampling procedure, but in common with other surveys of this kind the sample design was not the only consideration. The expansion procedure has also to take account of the availability of appropriate data to which to "gross-up" the survey data, and of the relative importance of achieving compatibility with other (national or regional) data. Several sets of expansion factors were therefore derived, using a number of criteria, and their use tested on the data-set. All used the Autumn 2007 wave of the NPS as the basis for the expansion, since the more contemporary data from the Spring 2008 wave did not come available until the closing stages of the study.

Full detail of the process involved is described in Appendix D. However Table 4.8 displays the final expansion factors adopted.

Table 4.8: Expansion factors in final set (D2O3T4aC)

Occ_Band	**JT_Band**	**Direction of Travel**		
		Outward	Return	Missing
Professional/Senior managerial	15-44 mins	357.0	227.9	284.1
	45-89 mins	64.6	52.8	59.4
	90-149 mins	26.1	31.7	28.6
	150 mins and over	20.8	36.4	28.8
	Missing	75.2	68.0	72.0
Middle managerial/technical	15-44 mins	297.6	162.5	220.8
	45-89 mins	111.2	57.7	79.6
	90-149 mins	32.3	19.1	25.9
	150 mins and over	19.4	21.8	20.6
	Missing	96.0	58.7	75.7
Junior/Manual/Other	15-44 mins	198.7	232.5	331.4
	45-89 mins	198.7	63.5	83.3
	90-149 mins	46.6	70.5	59.3
	150 mins and over	24.7	40.3	31.5
	Missing	140.2	109.6	124.1
Missing	15-44 mins	78.9	78.9	78.9
	45-89 mins	78.9	78.9	78.9
	90-149 mins	78.9	78.9	78.9
	150 mins and over	78.9	78.9	78.9
	Missing	78.9	78.9	78.9

4.6 Conclusions

The survey process obtained a high level of response, with a total of 1,660 completed questionnaires returned out of a total of 5,035 distributed, a response rate of 33%.

Comparison between scoping data collected at the time of distribution and the returned sample obtained shows little evidence of any bias, with the exception of an obvious issue over the proportions stating that they worked during the journey. Further analysis on this matter is considered in Chapter 5 of this report.

Validation has been carried out using checks across multiple questions, with any contradictions/conflicts examined and used to define new composite variables in some cases for further analysis.

A detailed analysis of NPS data has led to the development of a detailed set of expansion factors segmented by employment type and journey length.

5 Revealed Preference Analysis

5.1 Introduction

In this chapter we present the results of analysing key aspects of the Revealed Preference (RP) questions. This is based upon the cleaned dataset of 1,660 valid returned records, with the final set of expansion factors described in Appendix D applied.

The analysis here covers two principal features:

- Analysis of travel and traveller characteristics, covering:
  - Purpose and locations of travel (section 5.2.1)
  - Journey length information (section 5.2.2).

(Some socio-economic characteristics of the respondents were summarised in Table 4.6.)

- Analysis of use of travel time, covering:
  - The need to distinguish between the proportion of travellers who do some work and the percentage of time that they spend working (section 5.3)
  - Number of activities undertaken en-route (section 5.4)
  - The amount of time spent working (section 5.5);
  - The impact of crowding (section 5.6) and
  - Timing of work related activities (section 5.7).

The principal conclusions are highlighted in section 5.8. The results obtained provide necessary context for the study as a whole. For example, they show the extent to which business travellers are now working on trains; and demonstrate the growth in that activity since 2004. The main factors that influence that activity are determined; and difficulties discerned in determining the influence of some other factors, such as crowding level. The RP data provide the baseline that determines how the data collected in the Stated Intentions exercise (Chapter 6) should be analysed and interpreted: for example, a hypothesised 15 minute change in scheduled journey time is related to the journey time of the actual trip recorded, and estimates from the Stated Intentions survey of how much longer it would take if the work on the train were to be done in the office draw on the Revealed Preference data in the calculation of a 'Relative Productivity' factor[27]. Together, these data sources lead to Employer-related estimates of the Value of Time Savings; which, together with the Employee-related estimates derived from the Stated Preference results in Chapter 7, lead to the conclusions concerning Value of Time Savings for business journeys in Chapter 8.

5.2 Travel and traveller characteristics

5.2.1 Purpose of travel

The purpose of the business trips by the 1,660 respondents is shown in Table 5.1 for outward and return legs separately (by cross-tabulating Q1 and Q2 of the questionnaire).

[27] See Appendix F for the definition.

Table 5.1: Purpose of trip by direction of travel

		Percent of all business travellers, expanded data		
Q2. What is or was the **main** purpose of your business trip?		Q1. Are you on the outward or return leg of your business trip?		Total
		Outward	Return	
	Visiting a branch office for management purposes	14%	13%	14%
	Visiting a client	19%	19%	19%
	Attending a business meeting	42%	39%	41%
	Attending a seminar, course, etc	11%	16%	13%
	Delivering or picking up supplies	2%	1%	2%
	Other (please write in)	11%	11%	11%
Total		100%	100%	100%

For both directions of travel, “attending a business meeting” was the dominant purpose, followed by “visiting a client”. Further analysis was made of the origin and destination locations/purposes to substantiate the findings in Table 5.1. This is shown in Table 5.3.

As the table shows other workplace of employer and client/customer workplace dominates, with meetings obviously dominating the employer’s business activities.

5.2.2 Journey length information

An analysis of the journey length reported from the questionnaire (based upon responses from questions 26, and 29), provides the results shown in Table 5.2. As may be noted, with the dataset expanded to the NPS survey dataset, the majority of trips occur in the shortest distance band, up to 45 minutes in duration. Those over 150 minutes (2 hours 30 minutes) in journey times were few in number – this covers such trips as Preston-Euston and Newcastle-Kings Cross. These trips have increasingly been eroded by air and therefore such a low proportion of business trips by rail would be expected.

Table 5.2: Length of rail journey – percentage of respondents (expanded)

Length of journey	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
Less than 45 minutes	40%	45%	43%
45 mins to less than 90 mins	43%	32%	38%
90 mins to less than 150 mins'	14%	17%	15%
150 mins and over'	3%	6%	4%
Total	100%	100%	100%

The effect of journey length on the amount of work is an important consideration in this study, and before examining that we will consider in the next section the dependent variables that should be analysed.

Table 5.3: Origin and destination location types (unexpanded)

		Q11. Thinking about this/the outward leg of your business trip, what type of location are you going to?							
		Home	Usual workplace	Another workplace of employer	Education/Training/ Conference centre	Client/ customer workplace	Hotel/ guest house/ restaurant	Other type of location	Total
Q3. Thinking about this leg of your business trip, what type of location did you start from?	Home	70	56	176	95	183	66	73	717
	Usual workplace	38	30	55	16	52	26	26	242
	Another workplace of employer	107	18	21	1	5	12	5	170
	Education/Training/ Conference centre	60	10	1	3	0	1	7	82
	Client/customer workplace	148	74	7	0	23	8	4	265
	Hotel/guest house/restaurant	48	11	11	3	7	18	5	103
	Other type of location (please write in)	27	16	14	10	4	3	7	80
Total		500	214	283	126	275	133	129	1,660

5.3 Prelude: on the averaging process and the dependent variables

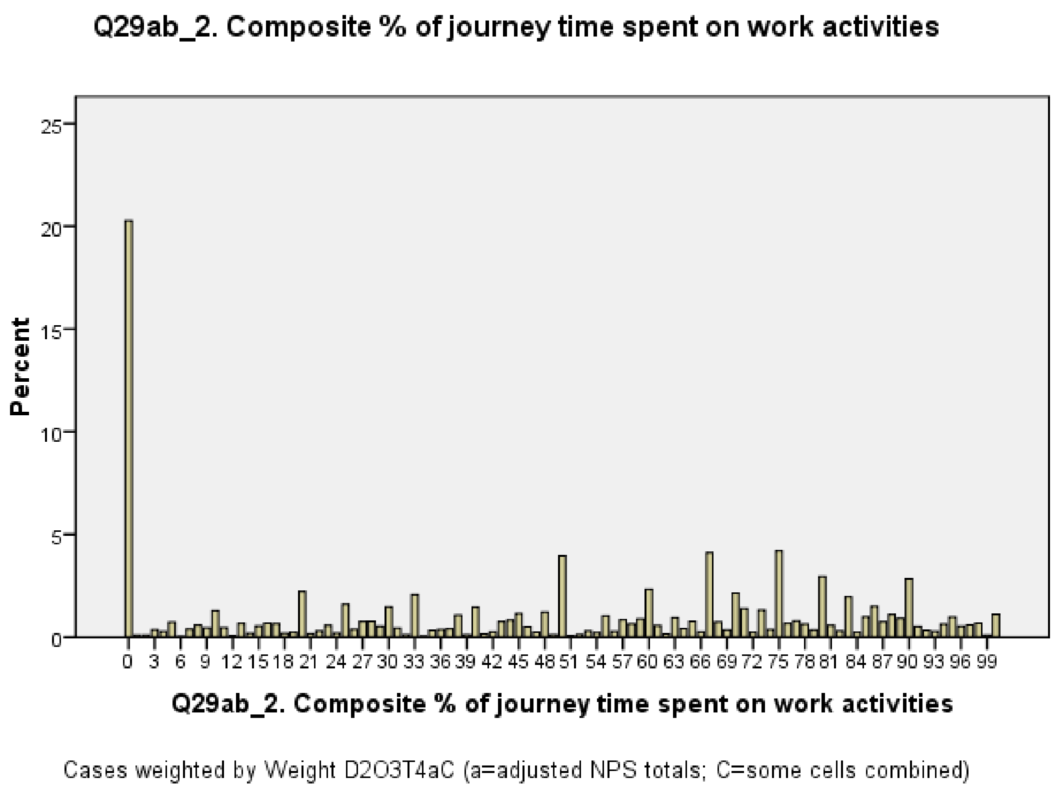
The analysis of activities and of the time spent working on them is based on the precept that, for explanatory/forecasting purposes, two types of dependent variables should be considered, these being:

- the proportion of business travellers who spend some time working; and
- the percentage of journey time which business travellers spend working, given that they do some work.

even though, in a practical application, it will be the product of the two that will be needed in order to estimate the proportion of journey time that all business travellers spend working.

There are two reasons for adopting these two measures. The first is the rationale, that the factors that affect whether someone works or not may differ from the factors that affect how long a person works. The second is the empirical evidence that two processes are at work. This is illustrated by the minute-by-minute frequency distribution of the recorded percentage of time spent working as derived from question 29, given in Figure 5.1. This clearly shows that the frequency of trips in the "zero percentage" interval is very different from those in any other interval of unit percentage width.

Figure 5.1: Frequency distribution of percentage of time spent working



It is important therefore to bear in mind throughout this report that estimates of the average percentages of time that business travellers spend working are for those that do some work; an average across all business travellers will be very much less. This is illustrated for three Occupation bands and over all the data in Table 5.4. Here, as in the above Figure, the basic variable, the percentage of the journey time that was spent working, is the composite variable (Q29ab_2) described in Appendix C. The first data column shows the average values for this variable (once expanded to NPS totals) when averaged over all business travellers; and the second when averaged across only those who spent some time working (that is, for those for whom Q29ab_2>0, or, equivalently, Q29ab_2_YN=1). Overall, the average is 46% of the journey time across business travellers, but 57% for those who spent some time working.

Strictly speaking, the average should be not an average of the reported percentages, as these are, but a time-weighted average (given by total minutes working / total minutes journey time for each category). However, the last column in this table shows that (for those who spent some time working) the time-weighted average is not very different from the average of reported percentages, and so, for simplicity, the latter is used in subsequent tabulations unless stated otherwise. (any difference between the two will of course become even less when the data are disaggregated by journey-time band.)

Table 5.4: Effect of different averaging processes on the percentage of time spent working

			Percentages, expanded data
OccBand1	Q29ab_2. Composite % of journey time spent on work activities		
	Averaged over all business travellers	Averaged over those who spent some time working	Time-weighted average for those who spent some time working
Senior management	51%	61%	61%
Middle management	40%	53%	55%
Junior management/Manual/Other	31%	47%	45%
Overall average	**46%**	**57%**	**58%**
Unweighted Count	1,614	1,364	1,359

Note: Totals may differ between tables due to missing data items for analysis

The above table is indicative of variations in the percentage of time spent working, which are explored further in section 5.5. But first it is worth exploring the activities undertaken in travelling, including the proportion of respondents who report some time spent working.

5.4 The activities undertaken whilst travelling

Up to 13 different named activities could be ticked by the respondent at Q27, as ones they had done or intended to do on the train, and one of these could be singled out (in Q28) as the one activity on which they spent most time. The structure mirrored that used in the Autumn 2004 NPS, but for reasons of compatibility with other questions in the survey, some changes in the wording of these activities and in their number were made. However, comparisons are still possible, and this is made in section 5.4.1, before discussing the results of the present study in greater detail.

As noted earlier, when comparing the present survey with NPS (or other surveys) the acronym used for this new study is SPURT 2008 (SPURT = Study of the Productive Use of Rail Travel-time).

5.4.1 Changes over time: preliminary comparisons with NPS 2004

Five of the named activities in SPURT 2008 related to work, and these may be related to equivalent questions in the Autumn 2004 NPS as follows.

A positive response to any one or more of the three activities

- Working related to employment (reading/writing/typing/thinking) [Q27_01];
- Studying related to employment (reading/writing/typing/thinking) [Q27_02];
- Working/studying unrelated to employment (reading/writing/typing/thinking) [Q27_03];

has been taken to equate to a response to the single NPS 2004 activity [in their Q44] “Working/studying (reading/writing/typing/thinking)” in respect of the proportion of business travellers answering this question.

The activity “Text messages/phone calls – work related” is taken to be the same in both surveys.

The activity in the NPS 2004 survey of “Talking to other passengers” has been equated to a response in SPURT 2008 to one or other or both of the activities:

- Talking to other passengers – work related [Q27_04]
- Talking to other passengers – personal-social [Q27_05].

On the above like-for-like basis, the proportion of business travellers reporting these activities in the two surveys (after expansion of the sample data of each to a national figure) are given in Table 5.5. There is little change in the proportions reporting that they talked to other passengers, but the changes in the proportions reporting work/study activity and making/receiving text messages/phone calls are significant. Over the 3½ years difference in the timing of the two surveys the changes correspond to growth rate of 12% per annum in the proportion of those working/studying and 19% per annum in the proportion of those undertaking text messages/phone calls (as noted in 5.3, the term “proportion” is generally used when referring to people, and “percentage” when referring to journey-times, to reduce the risk of confusing similar values).

Table 5.5: Changes over time in the proportion of all business travellers undertaking work activities

	Proportion, expanded data	
Activity	NPS 2004 (Autumn)	SPURT 2008 (Spring)
Working/studying (reading/writing/typing/thinking)	0.52	0.76
Text messages/phone calls – work related	0.22	0.41
Talking to other passengers	0.13	0.15
Sample count	4,063	1,655

NPS = National Passenger Survey; SPURT = Study of the Productive Use of Rail Travel-time

It must of course be remembered that the 1660 respondents to the SPURT questionnaire were only a 33% sample of the 5035 who took the questionnaire. The differences in characteristics of the respondents and non-respondents, analysed in Table 4.6, showed near equivalence in socio-demographic and travel characteristics but a clear difference in their response to the scoping question “Did you/ will you work on the train?”, with 81% of respondents indicating that they intended to but only 59% of non-respondents saying so. However, the subsequent analysis of 1,470 matched recruitment records and returned questionnaires, imply otherwise. For since:

- 51% who said they would work did in fact work (as recorded in Q30);
- 7% who said they would not work, did in fact not work;
- 31% said they would not work, but in fact did; and
- 12% said they would work but did not

this implies

- of those who said they would work, the proportion who did is 51/(51+12) = 0.81; and
- of those who said they would not work, the proportion who did is 31/(31+7) = 0.815.

It is not unreasonable to assume that these proportions would also apply to the set of non-respondents. Therefore the conclusion is reached that there is no evidence for supposing that the set of non-respondents would have a different *actual* work profile on the train than respondents, whatever their preliminary indications of intention might be.

It is however possible that the fact that SPURT was explicitly targeted on business travellers may have resulted in a different take-up than those who happened to be travelling on business when handed the NPS questionnaire at their boarding station

It should be noted that for the comparisons in this section, the “worked or not” responses to the first activity in Q27 of SPURT were those originally supplied, rather than the supplemented values that were adopted in the data validation phase. This was to ensure consistency across the two data sets.

It should also be noted that elsewhere in this report a different basis is used for estimating the proportion of business travellers undertaking work. This is because, unlike NPS 2004, SPURT 2008 captured data on the actual amount of time spent working; and it concluded that the evidence of the amount of time (in minutes or as a percentage of journey time) spent working was a more reliable indicator than ticking an “activities undertaken” check box. The development of this indicator variable (Q29ab_2_YN) is described in Appendix C; see also section 5.4.4.

5.4.2 Number of different activities undertaken en-route

The distribution of the number of different activities on the train is shown below in Table 5.6, based upon the response to question 27 for those reporting the time they spent working on the train (as noted at the conclusion of the previous section).

Table 5.6: Distribution of number of activities undertaken by working business travellers

			Percentage, expanded data
Number of activities undertaken (the number ticked in Q27)	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
1	7%	8%	7%
2	28%	22%	26%
3	25%	23%	24%
4	21%	22%	21%
5	12%	14%	13%
6	3%	8%	5%
7 or more	5%	4%	5%
Total	100%	100%	100%
Average number of activities	3.3	3.5	3.4

The majority of respondents undertook between 2 and 4 different activities en route, with an average of 3.4, and very little difference by direction of travel.

The average number of activities undertaken by those who spent some time working during their journey was also analysed by a simple aggregation of the rail service used. Thus, a Cross Country service would fall; under “Interregional-non London” whilst a London-Brighton service would be classified as “Interregional-London”. The results are shown in Table 5.7.

Table 5.7: Average number of activities undertaken by working business travellers, by type of rail service

	Mean, expanded data
Type of rail service	Average no. of activities
Intercity	3.7
Interregional-London	3.3
Interregional-non London	3.2
Suburban-London	3.3
Suburban-non London	2.9
Overall	3.4

Clearly, intercity services had a much higher number of different activities undertaken by those who spent some time working, possibly due to the longer distances travelled and the internal characteristics of the train.

The distribution of the number of different activities for those whose main activity is work (as given here by Q28) would provide a way of estimating the amount of time spent working in a similar manner to that used in the Virgin Trains report for the Autumn 2004 NPS data (which had no empirical data on the time spent).

5.4.3 Nature of the work activities undertaken on the train

The nature of the work activities undertaken on the train were investigated further using the responses to question 30. This question was designed to focus on those work activities that were related to the traveller's employment, but in-depth examination of the responses suggests that this focus may not have been taken in all cases. Table 5.8 shows the forms of work related activities undertaken during the rail journeys by length of journey by those who did not by-pass the question (as indicated in the first response to Q30).

Table 5.8: Work related activities by business travellers, by trip length

	Percentage of those answering Q30, expanded data				
Q30: Of those working, work activities related to employment included…	Length of trip				
	Less than 45 mins	45 to 89 minutes	90 to 149 minutes	150 mins and over	Overall
Preparing for a meeting	29%	43%	44%	37%	38%
Making/receiving calls	41%	44%	45%	53%	43%
Talking to colleagues/other	8%	14%	13%	17%	12%
Use of a laptop	12%	27%	36%	37%	23%
Use of a PDA/Blackberry	23%	25%	27%	26%	25%
Other work related to employment	37%	34%	38%	42%	36%

It should be noted that question 30 was not exclusive in its classifications. Overlap could and did occur between the different categories of such responses as “prepare for a meeting” and “work on company business”. Personal Digital Assistants (PDAs) such as a Blackberry may also serve as a phone, so there may also be some overlap with the response on “making/receiving calls”. The main activities recorded were preparing for a meeting and making or receiving telephone calls or text messages. Talking to others was a minority activity, reflecting the lack of group travel observed by interviewers during the surveys.

Considering the variability of activities by length of journey, it is clear that shorter distance trips limit the scope for undertaking productive work beyond that of making/receiving telephone calls. More in-depth activities such as preparing for a meeting, talking to colleagues/others or using a laptop suffer over shorter journey lengths.

Further analysis based upon direction of journey, as shown in Table 5.9, provides evidence that “making or receiving calls” and “other work related to employment” dominates the return leg of journeys, with much lower levels of preparing for meetings undertaken on the way home as would be expected! Overall, communication related activities (telephone, PDA, Blackberry) are more dominant activities on the return leg than on the outward.

Table 5.9: Work related activities undertaken by business travellers, by trip length

	Percentage of those answering Q30, expanded data				
Q30: Of those working, work activities related to employment included…	Length of trip				
	Less than 45 mins	45 to 89 minutes	90 to 149 minutes	150 mins and over	Overall
Outward journey					
Prepare for a meeting	42%	56%	63%	59%	52%
Make/receive calls	37%	45%	44%	49%	42%
Talk to colleagues/other	7%	14%	12%	12%	11%
Use laptop	14%	26%	41%	38%	25%
Use PDA/Blackberry	23%	24%	30%	19%	25%
Other work related to employment	33%	31%	28%	38%	32%
Return journey					
Prepare for a meeting	15%	20%	24%	22%	19%
Make/receive calls	45%	43%	45%	57%	45%
Talk to colleagues/other	8%	15%	13%	20%	12%
Use laptop	10%	27%	31%	37%	21%
Use PDA/Blackberry	24%	26%	24%	31%	25%
Other work related to employment	41%	39%	47%	45%	42%

5.4.4 Whether worked on train en-route

The proportion of business travellers that spent some time working on the train can be estimated in several ways from the SPURT data. In section 5.4.1 it was deduced from the response in Q27 on the numbers of activities undertaken. That choice was in order to achieve compatibility with similar questions in the NPS 2004 dataset. An alternative, more direct, indicator could have been taken from the first response in Q30, "None – I didn't work on this train". However, as will be explained in more detail in Appendix C, internal data validation had shown up some contradictions between different questions relating to whether work activities were undertaken, and it was concluded that Q30 was not a reliable indicator of whether somebody had worked or not. Across the data alone it was deemed more reliable to base the "working or not" indicator on evidence of the amount of time actually spent working, and hence using Q29 rather than Q27 or Q30 responses. The indicator chosen (called Q29ab_2_YN) was based on a composite variable derived from the Q29 estimates of the amount of time spent (on each of four activities) in either minutes or percentages or both, that led to the composite variable (Q29ab_2) for the percentage of time spent on "work activities related to employment".

Table 5.10 shows the proportion of respondents that spent some time working, by direction of travel and by length of journey, based upon the composite variable formed from question 29 of the survey.

Table 5.10: Proportion of business travellers who work on the train, by length of journey and direction of travel

			Proportion, expanded data
Length of journey	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
Less than 45 minutes	0.73	0.73	0.73
45 mins to less than 90 mins	0.88	0.79	0.84
90 mins to less than 150 mins'	0.89	0.80	0.85
150 mins and over'	0.87	0.91	0.90
Total	0.82	0.77	0.80

For the expanded dataset, 80% overall reported the time they spent on "work activities related to employment (e.g. reading, writing, typing, discussion, thinking, business meals etc)", a slightly higher percentage than those who had ticked the corresponding activities box in Q27 (see section 5.4.1). Generally, a greater proportion worked on the outward than the return leg of the journey as would be expected, with the exception of shorter distance trips (where it was equal by direction of travel) and for the longest distance band which showed a slightly higher proportion working on the return leg.

Levels of work has been also been examined relative to class of travel as shown in Table 5.11.

Table 5.11: Proportion of business travellers who work on the train, by class of travel

	Proportion, expanded data		
Class of travel (Q18)	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
Standard class	0.82	0.75	0.79
First class	0.84	0.86	0.85

This clearly shows that there is little difference between First Class and Standard class passengers in the propensity to work on trains on the outward leg, but somewhat more so on the return leg.

Further analysis has been made of the effects of crowding in the train upon the level of work activity undertaken, as shown in Table 5.12. In this analysis crowding has been defined based upon question 20 of the survey, being that of “How crowded would you say the carriage was when this train departed your boarding station?”

Table 5.12: Proportion of business travellers who work on the train, by level of crowding

	Proportion, expanded data		
Level of crowding of carriage when train departed the boarding station (Q20)	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
25% seats occupied	0.85	0.76	0.82
50% seats occupied	0.77	0.71	0.75
75% seats occupied	0.89	0.77	0.83
90% of seats occupied nobody standing	0.85	0.84	0.85
90% of seats occupied a few people standing	0.47	0.79	0.63
100% of seats occupied	0.77	0.79	0.78

The above table shows an unusual pattern in that the level of crowding appears not to affect whether work occurred en-route, particularly for the return leg of the journey. An effect is discernible for the outward leg, when seating becomes very restricted at the 90% occupied and some standing and 100% seats occupied levels. When standing is suggested, the proportion working reduces markedly, perhaps due to the greater difficulty of doing so or to security of working conditions, with standees being able to read what was being worked upon. However, the sample count is very low at the higher levels of crowding.

Question 17 (“For what proportion of **this** rail journey were you able to sit?”) provides another way of assessing the impact of crowding or standing on the ability to work. However, since most respondents were able to sit all the time, the numbers who could not are very small, so group averages are shown for these in Table 5.13..

Table 5.13: Proportion of business travellers who work on the train, by level of sitting ability

				Proportion, expanded data
Q17. For what proportion of this rail journey were you able to sit?	Sample count	Q1. Are you on the outward or return leg of your business trip?		Total
		Outward	Return	
All of it	1,562	83%	77%	80%
About three quarters	25	75%	24%	55%
About half About a quarter None of it	28	62%	86%	74%
Total	1,615	82%	77%	80%

Table 5.13 shows a clear dropping off of work activity where finding a seat is involved as we move from sitting ‘all the time’ to ‘about three quarters’. However, at lower levels of seating availability (about half, about a quarter, none of it) the sparseness of the data does not provide very reliable results, even when these categories are grouped. On the outward journey, the drop-off trend appears to continue. On the return journey, the percentage working rises again; this may be because the most common type of work on the return journey is the phone call or text message: this is one of the few things that you can do as well standing as sitting, so it might even be more likely to happen in crowded conditions, to relieve the tedium of standing. The conclusion remains that work activity is affected by whether one can sit all the time or not, but further insights are desirable.

5.4.5 Exploratory modelling of the propensity to work or not on trains

Factors that might explain the variability in the propensity for people to work or not on the train (as indicated by variable Q29ab_2_YN) were explored using the Answer Tree software. Answer Tree is a program that implements Multiple Classification Analysis (MCA). This assumes an additive model in examining the inter-relationship between several predictor variables and one dependent variable. It can handle predictors with nominal measures and relationships of any form between any of the variables, though it important that a dichotomous dependent variable has frequencies that are not too dissimilar.

This dependent variable Q29ab_2_YN in this analysis yielded 1,357 records in which the respondent reported the time spent on “working activities” and 248 records in which no time was recorded working but some time was recorded on “personal activities” (these numbers are lower than those reported elsewhere because Answer Tree requires records with data on all the variables being examined.)

The variables included in the tests were:

- Direction of travel (Outward/return on this leg of trip) (Q1);
- Main purpose of business trip (Q2);
- Whether travelling alone or with other adults in a group (Q13);
- Whether in Standard or First class (Q18);
- Whether a pull-down/lift up table was available during the journey (Q19_1);
- Whether a fixed table was available during the journey (Q19_2);
- Whether a power socket was available during the journey (Q19_3);

- Whether WiFi was available during the journey (Q19_4);
- The most crowded level reached in the carriage (Q22);
- The least crowded level reached in the carriage(Q23);
- Occupation (Q42, regrouped in 3 bands in OccBand_1);
- Journey time (Composite variable based mainly on Q26, classified by 4 bands in JTBand_2);
- Gender (Q45); and
- Age (Q44, grouped into 4 bands) .

For brevity, the Occupation group "Middle Management/Technical" is referred to just as "Middle Management" below; and the designation "Junior management/Manual/Other" covers the "Junior Management/Clerical/Supervisory/Technical", "Skilled Manual", "Unskilled Manual" and "Other" classifications in the questionnaire.

Statistical analyses in Answer Tree were based on unexpanded data, and are presented graphically in "tree" form in Figure 5.2 and summarised below.

[1] 1st level

- Across all business travellers, the main predictor variable as to whether people worked or not was ***Occupational class***; X^2 (6, n = 1636) = 51.9, $p < 0.001$, split between
  - Professional/ Senior Management travellers, of whom 87% spent some time working,
  - Middle Management travellers, of whom 79% did so, and
  - Junior Management/ Manual/ Other travellers, of whom 66% did so.

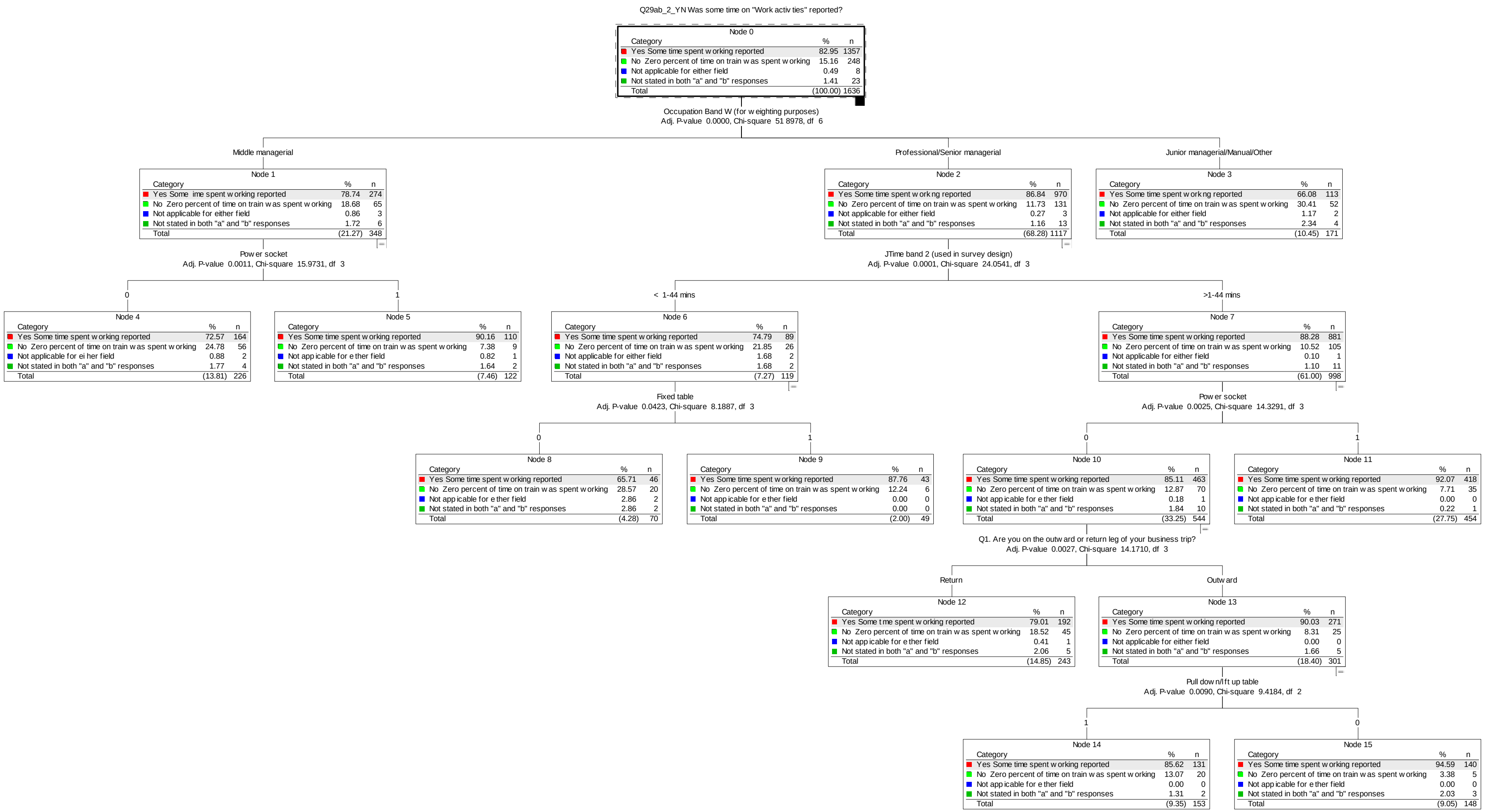
[2] 2nd level

- For Professional/ Senior Management travellers the main predictor to whether they reported working or not was ***journey time***; X^2 (3, n = 1117) = 24.1, $p < 0.001$, split between those on:
  - longer journeys(>= 45 minutes), of whom 88% spent some time working
  - shorter journeys (<45 minutes) of whom 75% spent some time working.
- For Middle Management travellers the main predictor was whether a ***power socket was available*** (or not); X^2 (3, n = 348) = 16.1, $p < 0.001$, split between those
  - with access to a power socket, of whom 91% spent some time working, and
  - those without access to a power socket, of whom 73% did so.
- For Junior Management/ Manual/ Other occupations- none of the predictor variables entered into the model that significantly affected whether they worked or not.

[3] 3rd level

- For Professional/ Senior management travellers on shorter journeys (up to 45 mins), the next predictor was whether a ***fixed table was available***; X^2 (3, n = 119) = 8.2, $p < 0.05$, split between
  - those with tables available, of whom 88% spent some time working, and
  - those without tables available, of whom 66% did so
- For Professional/ Senior management travellers on longer journeys, the next predictor concerned whether a ***power socket was available***; X^2 (3, n = 998) = 14.3, $p < 0.05$, split between those
  - with access to power sockets, of whom 92% spent some time working, and
  - those without such access, of whom 85% did so.
- For Middle Management occupations, no other predictors were found

Figure 5.2: Answer Tree model of the propensity of business travellers to work or not



Node	Yes %	Yes n	No %	No n	N/A %	N/A n	Not stated %	Not stated n	Total %	Total n
Node 0	82.95	1357	15.16	248	0.49	8	1.41	23	(100.00)	1636
Node 1	78.74	274	18.68	65	0.86	3	1.72	6	(21.27)	348
Node 2	86.84	970	11.73	131	0.27	3	1.16	13	(68.28)	1117
Node 3	66.08	113	30.41	52	1.17	2	2.34	4	(10.45)	171
Node 4	72.57	164	24.78	56	0.88	2	1.77	4	(13.81)	226
Node 5	90.16	110	7.38	9	0.82	1	1.64	2	(7.46)	122
Node 6	74.79	89	21.85	26	1.68	2	1.68	2	(7.27)	119
Node 7	88.28	881	10.52	105	0.10	1	1.10	11	(61.00)	998
Node 8	65.71	46	28.57	20	2.86	2	2.86	2	(4.28)	70
Node 9	87.76	43	12.24	6	0.00	0	0.00	0	(2.00)	49
Node 10	85.11	463	12.87	70	0.18	1	1.84	10	(33.25)	544
Node 11	92.07	418	7.71	35	0.00	0	0.22	1	(27.75)	454
Node 12	79.01	192	18.52	45	0.41	1	2.06	5	(14.85)	243
Node 13	90.03	271	8.31	25	0.00	0	1.66	5	(18.40)	301
Node 14	85.62	131	13.07	20	0.00	0	1.31	2	(9.35)	153
Node 15	94.59	140	3.38	5	0.00	0	2.03	3	(9.05)	148

[4] 4th level

- For Professional/ Senior Management travellers on longer journeys (45 mins or more) without access to power sockets the next predictor was whether they were on the ***return or outward leg*** of their journey; X^2 (3, n = 544) = 14.2, $p < 0.05$, split between
  - those on the outward journey. of whom 90% spent some time working, and
  - those on the return leg, of whom 79% did so.

[5] 5th level

- For Professional/ Senior Management travellers on the outward leg of a longer journey without access to power socket a further predictor was whether a ***pulldown/lift up table was available***; X^2 (2, n = 301) =9.4, $p < 0.05$, split between
  - those with a pull-down/lift-up table available, of whom 95% spent some time working, and
  - those without such a table available, of whom 86% did so.

The interpretation of these results needs some care. Some of the findings confirm the patterns shown up in tabulations elsewhere in this report. Some helpfully show up a sharper contrast, by indicating a split in categorisation at a different place, or with fewer categories, than have been used in exploratory tabulations. Some show that certain variables are less important than others in explaining the variations (and this led for example to the “Direction of travel” being deemed to be more appropriate than “Age” as an expansion factor in the final weights adopted to expand the sample data). Others are suggestive of a new variable that helps to explain (or in “Answer Tree terminology”, “predict”) the variability in the data. Some variables may not be included in the analysis because they do not satisfy the Answer Tree criteria for inclusion; yet may elsewhere be seen to be helpful in explaining some of the variability in the data.

Some of the results prompt discussion of the distinction between cause and effect. For example, it appears from the analysis here that the availability of a power socket or of a fixed table has an effect on the proportion of business travellers who spend some time working on the train, a perfectly sensible result. But it could be that the relationship is the other way round: that power sockets are most likely to be installed on trains where the Train Operating Companies know there is a high flow of business travellers, or alternatively, that business travellers who want to work on the train are more likely to choose to sit at a fixed table than those who do not. (There is also an ambiguity in the questionnaire, since although the question about “availability” comes soon after the question about the ability to sit, the two were not related; so the answers about “availability” may refer to the train or carriage rather than where the traveller sat).

5.5 The amount of time spent working on the train

This survey is the first to provide *empirical* data on the actual amount of time spent working on trains. Estimates had been made previously though, in the study conducted for Virgin Trains using data from the Autumn 2004 NPS (Kirby, Smyth and Carreno, 2006, 2007). In this, the answers given to questions on the number of different activities undertaken and the one activity on which most time was spent allowed estimates of the time spent working to be made by applying geometric probability theory. Similar questions were asked in the new study (Q27 and Q28) and so a similar approach is also possible; but in this chapter we concentrate on reporting the analyses of the empirical data; detailed comparisons with the results obtained by applying geometric probability are deferred.

As explained in section 5.3, the average amount of time spent working is an average with respect to those business travellers who spent some time working. This is expressed as a percentage of the journey time on the train, to help distinguish it from values of the proportion of those who worked. It could alternatively be expressed as a percentage of the available, or *usable*, time on train, defined by subtracting from the journey time the amounts of time people spend "settling down" and "preparing to disembark". A comparison between these two measures is included in Appendix G.

5.5.1 Distribution of time spent on different activities

Question 29 asked not only about the percentage of journey time spent on work related to employment, but also about the percentages spent on personal activities, on the initial "settling down" period and on the eventual preparation to disembark. The first two categories were essentially amalgamations of some of the activity categories in Q27; though some inconsistencies remained, as noted in section 4.5.2. The distribution of journey time across these categories is shown in Table 5.14. This analysis is only based upon those business travellers reporting (in Q29) that they spent some time working on the train.

Table 5.14: Distribution of time spent by working business travellers on different on-train activities

	Percentage of aggregate journey time, expanded data		
Activities undertaken	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
Settling down	7%	7%	7%
Work activities related to employment	60%	54%	57%
Personal activities	28%	34%	30%
Preparing to disembark	6%	5%	6%
Total	100%	100%	100%

The overall figure of 57% of the journey time being spent by business travellers on "work activities related to employment" is very much higher than the estimate of 30% spent by business travellers "working/studying" in the NPS of Autumn 2004. The basis of the latter's estimate was of course very different (see the TRi report for Virgin Trains), involving probability theory; but the higher figure here is not inconsistent with the changes over time shown in Table 5.5 for the like-for like comparison of the activities undertaken.

It is clear from this table that a greater percentage of journey time is spent working when on the outward leg of the journey than on the return, as may be expected; there is of course a compensating rise in the percentage of time on personal activities on the return leg, which might of course reflect a greater tiredness on the way home.

The information on the time taken to settle down or in preparing to disembark was sought in order to help investigate in more detail the effect of a reduction (or increase) in journey time on the amount of time available for working, an issue that is explored in Chapter 6. It may also be relevant to take that time into account when estimating the average percentage of journey time spent working; after all, such "preparation time" is not available for working. A question that arises both here and in section 5.5.4 is whether or not the preparation time is independent of journey time. Table 5.15 probes into this issue.

Table 5.15: Amount of time spent settling down or preparing to disembark

			Minutes
Journey time band	Settling down	Preparing to disembark	Total
Less than 45 mins	3.4	2.8	6.1
45-89 mins	3.9	3.3	7.2
90-149 mins	5.9	4.8	10.7
150 mins or more	7.8	5.2	12.9
Overall	5.0	4.0	9.1

From Q20a_1 and Q29a_4**,** for business travellers who spent some time working
Sample count = 1270

As may be noted, the average number of minutes for settling down or getting ready to disembark (for those who provided answers in minutes rather than as percentages) suggests that the time expended on such is not independent of journey time, with longer journeys having more time spent winding up and down.

5.5.2 Initial reviews of sources of variability

The percentage of time spent working by business travellers is of course affected by a number of factors. The variation by a single factor, Occupation band, was illustrated in Table 5.4 in the course of explaining why the average is taken over only those business travellers who did some work, rather than over all business travellers. The variation by two factors, one of which is direction of travel, is shown separately for journey length and whether the rail service was to or from London in Table 5.16.

Table 5.16: Percentage of journey-time spent working by working business travellers, by service type, direction of travel and journey length

		Average of composite percentages, expanded data		
Disaggregation		Q1. Are you on the outward or return leg of your business trip? Outward	Return	Total
By type of rail service				
	To London	59%	56%	58%
	From London	58%	51%	54%
	Not London	62%	56%	59%
Length of journey				
	Less than 45 minutes	58%	54%	56%
	45 mins to 89 mins	61%	55%	59%
	90 mins to 149 mins	61%	54%	58%
	150 mins and over	57%	53%	54%
Overall		60%	54%	57%

As this table shows, it is apparent that business travellers on trains not serving London spend a higher percentage of their journey-time working than those on services heading towards or from London, a perhaps surprising result. When assessed relative to journey length, it is clear that the highest percentage of journey time spent working is undertaken for those in the middle length time bands, between 45 minutes and 150 minutes.

The effects of crowding level (at the time of boarding) and direction of travel is shown in Table 5.17.

Table 5.17: Percentage of journey time spent working by working business travellers, by crowding level

	Average of composite percentages, expanded data			
Q20. How crowded would you say this carriage was when this train departed your boarding station?	Q1. Are you on the outward or return leg of your business trip?			
	Outward		Return	
	Mean of Expanded data	Unweighted Count	Mean of Expanded data	Unweighted Count
25% of seats occupied	58%	234	57%	178
50% of seats occupied	60%	208	52%	152
75% of seats occupied	66%	145	51%	131
90% of seats occupied, nobody standing	59%	76	58%	98
90% of seats occupied, a few people standing	45%	12	61%	33
100% of seats occupied	53%	33	48%	63
Total	60%	708	54%	655

The above provides evidence that the percentage of time spent working is at its lowest when all seats are occupied when the train leaves his/her boarding station; a not unsurprising result.

Of course, for explanatory and forecasting purposes the effect of different factors needs to be investigated for not one or two events at a time but simultaneously, as permitted by Answer Tree, and exploratory modelling to this end is described in the following section, 5.5.3.

5.5.3 Exploratory modelling of the amount of time spent working

Answer Tree was used to explore the factors that affected the amount of time spent working on trains, by those that did some work. The valid sample size was 1,352 records (after taking all predictor variables into account). The dependent variable was the composite measure of the percentage of the (composite) journey time that was spent working (Q29ab_2). As Multiple Classification Analysis ideally requires that a dichotomous dependent variable has approximately equal frequencies in each band, this recoded into three bands with approximately equal sample size, in an “Amount of work” variable with the values:

- 1 = low (those who spend up to 45% of their journey time working);
- 2 = medium (46-75 %); and
- 3 = high (76% plus).

The three bands contained respectively 32%, 38% and 30% of the valid sample.

The predictor variables were the same as those for the exploratory model of the proportion of business travellers that work on the train (see 5.4.5). The results are shown in Figure 5.3: and summarised below.

[1] 1st level

- Across all business travellers, the main predictor variable concerning the amount of work undertaken was ***occupational class***; X^2 (2, n = 1352) = 31.8, $p < 0.001$, split between those in
  - Junior managerial/Manual/Other occupations, of whom 50% spent less than 46% of their journey time working
  - Middle management, of whom 36% spent less than 46% of their time working,
  - Professional/Senior management, of whom 28% spent less than 46% of their time working.

[2] 2nd level

- For Professional/ Senior management travellers the next predictor concerned whether they were on the ***outward or return*** leg of their trip; X^2 (1, n = 966) = 14.2, $p < 0.001$, split between those on the
  - outward trip, of whom 37% spent over 75% of their time working
  - return trip, of whom 29% spent over 75% of their time working.
- For Junior management/manual/other travellers, the next main predictor was also whether they were on the ***outward or return*** leg of their trip; X^2 (1, n = 112) = 4.9, $p < 0.05$, split between with those on the
  - outbound trip, for whom a much greater proportion (21%) reported a high level of working time (over 75% of their time working) than those on the
  - return trip, where the proportion was 9%.
- For Middle Management travellers, none of the predictor variables became significant in accounting for the remaining variability in the amount of time spent working.

[3] 3rd level

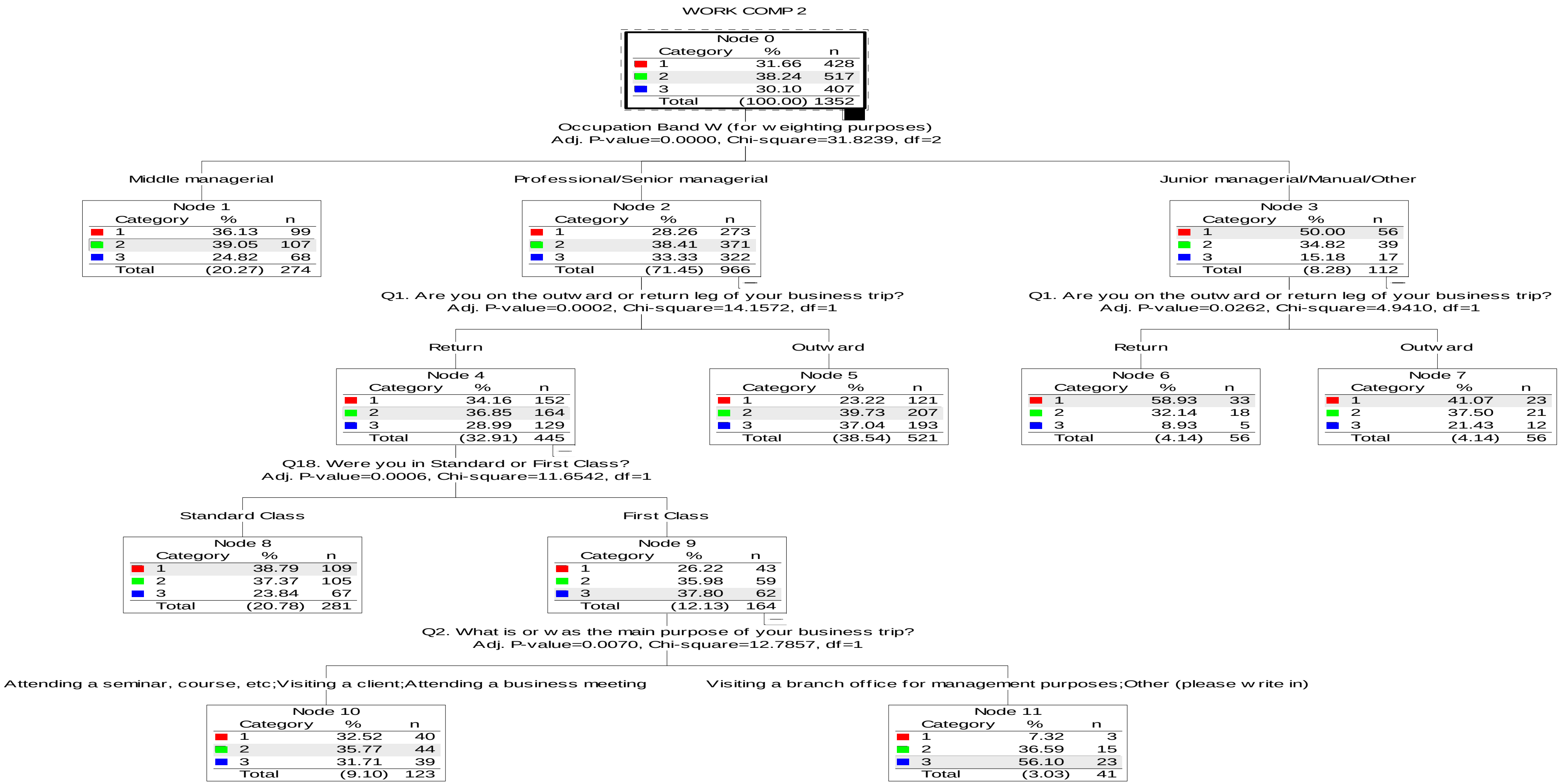
- For Professional/ Senior management travellers on return legs of trips, the next predictor concerned whether they were travelling ***First or Second class***, and was split between
  - those travelling First class, for whom the proportion spending a high amount of time working (over 75% of the journey time) was much more (at 38%) than for
  - those travelling Standard class, where the proportion was 24%.
- For Junior/ Manual/ Other travellers no other predictors were found

[4] 4th level

- For Professional/ Senior Management first class travellers on the return leg of their trip, the final predictor concerned the ***main purpose of their business trip***; X^2 (1, n = 164) = 12.8, $p < 0.05$, split between
  - those visiting a branch and those indicating an "other" purpose, of whom 56% spent a high amount (over 75%) of time working, and
  - those visiting a client, attending a business meeting, course or seminar, of whom 32% spent a high amount of time working.

Clearly the outward or return nature of the trip has quite a high impact on the proportion of time spent working. The 4th Level result suggests that the main purpose of the trip has a particularly high impact on the return journey after "visiting a branch for management purposes".

Figure 5.3: Answer Tree model of the percentage of time spent working on trains



5.5.4 Key factors affecting the proportion working and the percentage of time worked

Answer Tree revealed some of the factors affecting, firstly, the proportion of business travellers who spent some time working (see section 5.4.5) and secondly the percentage of journey time spent working by those who did some work (see section 5.5.3). In this section we review their points of commonality and differences and provide tables that best represent the variation of the average proportions/percentages across these factors.

"Occupation" was identified in both sets of analyses as being the first-level indicator. This is not an artefact of the expansion process, since Answer Tree was investigating interdependencies amongst variables in the unexpanded data. Indeed, the importance of Occupation in the Answer Tree analyses underlies the importance of including it amongst the expansion factors. The importance of Occupation is not surprising, since this variable may be regarded as a proxy for income (had income data been obtained in the NPS, the expansion might well have been against income bands). The relationship of occupation with income is explored in greater detail in Appendix E, which includes a comparison of the average income of business rail travellers with that for the population as a whole. A summary of the key issues is provided below.

- "Journey time" was important at the second level, but only for the Professional/Senior Manager category and only for the proportion of business travellers who were doing some work. It did not feature as at any level in explaining the variation in the percentage of journey time spent working.
- "Direction of travel" was important at the second level for the Professional/Senior Management and the Junior Management categories for the percentage of journey time spent working; but only at the fourth level (and that for Professional Senior Managers on long trips) for the proportion of business travellers that did some work.
- "First/Standard Class" of travel was important only for the percentage of time spent working for Professional/Senior Managers, but only at the third level.
- "Availability of a power socket" or "availability of a table" was important only in explaining the proportion of business travellers who spend some time working, and this only at the second level for Middle Managers and third level for Professional/Senior Managers.

These results confirm the original supposition that the factors involved (and of course their relative strengths) are different between the two dependent variables of proportion of working and the percentage of time spent working.

In the light of concerns about understanding the effect of crowding on the ability to work on trains, it is interesting to note that neither of the crowding variables that were tested (representing the most crowded and least crowded levels that a carriage became) was found to explain the variation. However that may be because of correlations with other variables, and this matter is discussed further in section 5.6.

To illustrate these findings we will show the effects of these findings on the average proportions/percentages respectively, initially for tables that shows the variation by just three of the main factors, namely Occupation, Direction of Travel and Journey time band. These cover the three factors that are most important at either first or second level for at least the Professional/Senior management category, for one or other or both dependent variables. This trio of independent variables (and the choice of bands in the two following tables) are the same as those used in expanding the data to NPS (Autumn 2007) totals.

We first consider, in Table 5.18, this trio of factors (and then some others) in explaining the variation in the proportion of business travellers who spend some time working.

Table 5.18: Key variations in proportion of business travellers that work on the train

	Proportion, expanded data /(Standard error of mean)							
	Senior management		Middle management		Junior management/ Manual/Other		All occupations	
	Outward	Return	Outward	Return	Outward	Return	Outward	Return
Up to 45 mins	0.78 (.06)	0.77 (.05)	0.67 (.11)	0.78 (.08)	0.44 (.18)	0.55 (.11)	0.73	0.73
45-89 mins	0.95 (.11)	0.84 (.03)	0.78 (.06)	0.71 (.05)	0.79 (.07)	0.68 (.08)	0.88	0.78
90-149 mins	0.90 (.02)	0.86 (.02)	0.92 (.04)	0.86 (.04)	0.81 (.09)	0.59 (.11)	0.89	0.81
150 mins or more	0.91 (.04)	0.95 (.03)	0.82 (.08)	0.90 (.07)	0.75 (.13)	0.70 (.15)	0.87	0.91
All journey times	0.87	0.82	0.75	0.77	0.73	0.60	0.82	0.77
Sample count = 1,636								

The values of the standard errors of the means in Table 5.18 suggest in a number of cases that some cells or bands might be best combined, their members being deemed to be drawn from the same population. An interesting case is that of the Junior Management group, for which the Answer Tree analysis (in section 5.4.5) concluded that, at Level 2, “none of the [other] predictor variables entered into the model that significantly affected whether they worked or not”. Comparing the means for the Outward and Return journeys for this group in Table 5.18, it would appear that the Direction of Travel variable should also enter into the explanatory set for this group; but if one then takes into account the standard errors of the means, the Answer Tree conclusion is more understandable.

There is no clear case for not including these three variables as key explanatory factors in this table. The Answer Tree analyses also suggest the importance of including “Power socket availability”. As this is at a higher level of importance than Direction of Travel, we show the effect of replacing the outward/return variable (Q1) by “Power socket availability” (Q19_3) in Table 5.19.

Table 5.19: Relation between Power Socket Availability and the proportion of business travellers working on the train

								Proportion, expanded data
	Senior management		Middle management		Junior management/ Manual/Other		Total	
	No power socket available	Power socket available	No power socket available	Power socket available	No power socket available	Power socket available	No power socket available	Power socket available
Less than 45 mins	0.76	0.84	0.69	0.88	0.57	0.23	0.71	0.79
45-89 mins	0.89	0.93	0.69	0.93	0.77	0.74	0.82	0.90
90-149 mins	0.84	0.91	0.86	0.92	0.69	0.65	0.82	0.88
150 mins or more	0.89	0.95	0.74	0.96	0.58	0.83	0.80	0.94
Total	0.82	0.90	0.71	0.92	0.68	0.63	0.77	0.87
Sample count = 1,638								

Comparing Table 5.18 and Table 5.19 it is apparent that Power Socket variable is better at splitting a given Occupation band (across all journey time bands) than is Direction of Travel, but only for Middle Management (as anticipated from the Answer Tree results). Whether Power Socket availability should be interpreted as a factor that influences the amount of productive work done on trains is debatable, for the reasons discussed in concluding section 5.4.5; the main question at this stage is whether it is worth while including it as a factor explaining the current variability, either instead of or as well as the Direction of Travel variable.

In Table 5.20 we examine the trio of factors (and then some others) in explaining the variation in the percentage journey time spent working (by those business travellers that do some work on the train).

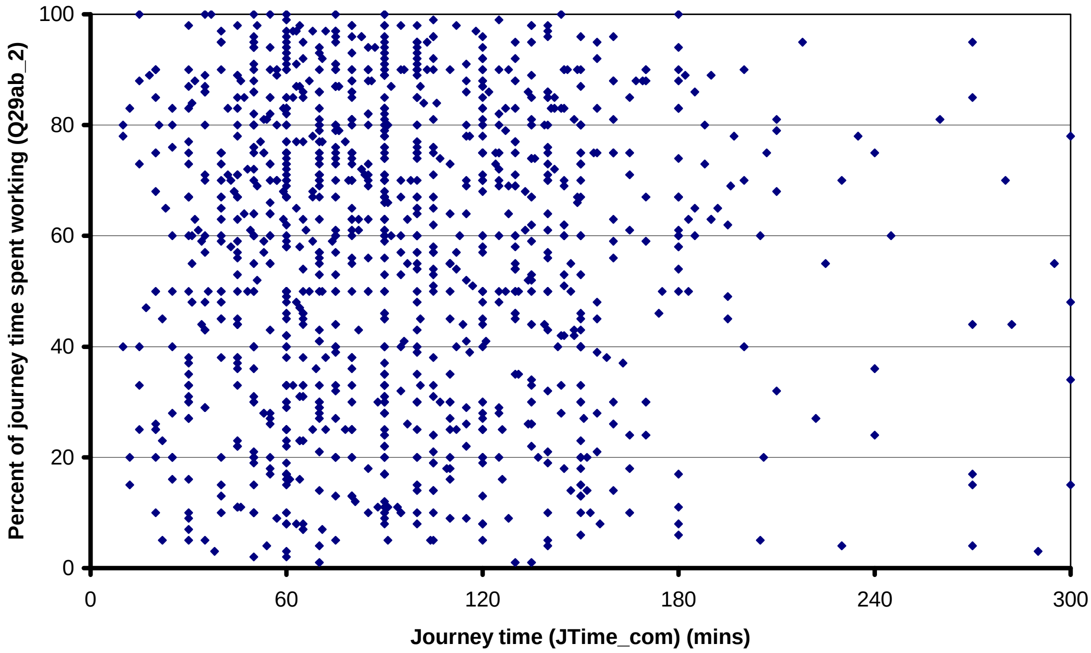
Table 5.20: Key variations in the percentage of journey time spent working by working business travellers

								Mean percentage, expanded data /(Standard error of mean)
	Senior management		Middle management		Junior management/ Manual/Other		All occupations	
	Outward	Return	Outward	Return	Outward	Return	Outward	Return
Up to 45 mins	61% (4)	57% (3)	49% (8)	51% (6)	54% (20)	41% (8)	58%	53%
45-89 mins	65% (2)	58% (2)	56% (4)	54% (4)	52% (5)	44% (5)	61%	55%
90-149 mins	64% (2)	56% (2)	59% (3)	55% (4)	51% (5)	39% (6)	61%	54%
150 mins or more	62% (3)	57% (4)	57% (6)	49% (6)	34% (10)	26% (8)	58%	53%
All journey times	63%	57%	54%	53%	52%	41%	60%	54%
Sample count = 1,357								

From section 5.5.3 it has already been seen that the journey time variable (which was defined by 3 bands) did not enter as an explanatory variable up to the fifth level of investigation. In the light of the standard error of the means included in Table 5.20, that appears to be a credible outcome. However, the average percentage of time spent working has been calculated as an average of the journey time as a whole, and there is evidence from other parts of Q29 that the amount of time available for doing anything (either personal or work activities) is reduced by the amount of time spent "settling down" or "preparing to disembark" (see Table 5.14). Were such "preparation time" to be the same whatever the length of the journey, that would imply a greater affect of journey length on the percentage of (available) time spent working. But Table 5.15 has already suggested an increasing trend of "preparation time" with journey length, rising from an average of 6 minutes to an average of 13 minutes across these four time bands.

The difficulty in discerning a trend with journey time is not surprising, given the amount of scatter in the plot of the percentage of time spent working against the journey time, shown in Figure 5.4.

Figure 5.4: Scattergram of percentage of journey time spent working by those who do some work, as a function of journey time on the train



As the variation with journey time appears not to be significant, it would be appropriate instead to distinguish between travel by First or Standard Class, since the Answer Tree results suggested this is a 3rd-level factor affecting at least Senior Managers. The results of this analysis are shown in Table 5.21.

Table 5.21: Class of Travel on the percentage of time spent working by working business travellers

								Mean percentage, expanded data
	Senior management		Middle management		Junior management/ Manual/Other		Total	
	Outward	Return	Outward	Return	Outward	Return	Outward	Return
Standard Class	64%	55%	53%	52%	52%	41%	60%	52%
First Class	60%	62%	60%	55%	38%	39%	60%	61%
Total	63%	57%	53%	53%	52%	41%	60%	54%
Sample count = 1,357								

As expected, the main effect of the First Class differentiation is in the Senior Management category, spreading the values for the Return journey over a range from 55% to 62% compared with 56% to 58% for the journey time bands. The estimates for First Class in the Junior Management category can be ignored, the sample count being less than 10.

5.6 The impact of crowding

One of the requirements for the study was the examination of the impact of crowding on the productive use of travel time. In the multivariate analyse conducted using Answer Tree (sections 5.4.5 and 5.5.3) it was found that neither of the two crowding variables tested (the highest and lowest levels of crowding reached in the carriage) contributed to explaining the underlying variability in the data for either the proportion undertaking some work or the percentage of time that they spent working.

However, other exploratory analyses suggested that an effect is discernible. Table 5.12 showed that there is a downward effect on the proportion that do some work when 90% or more of seats are occupied and some are standing, at least for the outward journey. Table 5.17 showed a similar downturn at that level in the percentage of time worked on the outward journey, and at the 100% of seats occupied on the return journey. An appraisal of the effects of the ability to sit on the proportion of those working, given in Table 5.13, also showed an effect if the person was not seated all the time, though with some volatility in the estimates thereafter due to the small sample sizes.

The effect of crowding, and/or of seating availability, needs therefore to be explored further, and it needs also to take into account the effect of the other key factors reviewed in section 5.5.4.

5.6.1 Distinguishing the effects of being able to sit and crowding level

As crowding affects the ability to sit, in this section we explore further the relative effects of crowding and sitting levels on the productive use of travel time. The first step in doing so is to review the categorisation that would seem to be appropriate in the light of the foregoing analyses. Sample size limitations were particularly marked in analysing the effect of seating availability. In the light of the distribution of the sample shown for Q17 in Table 5.22, it is clear that the only reasonable distinction is between those who are seated all the time (96%) and those who are not. The variable “Seated” was defined to provide that categorisation.

Table 5.22: Distribution of responses across seating availability

Q17. For what proportion of this rail journey were you able to sit?	Frequency of sample count	Valid Percent (Unexpanded)	Valid Percent (Expanded)
All of it	1,593	96.5%	95.5%
About three quarters	26	1.6%	1.9%
About half	15	0.9%	1.2%
About a quarter	4	0.2%	0.1%
None of it	12	0.7%	1.4%
Total	1,650	100.0%	100.0%

It should be noted that the dominance of the sample in just one category and the sparcity in the others meant that Q17 never crossed the statistical threshold for inclusion as a variable in the Answer Tree analyses. The distribution of the sample before and after expansion for the crowding variable (Q20) is shown in Table 5.23.

Table 5.23: Distribution of responses across initial crowding level

Q20. How crowded would you say the carriage was when this train departed your boarding station?	Frequency	Valid Percent (Unexpanded)	Valid Percent (Expanded)
25% of seats occupied	491	29.7%	29.25
50% of seats occupied	429	26.0%	25.5%
75% of seats occupied	329	19.9%	19.4%
90% of seats occupied, nobody standing	211	12.8%	13.6%
90% of seats occupied, a few people standing	60	3.6%	3.6%
100% of seats occupied	131	7.9%	8.7%
Total	1,651	100.0%	100.0%

Based upon the evidence above and that from Table 5.12 and 5.17, there is little difference in responses until the level of “90% of seats occupied, a few people standing” is reached. Therefore a two-way categorisation has been adopted from this stage onwards.

At this stage it also seems appropriate to take into account the possibility that the effect of crowding on people’s readiness and ability to work is affected by whether one is seated or not. The preceding analysis shows the occurrence of those that are seated all the time. The effects of cross-classifying seating and crowding on the numbers in the sample, the proportions who undertake some work and the percentages of time they spent working are shown in Table 5.24, 5.25 and 5.26 respectively.

Table 5.24: Crowding by seating levels: Distribution of sample count

	Count, unexpanded data		
Crowding (2 bands)	Seated all the time	Not seated all the time	Total
Up to 90% seats occupied, no standing	886	16	902
90% or more of seats occupied, some standing	675	37	712
Total	1,561	53	1614
Sample count for all business travellers: 1,614 (consistent across scale variables)			

Table 5.25: Crowding by seating levels: Proportion of business travellers working

	Proportion, expanded data		
Crowding (2 bands)	Seated all the time	Not seated all the time	Total
Up to 90% seats occupied, no standing	0.79	0.38	0.78
90% or more of seats occupied, some standing	0.81	0.77	0.81
Total	0.80	0.66	0.80
Sample count, all business travellers: 1,614 (consistent across scale variables)			

Table 5.26: Crowding by seating level: Percentage of time spent working (by those business travellers who worked)

	Mean composite percentage, expanded data		
Crowding (2 bands)	Seated all the time	Not seated all the time	Total
Up to 90% seats occupied, no standing	57%	51%	57%
90% or more of seats occupied, some standing	59%	38%	57%
Total	58%	40%	57%
Sample count, working business travellers: 1,363 (consistent across scale variables)			

Both Table 5.25 and Table 5.26 show that differences in crowding level (estimated at the time of a train's departure from the boarding station) have negligible effect on either the proportion working or the percentage of time worked, for those who have a seat throughout their journey. For those who do not have a seat throughout, the smallness of the sample count in the "up to 90% crowding (nobody standing" level (16 cases in Table 5.25 and only 10 case in Table 5.26 results in some contradictory behaviour in the former table and questionable evidence of a crowding effect on those not seated for both. On combining the effects of the two dependent variables, yielding the percentage of time spent working across all business travellers, shown in Table 5.27, these effects are still apparent.

Table 5.27: Crowding by seating levels: Percentage of time spent working (all business travellers)

	Mean composite percentage, expanded data		
Crowding (2 bands)	Seated all the time	Not seated all the time	Total
Up to 90% seats occupied, no standing	45%	19%	45%
90% or more of seats occupied, some standing	48%	29%	46%
Total	46%	27%	46%
Sample count, all business travellers: 1,614 (consistent across scale variables)			

Given the above difficulty in discerning reliable changes within the body of the table, it is on the marginal totals that some conclusions may be reached. For the crowding variable, there is virtually no discernible effect on either the proportion of business travellers working or the percentage of time that they spend working; but from that for the seating variable, a pronounced effect is apparent when disaggregating by whether or not the business traveller is able to sit all the time. For those that can sit all the time, the proportion of business travellers working is 0.80, with 58% of their journey time spent working; for those that cannot, the proportion working drops to 0.66, with 40% of their time spent working.

It must be borne in mind that, as the sample count in Table 5.24 suggests, this new survey may not have been fully representative of the crowding conditions that all business travellers experience at the time that they board a train. In planning the surveys, efforts were made to focus the surveys on known instances of business travellers crowding using the process outlined in Chapter 3, but based on the evidence within our dataset such occurrences were rare. Unfortunately the NPS data, which has been taken as the bench-mark, does not include variables that allow a direct comparison with national data on such a matter.

The overall conclusion from looking at the effect of these two factors together is that the ability to sit is more important than any measure of crowding in understanding the effect on productivity. Once all seats are taken in the carriage, it is perhaps the numbers standing that will most influence the overall average productivity of business travellers. That being the case, the small numbers in the sample of those who were not seated all the time (53) means that disaggregation by all the other main factors noted in section 5.5.4 is not feasible. It is however feasible for those who were seated all the time. On this occasion we show the combined effect, the percentage of journey time spent working by all business travellers who are seated throughout their journey, in Table 5.28.

Table 5.28: Percentage of journey time spent working by all seated business travellers

	Mean composite percentage, expanded data							
JTBand_2	Senior management		Middle management		Junior management/ Manual/Other		All occupations	
	Outward	Return	Outward	Return	Outward	Return	Outward	Return
Less than 45 mins	48%	46%	34%	39%	31%	22%	43%	40%
45-89 mins	61%	49%	46%	40%	43%	30%	54%	44%
90 mins or more	57%	49%	54%	47%	40%	23%	55%	44%
150 mins or more	56%	54%	49%	44%	25%	18%	50%	48%
All journeys	55%	48%	42%	41%	40%	24%	50%	43%
Sample count = 1,548								

In this, as in other similar tables, the sample sizes are such that it may be better to combine the last two journey time bands for all but the Senior management bands.

For those not seated all the time, with only 53 in the sample, a disaggregation is only reasonable if the two groups are about equal in size. That can be achieved by distinguishing between senior managers and all other occupation groups. The effect on the overall average percentage of time spent working is shown in Table 5.29.

Table 5.29: Effects of being seated and of occupation on percentage of journey time spent working by all business travellers

	Mean composite percentage, expanded data					
	Senior management		All other occupations		Total	
	Mean	Unweighted Count	Mean	Unweighted Count	Mean	Unweighted Count
Seated all the time	52%	1,079	37%	477	46%	1,556
Not seated all the time	36%	26	18%	26	27%	52
Total	51%	1,105	36%	503	46%	1,608

5.6.2 Developing procedures for taking account of crowding in the valuation of travel time savings

The analyses in section 5.6.1 strongly suggest that, over the range of conditions studied, it is the ability to sit throughout the journey rather than crowding that has an effect on the productive use of time of business travellers. The factors involved are relevant to the valuation of the employer's component in the valuation of travel time savings, but not necessarily to the valuation of the employee's component, which are the subject of the SP experiments presented in Chapter 7. For example, having to stand is a discomfort factor that can be expected to increase the longer one has to stand, so journey time may be more significant in the employee's valuation. The design of the SP experiments included studying the effect of changes in crowding levels (presented at 25%, 50% and 100% of seats taken) but not of changes in seating ability. In order to bring the Revealed Preference findings together in a consistent manner with the SP findings (see for example Figure 7.1) we now present the overall effects on the average percentage of time spent working (across all business travellers), split by crowding:

- 25% and 50% of seats occupied (55% of the sample);
- 75% and 90% of seats occupied (nobody standing) (33% of the sample); and
- 90% of seats occupied (some standing).and 100% of seats occupied (12% of the sample).

The disaggregation by a crowding variable means that the levels of disaggregation used previously can no longer be applied, because of the reduction in sample size. For this reason, the journey-time bands have here been reduced to three (<45 mins, 45-89 mins and 90+ mins), and the direction of travel distinction dropped (there is evidence from the SP results that the employee's valuation of journey time savings when on the return leg of the journey is higher than that on the outward leg; however, for the tables being considered here, the inclusion of such a distinction would mean reducing either the journey time band distinction or the occupation band distinction-or both- from three to two.) Retaining 3 occupation bands seems appropriate given that they are a proxy for income. As valuations of savings of employee's time for rail travel would be estimated for all business travellers, not just those who spend some time working on trains, the resultant averages for the amount of time spent working, shown in Table 5.30 are averages across all business travellers.

Table 5.30: Percentage of journey time spent working by all business travellers, by crowding level, journey time and occupation

		Mean composite percentage, expanded data			
Crowding level		Senior management	Middle management	Junior management/ Manual/Other	Total
Up to 50% seats occupied	< 5 mins	42%	31%	22%	37%
	45-90 mins	58%	40%	39%	50%
	90+ mins	56%	54%	24%	52%
	Total	*51%*	*38%*	*30%*	*45%*
75%-90% of seats occupied, no standing	< 45 mins	59%	34%	24%	49%
	45-90 mins	56%	46%	43%	51%
	90+ mins	54%	47%	30%	48%
	Total	*57%*	*41%*	*33%*	*50%*
90% or more of seats occupied, some standing	< 45 mins	27%	53%	.	34%
	45-90 mins	53%	35%	23%	43%
	90+ mins	33%	41%	43%	36%
	Total	*37%*	*44%*	*27%*	*38%*
Sample size = 1,602. Shaded cells show where the sample count is less than 30.					

As previously noted, there is little difference between the first two of these crowding bands in their effect. The shaded cells in Table 5.30 suggest where some might be more appropriately grouped with others to form more reliable estimates.

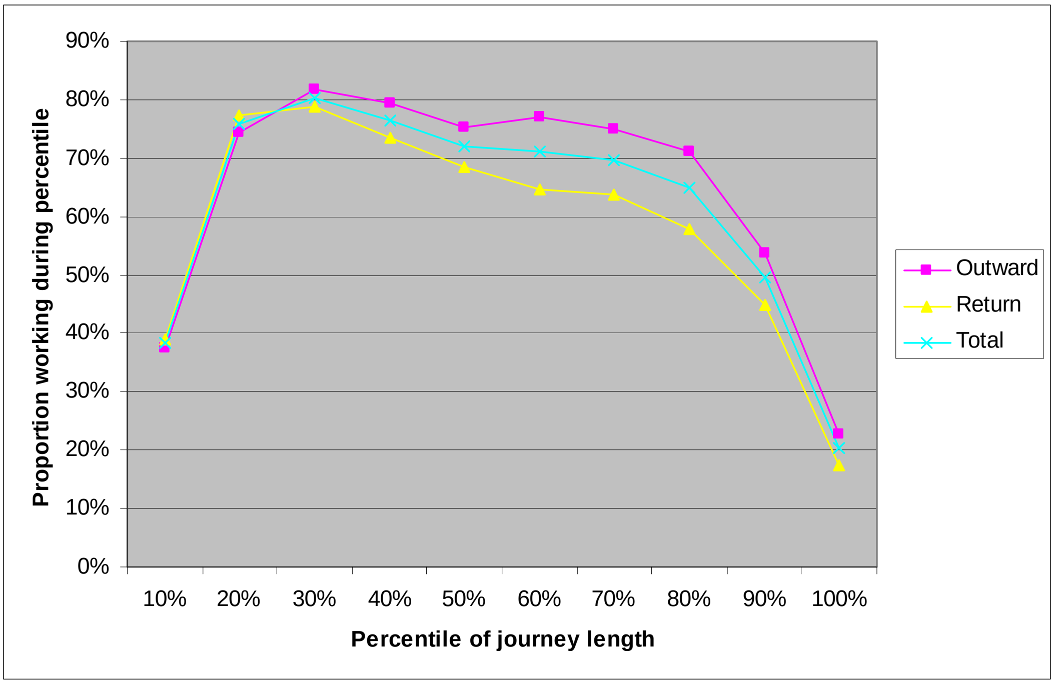
5.7 Timing of work related activities

A simple analysis has been made of the points in the journey that respondents said that they were undertaking work en-route, using the results from question 31. Table 5.31 shows these results split by outward or return legs of the journey, based on 10% segments of the journeys, with the results shown graphically in Figure 5.5..

Table 5.31: Timing of work activities by working business travellers

			Proportion, expanded data
Percentile of journey length	Proportion of journeys where work was undertaken during that time		
	Outward	Return	Total
10th percentile	0.38	0.34	0.36
20th percentile	0.75	0.77	0.76
30th percentile	0.84	0.80	0.82
40th percentile	0.79	0.76	0.78
50th percentile	0.75	0.70	0.73
60th percentile	0.79	0.67	0.74
70th percentile	0.76	0.66	0.72
80th percentile	0.71	0.58	0.66
90th percentile	0.56	0.45	0.51
100th percentile	0.21	0.17	0.19

Figure 5.5: Timing of work activities by working business travellers



As may be seen, the majority of activity on the outward journey was undertaken between the 20th and 80th percentiles of the journey, suggesting a fairly prompt start to working, with a gradual wind down at the end. For the return leg journeys, general levels of working are lower than the outward leg, with a decay in output occurring sooner than for the outward journey.

This analysis would seem to suggest that, should journey time be reduced, for whatever reason, its impact on work done might be marginal as most of it will have been done much earlier on in the journey.

5.8 Conclusions

Four principal conclusions may be drawn from this chapter.

The first is that the evidence for the amount of time spent working by business travellers is much stronger than had been indicated in the work carried out for Virgin Trains, which used activity data collected for the first (and so far only) time in the Autumn 2004 wave of the NPS. A like-for-like comparison showed a growth from 0.52 to 0.76 in the proportion undertaking some work/study on the train over the three and a half years. The percentage of journey time spent working (by those who did some work) also appears to have grown, from a probability-based estimate of 30% in 2004 to the empirical estimate of 57% in 2008 (a like-for-like probability-based comparison has yet to be undertaken).

The second is that different factors affect whether the business traveller does some work, and how long she/he spends working on the train. The variability in each is pronounced, making it difficult to discern patterns. At the top level, in each case, occupation group is the most important factor. Below that, other factors influence different groups at different levels. For example, journey time was important for explaining the variability in the proportion of the professional/senior management group that did some work, but not in the percentage of time spent by that or any other group; and the outward/return nature of the trip was important for explaining variations in the amount of time spent working, but not in the proportion that did some work. Nevertheless it was expedient to adopt a common set of factors to describe both sets of variations, and the combination of occupation class, journey-time band and direction of travel was deemed appropriate (and was consistent with the adopted scheme for expanding the data to nationally representative figures). The behavioural interpretation of some results is uncertain: for example, the fact that availability of a fixed table was more important in explaining the proportion of those working than the availability of a pull-down/lift-up table might be because those with most work chose such seats in preference. Similarly, the effect of power socket availability might be because the train operators prioritise provision of such sockets on those services with a high number of business travellers

The third conclusion is that there has been a problem of discerning the effects of crowding, when the statistical analysis did not suggest it was an important factor. The reason however was that an effect became apparent only at the highest ("some standing") crowding levels, and the sample count was then very small. It appeared that a different measure, that of "whether or not people had a seat all the time", could be a simpler yet fairly powerful indicator of the effect of crowding on the ability to do some work. Whilst the statistical analyses did not show up these measures as being important, the tabulations showed that an effect was discernible.

The final conclusion which may be drawn is that the timing of the work done on the train peaks early on in the journey. This suggests that, were the journey time to be reduced for any reason, it might not disturb the amount or profile of work undertaken very much.

6 Stated Intentions analysis

6.1 Introduction

An analysis has been undertaken of the responses to the questions relating to productivity of time spent working on the train compared with that in the office (Q32), and the effect of changes in the journey time on the amount of time spent working on the train (questions 33 to 36 and question 38).

It should be noted that Questions 32-34 were by-passed by those who claimed in Q30 that they did no work on the train. This accounted for 299 respondents; a further 15 did not answer any part of Q30, leaving 1,346 as the potential sample for these questions. However, some of those who should (from their answers to Q30) have by-passed Q32-34 did however respond to some of them, and it should be noted that there is an implicit assumption that people who did not work on the train would still not work on the train if the journey time was increased.

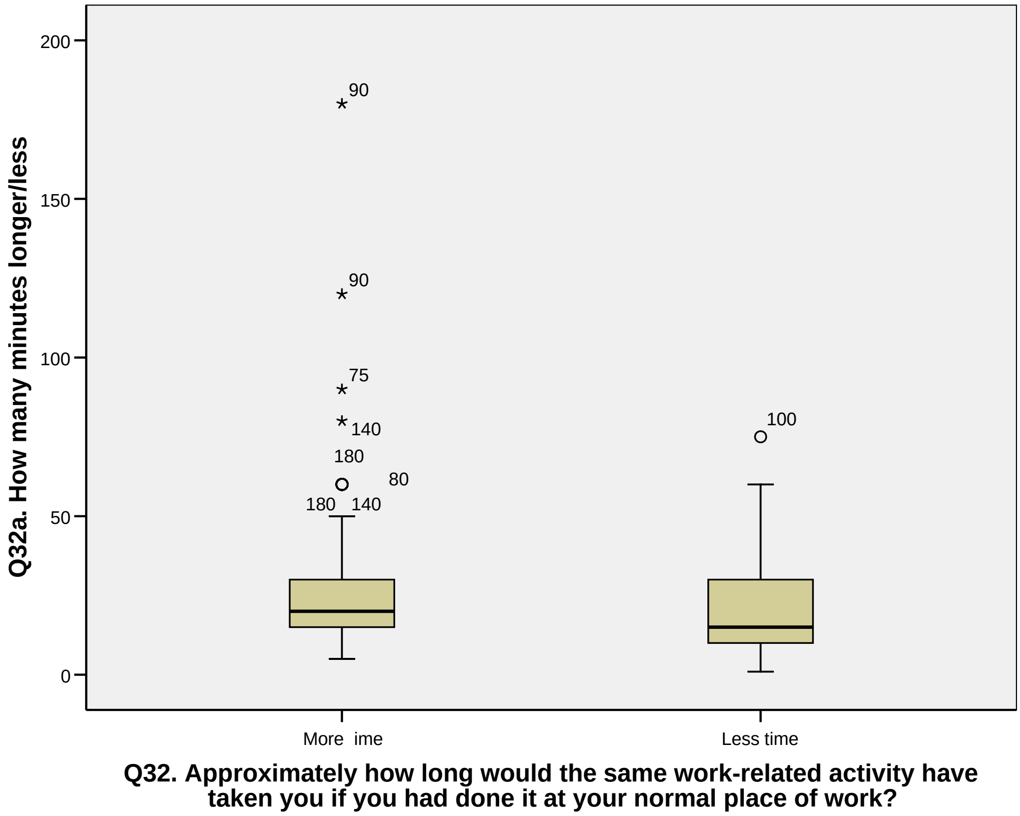
In this Chapter, the productivity of working on the train work relative to undertaking the same work in the office is analysed in section 6.2, using the responses to Q32. The responses to Q33 and Q34 are analysed in section 6.4 to explore (in section 6.4.1) the effect of an increase or (in section 6.4.2) a decrease in scheduled journey time on the amount of work undertaken on the train. The following section, 6.5, uses the response to Q35 to examine the effect of a reduction in journey time on the work undertaken off the train; and in section 6.6 these different effects of a journey time saving on the overall amount of working are brought together, in an important step towards determining the employer's valuation of journey-time savings for those travelling on firm's business. An extension of that analysis in an attempt to evaluate the differential effect of crowding level is provided in section 6.7. The main findings and conclusions of this chapter are summarised in section 6.8. Appendix G explores the consistency between the Stated Intentions responses on the effects of a reduction in journey time on the amount of on-train work, and the Revealed Preference data on the average percentage of time spent working on-train.

6.2 Effectiveness of use of train time

Question 32 asked "Approximately how long would the same work-related activity have taken you if you had done it at the normal place of work?", inviting the respondent to refer back to their answer (in Q29) to the amount of time spent (on work activities). Of the 1,346 potential respondents to Q32, 1,312 yielded usable responses. Of these 68% (of the expanded data) said that it would have taken about the same amount of time had they done the work in the office, 8% said it would have taken more time (but one in 6 did not say how much more) and 24% said it would have taken less time (but one in 9 did not say how much less). The weighted average of the differences were 29 minutes more where the work would take more time, and 18 minutes fewer where it would take less. Overall the average implies a reduction of 2 minutes were the on-train work to be done at the office.

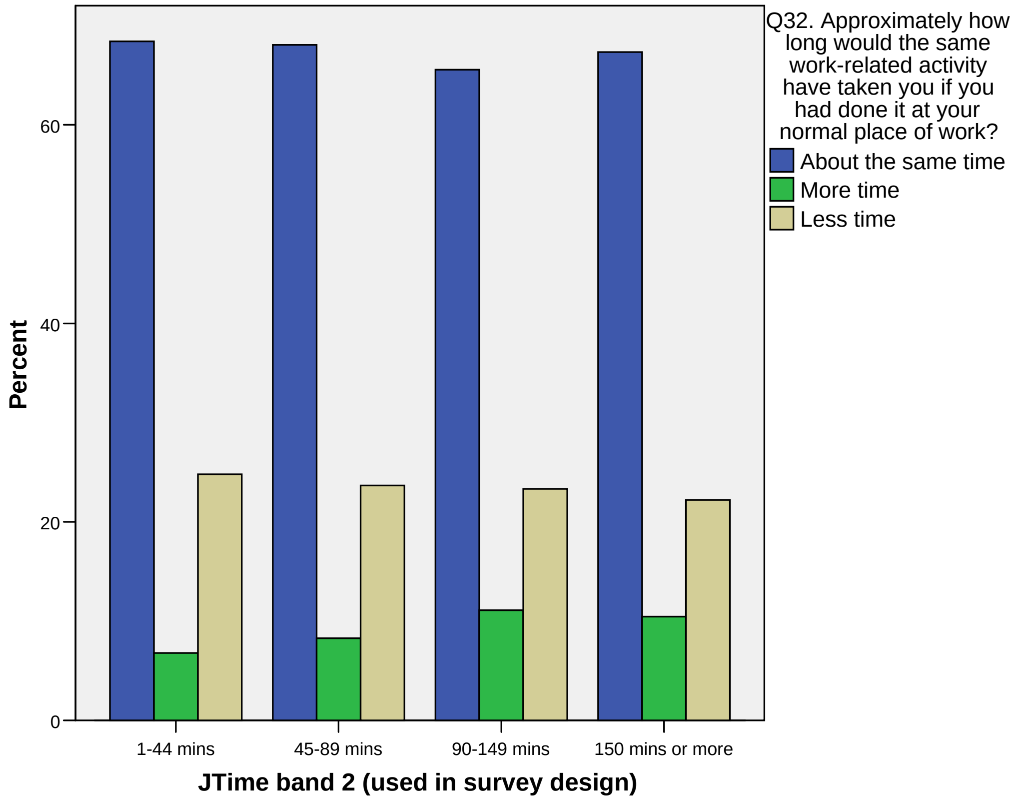
The averages stated are a little misleading, because the answers are very variable, as shown in the box-plot in Figure 6.1, in which the effect of journey time is illustrated by the value (in minutes) shown in small print against each of the outliers. The distribution shown in the figure is that for the raw data. When weighted, the box for "more time" grows a little, reducing the number of outliers, and that for "less time" shrinks, greatly increasing the number of outliers. A better overall measure is likely to be the median, which is about the same for the two cases at 15 minutes.

Figure 6.1: How much more or less time it would have taken had the work been done in the office



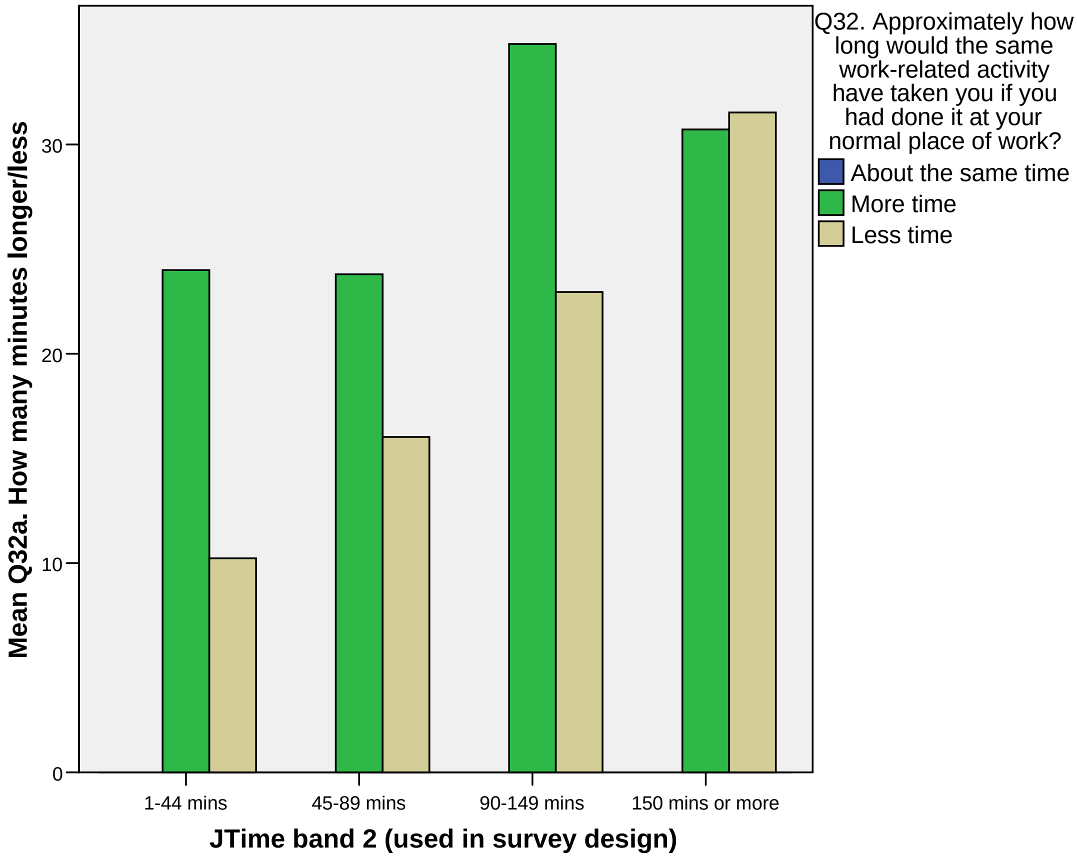
The variation on journey time and other variables is interesting. Figure 6.2 the relative proportions of those whose time working on the train would take longer or less if done at the usual place of work varies only slightly with journey time. A slight trend downwards for the proportion needing less time is apparent.

Figure 6.2: The effect of journey time on the relative proportions of those whose on-train work would need more or less time if done at the office



The mean of the change in the time spent working, were the work to be done at the office, is shown in Figure 6.3. This shows a steady upward trend in the amount by which it would be less, and a rather less steady trend upward for the amount by which it would be more. The category for “About the same time” is of course empty, as there is no change.

Figure 6.3: Variation with journey time of the mean change in time spent working if done at the office



The upward movements in both largely cancel each other out.

The overall average change in the amount of time spent working (by business travellers who implied in Q30 that they spent some time working) is summarised by journey-time band in Table 6.1 in minutes of the absolute change, for the expanded data. As a guide to the uncertainty in the estimates, the standard error of the mean is given as calculated at the level of the sample (see section 5.5.4 for comments on the difficulty of estimating it for the expanded data).

Table 6.1: Average absolute change in the amount of working time needed if the work was done at the normal place of work

	Minutes, average of expanded data		
Journey time band	Mean change (expanded)	Sample count	Standard error of sample mean
Less than 45 minutes	-1.12	115	0.8
45 mins to less than 90 mins	-1.88	499	0.5
90 mins to less than 150 mins'	-1.85	472	0.9
150 mins and over'	-4.02	160	1.5
Overall	-1.71	1246	0.4
Sample count=1,246			

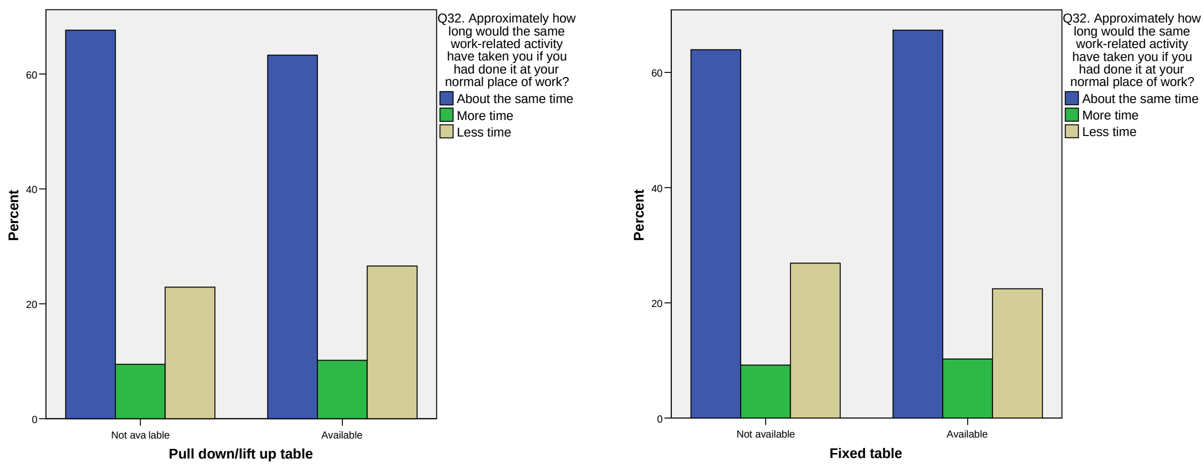
The data is presented in relative terms in Table 6.2, by the average relative productivity, where relative productivity for an individual is the ratio of the time the work would take in the usual work-place to the time it took on the train[28]; and the average is the ratio of the sums of these times. Note that the two tables (the absolute change in minutes and the relative productivity of the time spent working) are not to the same base, the usable sample having dropped from 1,246 to 1,197.

Table 6.2: Average relative productivity: the ratio of the working time needed if the work was done at the normal place of work to that needed on-the train

Time-weighted average of relative productivity factors	
Journey time band	Mean
Less than 45 mins	98%
45-89 mins	97%
90-149 mins	98%
150 mins or more	96%
Total	97%
Sample count = 1,197	

The question of whether on-train productivity of working time is higher or lower than at the office might be affected by a number of factors, such as the availability of a table, a power socket, WiFi, a lap-top and crowding levels. The effect of the availability of certain facilities (from Q19) or their use (from Q30) on the relative productivity has been explored. Perhaps the most consistent effect is that of table availability, where Figure 6.4 suggests that a pull-down/lift-up table decreases productivity of working time relative to the office, whereas a fixed table improves it.

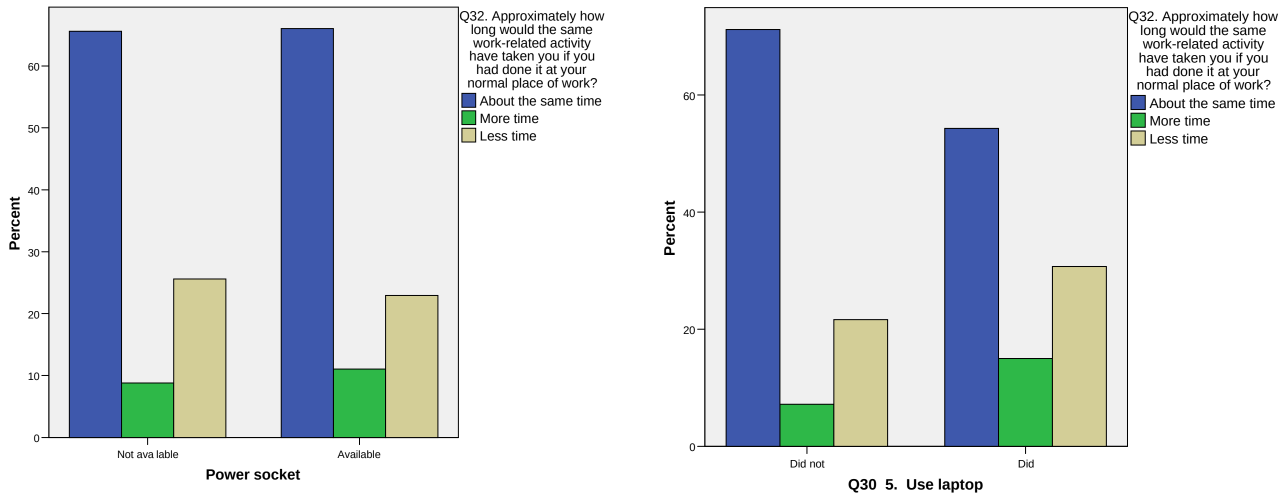
Figure 6.4: Effect of table availability on percentages that would need the same, more or less time at the office



[28] For a fuller discussion of the definition of 'Productivity' and 'Relative Productivity', see Appendix F.

From the responses in Q19, the availability of a power socket appears to reduce the numbers reporting that their work would take less time at the office, as shown in the left diagram in Figure 6.5 (similarly, the availability of WiFi appears to slightly increase the numbers reporting that their work would take more time at the office). However, the response on the use of the lap-top (from Q30) given in the right diagram of Figure 6.5 shows a mixed effect, both increasing the proportion reporting that the work would take more time if done at the office, and increasing the proportion reporting that it would take less time.

Figure 6.5: Effect of power socket availability and laptop usage on comparative productivity of time spent working



The effects of crowding (when the train departed the boarding station) on the level of productivity of working time on-train relative to that in the office has been analysed from the responses in questions 20 and 32, with the results shown in minutes of change in Table 6.3, and as the Relative productivity in Table 6.4.

Table 6.3: Average change in the amount of working time needed by those working if the work was done at the office, by crowding level

	Minutes, averaged for expanded data	
Level of crowding on boarding train	Mean change (unweighted)	Mean change (weighted)l
25% seats occupied	-1.0	-1.0
50% seats occupied	-1.2	-0.8
75% seats occupied	-2.4	-0.9
90% of seats occupied nobody standing	-2.2	-2.0
90% of seats occupied a few people standing	-6.8	-5.6
100% of seats occupied	-2.7	-3.2
Total	-1.8	-1.4

Table 6.4: Relative productivity by crowding level

	Mean, expanded data
Crowding level	Relative productivity (%)
Up to 50% seats occupied	98%
75%-90% of seats occupied, no standing	103%
90% or more of seats occupied, some standing	89%
Total	99%

It is very noticeable that at the higher crowding levels on the train the implied level of productivity of working time on the train relative to that in the office drops. For example, in uncrowded conditions the difference in work versus office time is close to zero, but as crowding reaches standing levels at 90% of seats occupied, the amount by which the time taken at the office is less than that taken on the train (for those reporting working on the train) rises to 5.6 minutes (weighted).

6.3 Context concerning questions about changes in scheduled journey time

The questions 33-36 and 38 and consequently the analyses in the following sections relates to one of three hypothetical changes in scheduled journey time associated with the train. The survey design envisaged each change being related to journey times in the ranges shown in Table 6.5.

Table 6.5: Hypothesised changes in scheduled time in questionnaires (Q33-36, 38)

Design code	Designed journey time ranges	Time shown
A	Less than 45 minutes	10 mins
B	45 mins to less than 90 mins	15 mins
C	90 mins to less than 150 mins'	15 mins
D	150 mins and over'	20 mins

However, the hypothesised changes in scheduled journey time, although associated with a narrow range of journey times at the design stage, did actually cover a wider range, as illustrated in Table 6.6. This table gives the percentage distribution for both the expanded data ("Exp") and the sample data (N%), as these are different due to the large expansion needed at the lower range of journey times.

Table 6.6: The range of journey times in which work might be affected by the hypothesised changes in scheduled journey times

	Percentage of business travellers that did some work									
	Change in JT hypothesised at Q33-36 (M minutes)									
Journey time band	A: 10 mins		B: 15 mins		C: 15 mins		D: 20 mins		Total	
	Exp	N%	Exp	N%	Exp	N%	Exp	N%	Exp	N%
Less than 45 mins	88%	63%	12%	3%	14%	2%	14%	1%	37%	10%
45-89 mins	11%	30%	75%	69%	17%	9%	12%	5%	41%	39%
90-149 mins	0%	3%	12%	25%	59%	75%	26%	31%	17%	38%
150 mins or more	1%	4%	1%	3%	10%	14%	48%	63%	5%	13%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Number N in sample		155		632		404		145		1,336

The data in this table are for the subset who were not, in Q30, saying that they did no work on the train, and so should have answered Q33-34 (though not all did so). (The number who should have responded to Q35, 36 and 38 to which these hypothetical changes also related, totalled 1645). This question (Q30) is not however the one used in the analyses here to differentiate between those who did some work on the train and those who did not; the composite measure of the percentage of time spent working, (Q29ab_2) was the basis for that differentiation.

6.4 The effect of changes in scheduled journey time on working on-train

Respondents were asked in Q33-34, "Suppose **this** rail journey was scheduled to last [M] minutes **longer** [in Q33; **shorter** in Q34] how long would you have spent undertaking work-related activity on train?", where [M] was either 10, 15 or 20 minutes. They were invited to tick one of three check boxes ("About the same time"; "More time" or "Less time") as well as writing in how many minutes longer or less.

From the response to Q33, a very small proportion (1%) claim they would spend less time on a work-related activity on the train if the journey time was scheduled to be longer; and similarly just 1% of those responding to Q34 claim they would spend more time on a work-related activity on the train if the journey time was scheduled to be shorter. These responses are opposite in direction to that which would be expected from the question, so these records (34 in total) were excluded from the analyses that follow.

6.4.1 The effects of an increase in scheduled time

The average amounts of the increase in work-related time on the train given in Q33 are shown for each of the hypothesised increases in Table 6.7. Because the responses to a given change in journey times were given over a wider range of journey times than planned (see Table 6.6), the averages are given in Table 6.8 for each of the design-related time bands. Variation by crowding levels is illustrated in Table 6.9. Similar analyses for the hypothesised decreases in scheduled journey time of Q34 are shown in Table 6.10, 6.11 and 6.12 respectively.

For Table 6.7 and 6.10 the total time changes are also shown as percentages relative to the time increases or decreases shown to the respondents, based upon the values given in Table 6.5.

Table 6.7: Average increase in work related time on-train due to an increase in scheduled journey time, as a function of that increase

			Minutes, expanded data
Change in JT hypothesised at Q33-36 (M minutes)	Q33. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes longer how long would you have spent undertaking work related activity?		
	Average for those working who responded "More time	Average for those working who responded "About the same" or "More time"	Average over all business travellers (and % of increase in journey time)
A: 10 mins	9.3	5.0	3.3 (33%)
B: 15 mins	13.2	5.2	4.1 (27%)
C: 15 mins	13.8	4.2	3.6 (24%)
D: 20 mins	17.1	7.0	5.5 (28%)
Overall	11.9	5.1	3.8
Sample count	448	1,241	1,537
Consistent data-set: within Q33/33a and across to the evidence of percentage time spent working			

As may be observed from Table 6.7, for the given 10, 15 or 20 minutes time extensions, and for all respondents, between 24% and 33% of the increase in scheduled journey time might be translated into additional time spent working on the train. The greatest gain in time overall is that for the shorter distance trips, where more of the time extension is translated into additional productive working time. For the longer journeys, it is possible that much of the desired work has already been accomplished, so that time extensions of such trips are more likely to be translated into additional leisure time.

Table 6.8: Average increase in work-related time on train due to an increase in scheduled journey time, as a function of journey time

			Minutes, expanded data
Journey time band	Q33. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes longer how long would you have spent undertaking work related activity?		
	Average for those working who responded "More time	Average for those working who responded "About the same" or "More time"	Average over all business travellers
Less than 45 mins	10.2	5.8	3.8
45-89 mins	13.1	4.8	3.9
90-149 mins	14.4	4.6	3.8
150 mins or more	16.1	3.9	3.4
Total	11.9	5.1	3.8
Sample count	448	1236	1530
Consistent data-set: within Q33/33a and across to the evidence of time spent working (Q29ab_2)			

When analysed relative to levels of crowding in the carriage (as reported by the respondents at the time of the train's departure), the greatest additional productivity in the use of travel time is observed to apply for the least crowded carriages. For carriages with 100% seats occupied, there is a noticeable drop-off in productive additional time.

Table 6.9: Average increase in work-related time on train due to an increase in scheduled journey time, as a function of train crowding levels

			Minutes, expanded data
Q20. How crowded would you say the carriage was when this train departed your boarding station?	Q33. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes longer how long would you have spent undertaking work related activity?		
	Average for those working who responded "More time	Average for those working who responded "About the same" or "More time"	Average over all business travellers
25% of seats occupied	12.4	5.5	4.3
50% of seats occupied	12.2	4.5	3.2
75% of seats occupied	11.4	5.4	4.4
90% of seats occupied, nobody standing	11.8	5.0	3.8
90% of seats occupied, a few people standing	12.6	5.1	3.2
100% of seats occupied	9.9	4.3	2.7
Overall	11.9	5.1	3.8
Sample count	446	1,236	1,532

6.4.2 The effects of a decrease in scheduled journey time

We will now consider the effect of a decrease in scheduled time on on-train work, using the responses to Q34. The reductions in time spent working on the train are reported in Table 6.10 as a function of the hypothesised reduction in journey time. The last column, which also gives the overall average reduction in working time as a percentage of the reduction in scheduled journey time, shows that between 23% and 37% of the reduction in journey time would be lost to productive on-train working.

Table 6.10: Average decrease in work related time on train due to a decrease in scheduled journey time, as a function of that decrease

			Minutes, expanded data
Design code: Hypothesised change in scheduled JT	Q34. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes shorter how long would you have spent undertaking work related activity?		
	Average for those working who responded "Less time"	Average for those working stating "About the same" or "Less time"	Average over business travellers (& % of reduction in journey time)
A: 10 mins	-9.2	-5.7	-3.7 (37%)
B: 15 mins	-13.5	-5.8	-4.5 (30%)
C: 15 mins	-14.2	-4.1	-3.5 (23%)
D: 20 mins	-19.8	-8.1	-6.4 (32%)
Overall	-12.1	-5.6	-4.2 (31%)
Sample count	452	1,240	1,536
Consistent data-set: within Q34/34a and across to the evidence of time spent working (Q29ab_2)			

The average reduction in on-train working time is shown as a function of the journey times used in the survey design (see Table 6.6) in Table 6.11.

Table 6.11: Average decrease in work related time on train due to a decrease in scheduled journey time, as a function of journey time

			Minutes, expanded data
Journey time band	Q34. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes shorter how long would you have spent undertaking work related activity?		
	Average for those working who responded "Less time"	Average for those working stating "About the same" or "Less time"	Average over business travellers (& % of reduction in journey time)
Less than 45 mins	-10.5	-6.9	-4.5
45-89 mins	-13.4	-5.2	-4.1
90-149 mins	-14.6	-4.5	-3.7
150 mins or more	-15.4	-3.8	-3.3
Total	-12.1	-5.6	-4.2
Sample count	452	1,235	1,529
Consistent data-set: within Q34/34a and across to the evidence of time spent working (Q29ab_2)			

The relatively small size of these reductions in on-train working time arises because a large percentage of those travelling (overall, 51%) are able to complete their work unaffected by the reduction in scheduled time. The percentages involved are shown for the journey-time bands in Table 6.12. It is clear that with longer journey times, the percentage unaffected is higher, as would be expected, even though the mean value of the change hypothesised has also increased.

Table 6.12: Percentage of those work is affected or not by reductions in scheduled time

				Row percentages, expanded data
Journey time band	Average value of "M" minutes	Q34. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes shorter how long would you have spent undertaking work related activity?		
		About the same time	Less time	Sample count
Less than 45 mins	11.3	33%	67%	120
45-89 mins	14.7	58%	41%	495
90-149 mins	15.4	66%	33%	480
150 mins or more	17.4	68%	31%	161
Total	13.7	51%	49%	1,256

When assessed against levels of crowding, shown in Table 6.13, on average 4.2 minutes of the time reduction would have been lost to productive on-train work, almost irrespective of crowding conditions. Whilst the least loss of working time is apparent for the most crowded conditions, that is not surprising as these conditions inhibit working. .

Table 6.13: Average decrease in work-related time on train due to a decrease in scheduled journey time, as a function of train crowding levels (Q34)

			Minutes, expanded data
Q20. How crowded would you say the carriage was when this train departed your boarding station?	Q34. Suppose this rail journey was scheduled to last M (=10, 15 or 20) minutes shorter how long would you have spent undertaking work related activity?		
	Average for those working who responded "Less time"	Average for those working stating "About the same" or "Less time"	Average over all business travellers
25% of seats occupied	-12.4	-5.8	-4.5
50% of seats occupied	-12.1	-5.4	-3.8
75% of seats occupied	-11.6	-5.7	-4.6
90% of seats occupied, nobody standing	-13.1	-5.6	-4.3
90% of seats occupied, a few people standing	-12.7	-6.3	-3.7
100% of seats occupied	-9.9	-4.7	-3.0
Total	-12.1	-5.6	-4.2
Sample count	451	1,235	1,531
Consistent data-set: within Q34/34a and across to the evidence of time spent working (Q29ab_2)			

Further insights into the Stated Intentions data on the effect of a decrease in scheduled journey time on the amount of time spent working on-train can be found in the figures and tables in Appendix G, where the consistency with Revealed Preference data is explored.

6.5 The extent to which reductions in scheduled journey time result in work being done off-train

This section uses Q35 to explore the effect of a given reduction in scheduled journey time on the amount of work undertaken off the train. Question 35 shows whether the time saved by virtue of the train arriving earlier was spent working, and if so where. The responses are analysed by outward/return nature of the trip and by time period of scheduled arrival time in Table 6.14 and 6.15 respectively.

Table 6.14 includes a distinction between those who said they worked on the train (using the composite variable Q29ab_2_YN) and those who did not. Overall just 39% of business travellers would spend their savings in journey-time working off-train, but for those who worked on the train the percentage was higher (46%). Of those who did no work on the train 12% would use the reduction in time to work off the train.

Table 6.14: Whether and where worked in saved time by direction of travel

Column percentages, expanded data

Q35. If this train was scheduled to arrive your destination station M (=10, 15 or 20) minutes earlier, do you think you would have worked or not in the M minutes saved time?	Worked on-train			Did not work on-train			All
	Outward	Return	Total	Outward	Return	Total	
Not worked off-train	50%	58%	54%	84%	92%	88%	61%
Worked in usual workplace	14%	20%	16%	11%	3%	7%	14%
Worked in other workplace	12%	3%	8%	1%	0%	1%	6%
Worked at home	8%	15%	11%	4%	4%	4%	10%
Worked elsewhere e.g. cafe, hotel	13%	3%	8%	0%	1%	0%	7%
Other - please specify	3%	2%	3%	0%	1%	0%	2%
Total	100%	100%	100%	100%	100%	100%	100%
Sample count	678	634	1,312	95	144	239	1,581

Table 6.15 shows that the percentage that would do no work off-train varies with the time of arrival of the train; being 55% up to 4pm, rising to 71% during the afternoon peak (4pm to 7pm), a change that is consistent with the change from outward to return direction reported in Table 6.14. Thereafter the percentage not working in the saved time rises not to 100% but to 73%, largely due to work being taken home.

Table 6.15: Whether and where worked by time period of scheduled arrival

Column percentages, expanded data

Q35. If this train was scheduled to arrive at your destination station M minutes earlier, do you think you would have worked or not in the time saved?	Q8_Period Scheduled arrival time at alighting point				
	before 10:00	10:00-15:59	16:00-18:59	19:00 and later	Total
Not worked	55%	56%	71%	73%	60%
Worked in usual workplace	15%	16%	11%	4%	14%
Worked in other workplace	17%	6%	2%	1%	7%
Worked at home	2%	11%	11%	18%	10%
Worked elsewhere e.g. cafe, hotel etc	9%	8%	2%	0%	7%
Other - please specify	2%	3%	2%	4%	2%
Total	100%	100%	100%	100%	100%
Sample count	238	740	376	105	1459

6.6 The overall effect of reductions in scheduled journey time on working time

The overall effect of a reduction in scheduled journey time on the amount of time spent working for the business trip as a whole is analysed in two ways.

- At a grouped level, by bringing together the information from Q34, on the average impact of a shorter journey time on the amount of time spent working on the train (section 6.4.2), with that from Q35 on the uses made of that saved time after the passenger has left the train (section 6.5); and
- At an individual level, by creating a new variable summarising the impact on each respondent of the effect of each of these changes.

The two approaches are equivalent. The second was needed in order to associate each individual's responses with their income, for the valuation of travel time savings (for Chapter 8). For both approaches, the responses in Q35 were summarised into a "not worked"/ did work" variable.

6.6.1 Analysis at the grouped level

At the grouped level, the analysis framework shown in Table 6.16 was developed. It distinguishes between the reduction in time spent working on the train, and that of the time spent working thereafter, for each of four journey time bands. Estimates of the average reduction in time worked on the train were taken from Q34. Not surprisingly, the estimate is 0 for those who were not affected and almost the whole amount of the reduction in scheduled time for those who were (see also Table 6.10 and Table 6.11). Estimates of the amount of "saved" time spent working off-train were based on the maximum possible amount of time that could be spent on such work, that is, the hypothesised saving of 10, 15 or 20 minutes; weighted averages of these values for those who did do some work off-train are shown in the columns headed "Weighted average maximal off-train working time". It might be argued that the "maximal estimate" of time spent working off-train (by those who do such work) may not be attained in practice. For example, there could well be some "down-time" if the venue for the additional work is not a place one was going to anyway (for example, a café). But such venues account for only a small proportion of the total (see Table 6.15); hence for the majority, who travel on to their workplace or to home, no extra downtime is involved and the "saved time" could well all be spent working.

The detail in Table 6.16 is summarised by journey time band in Table 6.17, in which the first two columns are just the weighted average of the changes in on-train working and off-train working shown in the last two columns of Table 6.16. The third column then gives the combined effect. Division by the average of the supposed reductions in scheduled times (given in the third column), leads to the estimates of the average changes in working time due to a one minute change in the scheduled journey time, given in the last column.

Table 6.16: Principal effects of journey-time reductions on the amount of time spent working

Minutes, expanded data

	Q34. Suppose this rail journey was scheduled to be M (=10, 15 or 20) minutes shorter….	… how long would you have spent undertaking work (on the train)? (Q34)					
		About the same time		Less time		Total	
Journey time band	… would you work or not (off -train) in the M minutes of saved time? (Q35)	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in on-train working time	Weighted average maximal off-train working time
Less than 45 mins	Not worked off-train	.0	0.0	-11.4	0.0	-5.8	0.0
	Worked somewhere	.0	10.6	-10.2	11.4	-7.7	11.2
45-89 mins	Not worked off-train	.0	0.0	-13.0	0.0	-3.3	0.0
	Worked somewhere	.0	14.7	-13.8	14.9	-7.0	14.8
90-149 mins	Not worked off-train	.0	0.0	-14.4	0.0	-3.1	0.0
	Worked somewhere	.0	15.4	-14.7	15.6	-5.9	15.4
150 mins or more	Not worked off-train	.0	0.0	-16.1	0.0	-2.8	0.0
	Worked somewhere	.0	17.9	-15.0	17.5	-6.1	17.7
Overall	Not worked off-train	.0	0.0	-12.4	0.0	-4.1	0.0
	Worked somewhere	.0	14.0	-12.0	13.2	-7.1	13.5
Sample count		760		429		1,189	

Table 6.17: Summary results of the effects of journey time reduction on the mean time spent working

					Minutes, averaged over all business travellers, expanded
Journey time band	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in overall time spent working	Weighted mean reduction hypothesised in scheduled journey time	Weighted mean change per minute of reduced time
Less than 45 mins	-6.82	5.89	-0.93	11.30	-0.0827
45-89 mins	-5.13	7.28	2.15	14.73	0.1459
90-149 mins	-4.33	6.70	2.37	15.39	0.1537
150 mins or more	-3.94	6.02	2.08	17.40	0.1194
Total	-5.57	6.59	1.02	13.68	0.0747

From Table 6.17 it appears that the reduction in the time spent working decreases as journey time increases, which is a somewhat surprising result as the mean hypothesised reduction in scheduled journey time increases with journey time. This outcome may in part be due to the much lower proportion of business travellers who do some work in the smallest time range (see Table 5.10. From columns 3 and 5 of Table 6.17, the percentage of “saved time” that is spent working may be estimated, and is shown in Table 6.18; the fact that this decreases as the journey time increases is not surprising, as presumably the longer the train journey, the more time one has available on-train in which to do the work one wants or needs to do.

Table 6.18: Variation with journey time in the percentage of saved time that is spent working off-train

Journey time band	Percentage of the reduction in journey-time that would be spent working off-train
Less than 45 mins	52%
45-89 mins	49%
90-149 mins	44%
150 mins or more	34%
Total	49%

It is recommended that the effect of other factors, such as time of day and direction of travel, on this and related quantities also be explored.

6.6.2 Analysis at the individual level

As explained at the start of this section, as a basis for contributing to the valuation of travel time savings, a new variable PILT ("Productivity Impact of Less Time") was defined, being the sum of two intermediate components that reflected the impact on on-train working ("PILT_OnTrain") and off-train working ("PILT_OffTrain") respectively. The on-train component of PILT took account of the relative productivity of work done on the train (relative to that in the work-place). Care was taken to ensure consistent treatment of missing values. The averages of these individual values across the four journey time bands, shown in Table 6.19, are consistent with the weighted average figures obtained for grouped data in the last column of Table 6.17.

Table 6.19: The average impact of less journey time on individuals' productivity

		Minutes, expanded data
Journey time band	PILT_Overall=PILT_OnTrain+PILT_OffTrain	
	Mean (Expanded)	Unweighted Count
Less than 45 mins	-.0639	110
45-89 mins	.1513	468
90-149 mins	.1692	452
150 mins or more	.1342	143
Total	.0753	1,173

The small negative value for the change in the total amount of work done (which occurs only for the lowest journey-time band) shown in Table 6.19, which was also seen at the aggregate level of analysis, is explained by the detail given at the aggregate level in Table 6.17, the average gain by being able to work off-train the saved time (5.9 mins) is less than the reduction in time spent working on-train (6.8 mins). Overall however a reduction in scheduled journey time increases the amount of time spent working.

By multiplying each of the individual values of the "PILT" variable by the "personal income" for the individual (or rather the average for their income category), a basis for estimating the employer's valuation of a savings in journey time is obtained. This is shown in Table 6.20 both as an income-weighted figure (without contributions to employer's on-costs of national insurance and pensions) and as a proportion of the average income for those in that category.

Table 6.20: Income weighted estimates of effect of reduction in journey-time

	Pounds, and as percentage of income; Pounds, Number			
	Income-weighted value of changes in working time per minute reduction in journey time (PILT_Income)	Percentage of income	Average personal income	Unweighted Count
Less than 45 mins	£1,035	2%	£55,437	99
45-89 mins	£9,042	15%	£58,776	417
90-149 mins	£10,500	17%	£60,026	400
150 mins or more	£11,673	19%	£62,253	126
Total	£6,442	11%	£57,919	1,042

The income-weighted values of changes in working time per minute's reduction in journey time, given in the first column of data in Table 6.20, immediately convert into estimates of the value of an hour's reduction in travel time, on multiplying by 1.212 (employer's on-costs, covering National Insurance and pension contributions) and assuming 1,755 working hours per year. This yields the estimates given in Table 6.21, for further discussion of which see Chapter 8.

Table 6.21: Employer-related value of time implications

	Value to the employer of one hours's reduction in scheduled journey time
Less than 45 mins	£0.71
45-89 mins	£6.24
90-149 mins	£7.25
150 mins or more	£8.06
Total	£4.45

It should be noted however that due to the higher rate of non-response to the income questions, the sample count in Table 6.20 is reduced from those in the preceding two tables, and the estimates of the corresponding average values of the overall PILT change accordingly. To facilitate comparison, these estimates are shown alongside the two sets previous obtained in Table 6.22.

Table 6.22: Comparison of three estimates of the proportion of a journey time saving that is returned to work

	Mean across groups (from Table 6.17 (A)	Mean for all respondents (from Table 6.19) (B)	Mean for respondents with income data (relates to Table 6.20) (C)
Less than 45 mins	-0.0827	-0.0639	-0.0291
45-89 mins	0.1459	0.1513	0.1351
90-149 mins	0.1537	0.1692	0.1719
150 mins or more	0.1194	0.1342	0.1425
Total	0.0747	0.0753	0.0807
Sample count	1,189	1,173	1,042

Variability in estimates such as these may be accounted for by a number of factors. A main difference between those in columns (A) and (B) is that the latter is the average of individually calculated values; the former is based on averaged values for groups. A main difference between those in columns (B) and (C) is the difference not so much in sample size – where any differences would be due to sampling variability – but in missing values. Care has been taken throughout these analyses to ensure consistency of treatment of missing values (such that all the records contributing to a given table have valid values for all variables used in that table). Here, as in any study of this kind, it is not in principle appropriate to assume that the missing cases have the same characteristics as the valid cases.

In practice, in the absence of appropriate tests or of robust procedures to impute the missing values, we must *de facto* imply such an assumption, even though some 30% of the original sample of 1660 respondents are not contributing to these estimates. There are additionally other factors that may contribute to the uncertainty associated with these and other estimates. The first is the well-known fact that people's estimates of time – or in this Chapter, differences in time – are bunched, being biased towards 5, 10 and (in particular) the 15 minute mark spent working. Hence small changes in the records contributing to a table can have a pronounced effect on some averages. The second is the effect of uncertainties in the expansion factors, which in these data are more pronounced at the low journey-time end.

The PILT variable developed in this section is used in the following section to explore the differential effects of crowding level, on the amount of work done if journey time is reduced; but its most important application is in Chapter 8, where, based on these results, value of time estimates from the employer's perspective are combined with those (from Chapter 7) from the employee's perspective in deducing new overall values of journey-time savings.

6.7 The differential effects of crowding level

The analysis of the effect of crowding level or seating ability discussed in section 5.6.1 led in section 5.6.2 to discerning the effect of crowding on the percentage of time spent working via 3 levels of crowding, 3 of journey time band and 3 of occupation, albeit with reservations, for sample size reasons, about the number of levels. In the context of valuing the impact on productivity of a reduction in scheduled journey time, it is unnecessary to categorise by occupation, which was a proxy for income, as the income variable can be used as a multiplier. That enables the data to be regrouped, and the customary four journey time bands re-introduced. Applying the "PILT" variable described in the previous section to discern the average impact on all business travellers (whether they worked on the train or not), leads to a pattern of variation by the three crowding levels shown in Table 6.23.

Table 6.23: Minutes of productive use of a minute of reduced journey time by crowding level

		Minutes per minute, expanded data		
Journey time band	Up to 50% seats occupied	75%-90% of seats occupied, no standing	90% or more of seats occupied, some standing	Total
Less than 45 mins	-.1087	-.0121	-.0193	-.0639
45-89 mins	.1420	.1782	.1136	.1502
90-149 mins	.1921	.1315	.1478	.1692
150 mins or more	.1512	.0677	.2106	.1258
Total	.0652	.0878	.0773	.0742
Sample count: 1,168				

It is as well to be aware of the smallness of the sample count in some cells of this matrix. This distribution is shown in Table 6.24.

Table 6.24: Sample count contributing to these estimates

				Sample count
Journey time band	Up to 50% seats occupied	75%-90% of seats occupied, no standing	90% or more of seats occupied, some standing	Total
Less than 45 mins	57	42	11	110
45-89 mins	261	146	58	465
90-149 mins	273	140	39	452
150 mins or more	86	47	8	141
Total	677	375	116	1168

To contribute to the valuation of time savings, income weighted values of PILT are needed. Converted to an hourly basis (assuming 1755 work hours per year), the valuation of the effects of a journey time reduction on work is shown in Table 6.25. To become the employers' valuation of the time saving, on-costs need to be included, and this is taken forward in Section 8.8.

Table 6.25: Income-weighted benefit of reductions in journey time

				£/hour, expanded data
Journey time band	Up to 50% seats occupied	75%-90% of seats occupied, no standing	90% or more of seats occupied, some standing	Total
Less than 45 mins	-£0.87	£2.39	£0.91	£0.59
45-89 mins	£4.99	£5.94	£3.74	£5.15
90-149 mins	£7.58	£2.85	£5.66	£5.98
150 mins or more	£6.78	£5.62	£3.81	£6.19
Total	£3.55	£3.92	£3.12	£3.64
Sample count: 1037				

There are however differences in the sample sizes involved, due to the lower response rate for the question about income. To ensure compatibility with Table 6.25, the mean values of the PILT variable that had been shown in Table 6.23 have been recalculated to correspond with the income-weighted values in the Table 6.25, with the result shown in Table 6.26.

Table 6.26 Minutes of productive use of less time corresponding to the income-data

				Minutes, expanded data
	Up to 50% seats occupied	75%-90% of seats occupied, no standing	90% or more of seats occupied, some standing	Total
Less than 45 mins	-.0804	.0069	.1171	-.0291
45-89 mins	.1121	.1731	.1332	.1338
90-149 mins	.2088	.0980	.1702	.1719
150 mins or more	.1461	.0940	.2106	.1330
Total	.0658	.0860	.1364	.0795
Sample count: 1,037				

6.8

6.9 Conclusions

This section provides the principal conclusions to the Stated Intentions analysis.

- Two-thirds of business travellers say that the work they do on the train would take about the same time if done in their normal place of work; about one-tenth say it would take more time if done at the office, and about one quarter less time. Whilst there is considerable variability in the data, there is evidence of both a slight downward trend for the proportion reporting "less time" to decrease as journey time increases, and a much stronger upward trend in the amount of time by which it would be less. A relative productivity factor, defined as the ratio of time needed at the normal work-place to time worked on-train, varied between a time-weighted average of 96% and 98% across the journey-time-bands.

- There is some evidence that:
  - a pull-down/lift-up table decreases productivity relative to that in their normal work-place, whereas a fixed table improves it;
  - availability of power socket reduces the proportion reporting that it would take less time at the normal work-place;
  - those using a lap-top report both a higher proportion requiring less time and a higher proportion requiring more time (at the normal work-place) than those not using a lap-top, suggesting mixed experiences in its effectiveness; and
  - as crowding levels reach standing conditions, on-train productivity relative to that in the normal work-place falls.
- If the scheduled journey time is increased, then, as a function of journey time, between a quarter and a third of that increase will be translated into additional time working on the train, with the greatest additional productivity occurring on the least crowded carriages.

- If the scheduled journey time is decreased, between a quarter and 37% of that decrease will be lost to productive working on board the train, according to the journey time. This reflects the high percentage (51% overall) of business travellers whose time spent working will be unaffected by the change; the percentage is higher for the longer journeys.

- If a decrease in scheduled journey time occurs, some 40% of all business travellers will spend the savings in journey-time working. Assuming that each of these spend all the saved time working, this means that the proportion of saved time converted to productive work is at most 40%. This contrasts with the conventional wisdom that, for business travellers, 100% of a reduction in journey time will be converted into productive work. The percentage varies (from 46% to 12%) according to whether a person works or not on the train; by direction of travel; and/or by the time at which the train arrives. Some 27% of those arriving after 7pm would do some work with the saved time, mainly at home.

- The combination of a reduction in on-train working and an increase in off-train working led to an overall (weighted) mean gain in the time spent working of little over 1 minute. Given that the overall average reduction in time hypothesised was 13.7 minutes this implies a mean change of 0.075 minute per minute of journey time reduction, though the average value was about twice that for journeys in the 45-149 minute ranges.
- A new variable ("PILT" = Productivity Impact of Less Time") was defined at the level of the individual to facilitate estimation of the value of time savings (from the employer's perspective). This included the use of the relative productivity factor defined earlier, to convert the change in on-train working time to an estimate of the time appropriate to the work-place environment. As the average value of the relative productivity factor is high (97%), the overall average impact on both on-train and off-train working was still a mean value of 0.075 minute of work gained per minute of journey time reduction, though the values for each time-band changed slightly.

- Converted to a monetary basis by multiplication by the corresponding personal income, the average values of the product PILT*income expressed as a percentage of the sum of incomes ranged from 2% for the lowest (less than 45 minutes) time band to 19% for the highest time band (journeys of 2½ hours or more). The average overall was 11%.

- Preliminary estimates of the valuation of time savings at different crowding levels have also been made; but due to the smallness of the sample size at the level where some standing occurs (with 90% or more of seats occupied) the estimates obtained must be treated with caution.

- These findings have significant implications for the way in which savings in journey times may be valued. However, it must be born in mind that:
  - Those who work on trains are not only business travellers. Hence the impact on them of any change in journey time also needs to be taken into account, whether this be on or off the train.
  - Whilst the present study has shown that the ability to work on trains has implications for the economic assessment of transport schemes; a related issue that needs investigation is the extent to which that ability influences the demand for rail transport.

7 Stated Preference Analysis

7.1 Introduction

The results of the Stated Preference (SP) element of the questionnaire were taken through a cleaning process using the statistical analysis package SPSS, followed by analysis using the industry standard discrete choice modelling software, ALOGIT (version 4.2c).

Before reporting the results of the SP analysis it is worthwhile to consider the key points to look out for in the results of ALOGIT analysis.

- **Sign of coefficient** – for attributes which in increasing in size make the choice of a mode of travel or route worse the attribute as estimated by ALOGIT should be negative. So, for example, as journey time goes up the likelihood of choosing this mode of transport will decrease, so journey time would be expected to have a negative sign.
- **Significance of attribute** – the significance of the attribute in describing the behaviour of a respondent is shown by the t-ratio. At a 5% significance and 95% confidence level a t-ratio of magnitude greater than 1.96 is required, below this value showing that the variable does not contribute to explaining the behaviour as compared to not having the variable included. Some judgement is always useful in applying t-tests, however, since they depend on the size of the sample used to estimate the effect—more observations will always yield more "significant" behavioural effects, so theory and prior evidence should also be taken into account.
- **Goodness of fit** – how well the overall model explains the body of behaviour of the sample is described by the Rho-squared value. For SP binary choice models a Rho-squared with respect to constants value above 0.15 is viewed as a good model.

Taking into account these three parameters we will now set out the model results from the pilot surveys. In all cases it should be noted that the number of observations given is that obtained from the total number of choices in each SP game, with 12 games presented to each person.

The variables assessed in the SP surveys are as follows:

- Single rail fare cost (in pounds);
- Difference in journey time (in minutes);
- Level of train crowding (assessed relative to base level of 25% of seats taken); and
- Mobile phone reception (assessed relative to a base coverage which is poor).

The data was analysed for the complete dataset (all designs A-H), with both linear and non-linear models used. In both cases given that the SP designs are within mode no allowance for a constant between choices A and B was allowed.

7.1.1 Jack Knifing

Methods to analyse SP data require the assumption that each observation is independent. However, this assumption is not strictly valid when several repeated choices are made by each respondent, because an important feature of SP data is that multiple observations are obtained from each respondent. That is one of the limitations of SP methods: "Repeated Measurement Problem" (Ortuzar and Willumsen, 2001).

As one of effective means to eliminate this problem, a re-sampling technique has been used in many SP analyses. Cirillo et al. (1996) applied Jackknife and Bootstrap re-sampling techniques to correct the repeated measurement problems. The results of applying the Jackknife method confirmed that the estimated coefficient values remained unbiased, but the bias in the variance estimates were varied. They concluded that the repeated measurement problems were not serious in terms of size of the coefficients, and recommended Jackknife for practical work because it is easy to implement and produce smoother estimates at low re-sampling rates.

For the purposes of this SP analysis the Jackknife technique is employed. The idea of this technique is to re-use the sample several times by dividing it into sub-samples and by recombining them to assemble an estimate of the unknown parameter which has good sampling properties and perhaps more importantly, to produce an estimate of the variance of this statistic. In ALOGIT, the programme “JACKKNIFE” allows the number of sub-samples to be only between 2 and 99. In this analysis, 20 sub-samples are studied with the repeated measurements (i.e. the respondent’s ID number that we used for each returned questionnaire paper). 20 sub-samples also were suggested and commonly used in empirical studies (HCG, 2001; Cho and Kim, 2002).

7.2 Method of analysis

The SP analysis proceeded along the following steps:

Data preparation: For SP analysis, the unit of observation is a single SP response. Therefore, each respondent record was split into eight separate records, one for each of the eight SP responses that the respondent provided. The SP attribute levels for that particular scenario were then appended to the record. Finally, all other respondent-specific data items (age, income, etc.) were appended to the appropriate records.

Estimation method: All models described in this section were estimated using the ALOGIT software to perform binary logit analysis. Logit analysis is accepted as the standard method for analysis of discrete choice data. Because we are using up to eight separate choice observations for each respondent, the results are subject to the ‘repeated measures’ problem—the fact that the residual error across responses for the same individual will tend to be correlated. This in turn means that standard logit analysis will tend to under-predict the standard error on the estimates and thus over-state their statistical significance. To address this problem, jack-knife analysis was used to provide an unbiased estimate of the true standard errors.

Model specification tests: Before attempting to look at differences in values between different subsegments of the population, it is important to find a model form that best fits the data. We performed a number of model specification tests, including:

- Use separate coefficients for time savings versus losses, and for fare savings versus losses;
- Test the so-called ‘halo effect’, where respondents place a positive value on staying with their ‘current’ value, rather than shifting to a different value of time or cost. This is tested by assigning an additional dummy (0/1) variable to the ‘current’ level;
- Test certain non-linear forms, such as logarithmic, for the time and cost variables; and
- Test non-linear, piecewise specifications for the crowding attribute.

Segmentation tests: One of the key objectives of the study is to look at the variation in willingness to pay for time and/or crowding changes across different market segments. It is possible to do this one variable at a time, either by interacting that segmentation variable with the attribute levels, or by estimating a completely separate model for each segment. There are two problems with these approaches, however. First, different segmentation variables are often correlated with each other. For instance, income is often correlated with the age of the traveller, with incomes generally increasing somewhat with age, all else being equal. As a result, if we analyze income and age one-at-a-time, we are quite liable to attribute the affect of one variable to the other variable. It is necessary to analyze both variables simultaneously to sort out their relative influences. If, however, we attempted to estimate a separate model for every combination of segmentation categories (i.e. for all high income respondents under age 40), the sample size within each category would become quite small. A much more efficient analysis method is termed ‘orthogonal segmentation’, and has been used in most of the major Value of Time studies in Europe. With this approach, each segmentation variable is interacted with each relevant SP attribute, and the entire sample is included within a single model. In this way, all choice observations can contribute to the estimation of all relevant effects.

Using this approach, we tested the segmentation effects of the following variables on the following choice attributes:

- Household income level: 5 segments, tested for interactions with cost;
- Age level: As a linear variable, allowed to interact with time, crowding, and mobile reception;
- Gender: A dummy variable representing data cases where the respondent was female, interacted with time, crowding, and reception;
- Journey leg: A return journey dummy variable, interacted with time, crowding, and reception;
- Geographic segment: Dummy variables for trips to or from London specified, with testing of interaction with time, crowding, and reception;
- Self-employed: A dummy variable was applied, interacted with cost;
- Fare reimbursement: A dummy variable for actual fare paid out of pocket was used, interacted with cost;
- Ticket type: A dummy variable for season ticket use was allowed, interacted with cost;
- Class of travel: A dummy variable for First Class, interacted with all four model attributes; and
- Working during travel: A dummy variable for no-work done on the train, plus a linear variable for percent of time spent working, interacted with time, crowding, and reception.

7.3 Results

Five key models are reported in Table 7.1:

- Model A - base model with dummy estimation of crowding, and mobile phone reception, and no incremental variation in the effects for different segments of the sample;
- Model B - as model A, but adding incremental variations in the effects of the SP attributes for different segments of the sample;
- Model C – as model B but with insignificant incremental effects removed;
- Model D - as model A but with testing of log functionality of rail fare; and
- Model E - as model C but with testing of log functionality of rail fare.

Table 7.1: Stated Preference Estimation Results

Model	A			B			C			D			E		
Observations	12452			12452			12452			12452			12452		
Final log likelihood	-6961.5			-6701.3			-6705.1			-6825.9			-6624.1		
Rho-squared(0)	0.193			0.224			0.223			0.209			0.233		
Rho-squared(const)	0.191			0.221			0.221			0.207			0.230		
Variable (Dummy variables unless indicated otherwise)	Coeff	T-stat	Value	Coeff	T-stat	Value	Coeff	T-stat	Value	Coeff	T-stat	Value*	Coeff	T-stat	Value*
FARE															
Fare (pounds)	-0.163	-28.4		-0.212	-25.0		-0.208	-25.4		-0.0423	-4.6		-0.048	fixed	
Log of fare (ln(pounds))										-4.52	-16.2		-5.15	-27.5	
Current fare offered ^^	0.593	27.0	-£3.64	0.625	27.6	-£2.95	0.624	27.6	-£3.00	0.776	30.1	-£4.07	0.801	32.1	-£3.69
TIME															
Journey time decrease (min)	-0.0344	-12.4	£12.7/hr	-0.0344	fixed	£9.7/hr	-0.0312	fixed	£9.0/hr	-0.0346	-12.3	£10.9/hr	-0.0285	Fixed	£7.9/hr
Journey time increase (min)	-0.0656	-21.6	£24.2/hr	-0.0656	-8.9	£18.6/hr	-0.0595	-15.4	£17.2/hr	-0.0595	-19.1	£18.7/hr	-0.0495	-13.2	£13.7/hr
CROWDING															
50% of seats occupied	-0.16	-2.6	£0.98	-0.13	fixed	£0.62	-0.14	fixed	£0.68	-0.567	-8.2	£2.98	-0.56	Fixed	£2.58
75% of seats occupied	-0.495	-9.1	£3.04	-0.41	fixed	£1.92	-0.43	fixed	£2.09	-0.722	-12.7	£3.79	-0.74	Fixed	£3.41
100% of seats occupied	-1.81	-25.3	£11.10	-1.49	-6.6	£7.03	-1.59	-11.9	£7.64	-2.22	-27.4	£11.65	-2.22	-23.9	£10.24
Crowding * journey time (min)				-0.0037	-3.0	1.05	-0.0036	-3.0	1.04						
MOBILE RECEPTION															
Clear reception	0.544	13.8	-£3.34	0.0867	0.6	-£0.41	0.132	1.5	-£0.63	0.603	15.1	-£3.17	0.346	5.0	-£1.60
Clear rec. * journey time (min)				0.0019	2.6	-0.54	0.002	2.6	-0.58						
ORDER BIAS															
Left-hand option (A)	0.286	10.1	-£1.75	0.308	12.9	-£1.45	0.31	12.9	-£1.49	0.467	14.8	-£2.45	0.476	17.8	-£2.19

ADDITIVE SEGMENT-SPECIFIC EFFECTS	Coeff	T-stat	Value vs. Base	Coeff	T-stat	Value vs. Base	Coeff	T-stat	Value vs. Base
FARE									
Income 0-50,000	-0.0133	-1.5	-6%	-0.0139	-1.6	-6%	-0.069	-1.6	-6%
Income 75-100,000	0.0292	3.2	16%	0.0296	3.2	17%	0.140	3.0	14%
Income over 100,000	0.0723	8.3	52%	0.0728	8.4	54%	0.358	8.2	46%
Income missing	-0.0204	-2.0	-9%	-0.0198	-1.9	-9%	-0.0612	-1.2	-5%
First class	0.0606	5.1	40%	0.0489	5.4	31%	0.130	2.5	13%
Self-employed	0.0358	4.1	20%	0.0365	4.2	21%	0.215	5.0	23%
Paid out of own pocket	-0.0524	-4.9	-20%	-0.0525	-5.0	-20%	-0.280	-5.6	-20%
Season ticket	-0.0008	0.0	0%						
JOURNEY TIME									
Trip to London	-0.0115	-2.3	18%	-0.0134	-3.5	23%	-0.0135	-3.6	27%
Return journey leg	-0.0076	-1.8	12%	-0.0092	-2.4	15%	-0.0121	-3.2	24%
No work done on train	0.0057	0.8	-9%	0.0062	1.2	-10%	0.0060	1.2	-12%
First class	0.0095	1.6	-14%						
Female	0.0009	0.2	-1%/yr						
Age (years-50)	-0.0002	-1.0	0%						
Fraction. of journey time working	0.0004	0.1	-1%						
Travelling with others	0.002	0.4	-3%						
Trip from London	0.0007	0.1	-1%						
CROWDING									
First class	-0.195	-1.2	10%	-0.234	-1.5	12%	-0.449	-2.8	20%
Age (years-50)	-0.0113	-2.2	1%/yr	-0.0123	-2.5	1%/yr	-0.0131	-2.6	1%/yr
Female	-0.129	-1.0	7%	-0.116	-1.0	6%	-0.0955	-0.8	4%
Return journey leg	-0.0658	-0.6	3%						
No work done on train	0.0162	0.1	-1%						

Frac. of journey time working	-0.0825	-0.4	4%									
Travelling with others	0.107	0.7	-6%									
Trip to London	-0.0786	-0.6	4%									
Trip from London	-0.0248	-0.2	1%									
MOBILE RECEPTION												
Frac. of journey time working	0.332	2.2	105%	0.384	4.0	103%				0.357	3.7	103%
First class	0.288	2.9	92%	0.29	3.0	78%				0.300	3.0	87%
Age (years-50)	-0.0088	-2.6	-3%/yr	-0.008	-2.5	-2%/yr				-0.0102	-3.1	-3%/yr
Travelling with others	-0.119	-1.2	-38%	-0.167	-2.0	-45%				-0.156	-1.9	-44%
Female	0.141	1.7	45%	0.134	1.7	36%				0.0625	0.8	18%
Return journey leg	0.0411	0.5	13%									
No work done on train	-0.0498	-0.4	-16%									
Trip to London	0.0662	0.7	21%									
Trip from London	0.0723	0.8	23%									

Note: * for models D and E, values are calculated assuming a fare level of £30

^^ indicates ‘halo effect’ variable estimated

The base values listed in Table 7.1 are without any of the modifiers/incremental effects (the rest of the % values in the table).

Based upon the results shown in Table 7.1, it is clear that very good models have been obtained, with low log-likelihoods and high Rho-squared values. Some instances exist of variables being only just significant, with t-stats less than 1.96.

Before the models reported in Table 7.1, initial model testing showed both time and cost to have highly different values for savings versus losses, with losses valued about twice as much per unit change as savings. A greater marginal effect of losses as opposed to gains is a typical result in Stated Preference research.

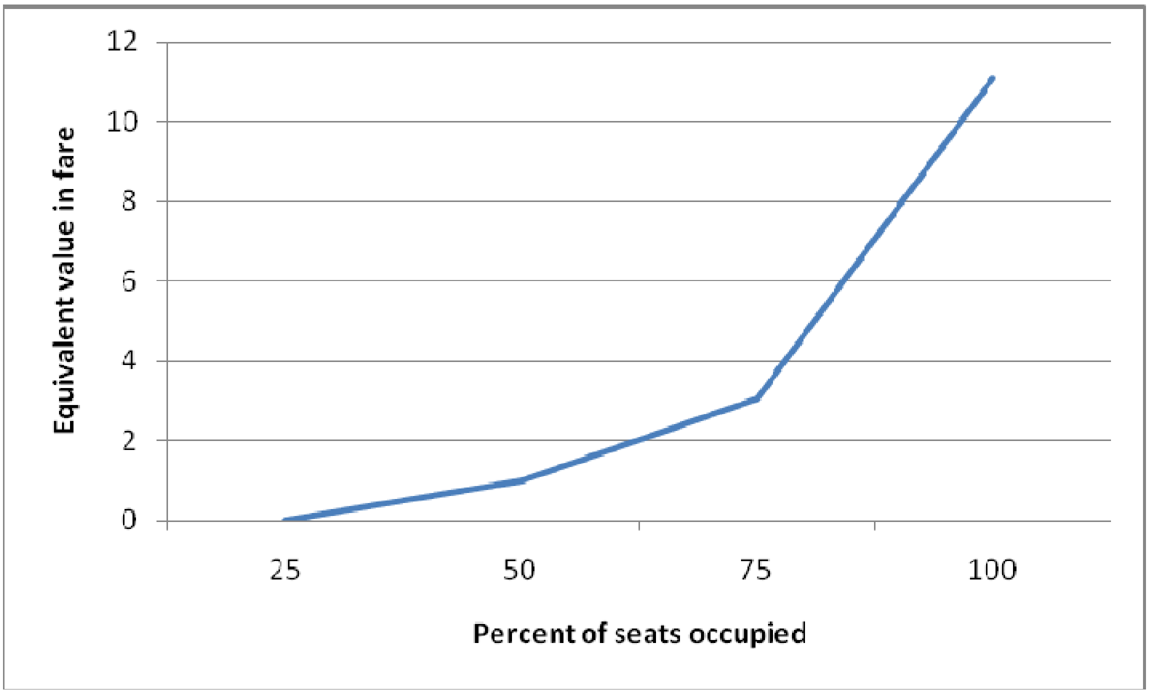
When 'halo effect' variables were added, the results for time and cost were quite different. For journey time, the 'current level' dummy variable was found to not be very significant, and the different values for time savings versus time losses persist. On the other hand, for fare the 'current level' dummy variable was found to be highly significant and positive, and including it virtually eliminated any difference in per unit valuation between cost increases and decreases. Thus, for all further tests, the current level dummy variable for cost was kept in the models, but a single cost coefficient was used for both savings and losses.

7.3.1 Model specification tests

The best model without segmentation is shown as Model A in Table 7.1. Some results, normalized to the fare coefficient, have been shown in the "Value" column, and can be interpreted as follows:

- The Value of Time (VOT) for a time saving is roughly £12.66/hour, while the VOT for a time loss is £24.15 /hour.
- The equivalent "cost" of going from 25% of seats occupied to 50% occupied is valued at about £1. Going to 75% of seats occupied raises the cost to about £3. Finally, going to 100% of seats occupied raises the cost to about £11. The estimated function is shown in Figure 7.1.
- Clear mobile reception has a positive value of just over £3.
- The "halo effect" of offering the current fare level also has a positive value of just over £3.
- The order bias variable indicates a bias toward the left-hand Option A, all else being equal. The equivalent value of this bias is about £1.75. The design was balanced to minimize the correlation of this bias with the attribute levels.

Figure 7.1: Valuation of crowding levels (£)

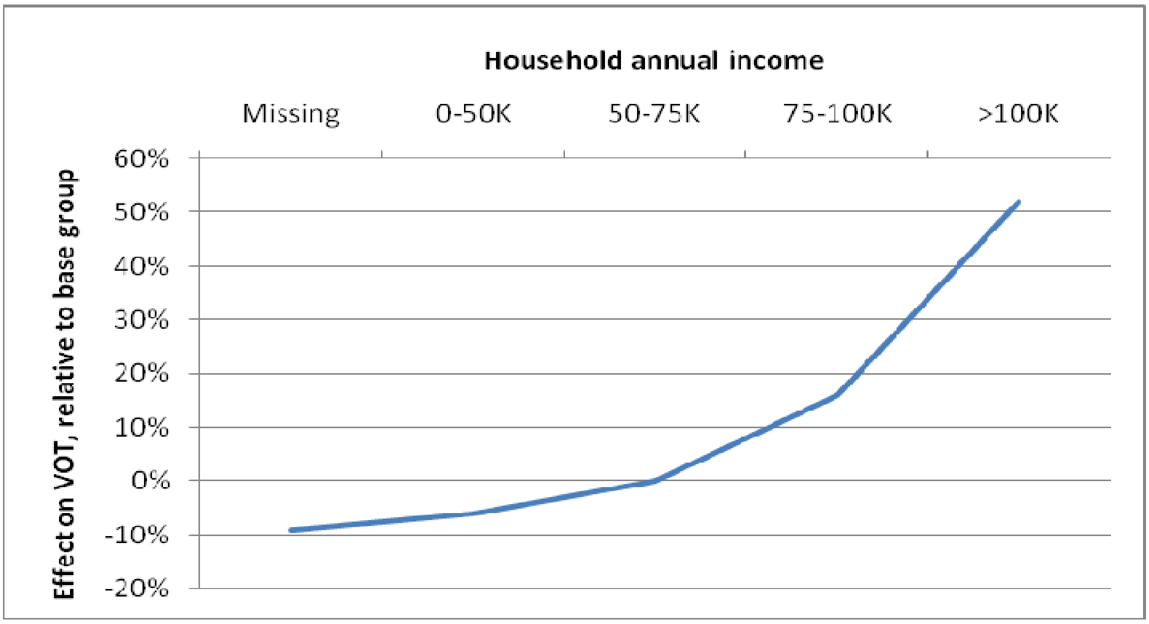


7.3.2 Segmentation tests

Model B in the table below shows all of the additional segmentation variables tested, while Model C is the same as Model B, but eliminating the least significant segmentation variables. As mentioned above, all segmentation was undertaken simultaneously to avoid spurious results and make the most efficient use of the data. Also, in order to apply the segmentation effects to the full non-linear effects of journey time and crowding, the shapes of the non-linearities for those two variables were constrained to be the same as in Model A (estimating full separate non-linear functions for each segment would require too large a sample to estimate accurately).

In the 'Value" column in the table for the segment-specific effects, we show the percentage change in value relative to the "base" segment. For income, for example, the base segment includes those with household incomes in the range £50,000-£75,000 per annum. The additional fare coefficient for income in the range £75,000-£100,000 is 0.0292/£ income. When added to the base fare coefficient of -0.212, this gives -0.1828/£ income. Thus, the fare coefficient is about 14% smaller than for the base group. VOT, however, is proportional to the inverse of the fare coefficient, so the VOT for this income groups is 16% higher than for the base group. Similarly, the VOT for the highest income group (>£100,000) is 52% higher than for the base group, while the VOT for the lowest income group (<£50,000) is only 6% lower than for the base group. This trend of value of time. with income is shown in the graph below. This result of VOT increasing with income, but less than proportionally, is typical for both RP and SP models.

Figure 7.2: Value of time related to household income



Also noted from the SP results, first class travellers also have about 30% higher VOT, and self-employed travellers have about 20% higher, while those who pay their train fare out of their own pocket have a value of time about 20% lower (more fare-sensitive).

There are very few significant segmentation effects on journey time, other than:

- Those travelling to London have a value about 20% higher than others;
- Those travelling on the return journey home have a value about 15% higher than those on the outbound journey; and
- Those who reported performing no paid work during the journey have a VOT about 10% lower, although this is not statistically significant.

For crowding, Models B and C show a significant interaction with total journey time. For every hour spent on the train, the sensitivity to crowding increases by about 15% (about £1.05 per hour, added to the "base" value of £7.04). Other segmentation effects are:

- Those travelling in First Class are about 10% more sensitive to crowding than those in Standard class;
- Older travellers are more sensitive to crowding than younger travellers, with the value increasing about 1% per year of age; and
- Females value (relief from) crowding about 5% more than males, though the difference is not statistically significant.

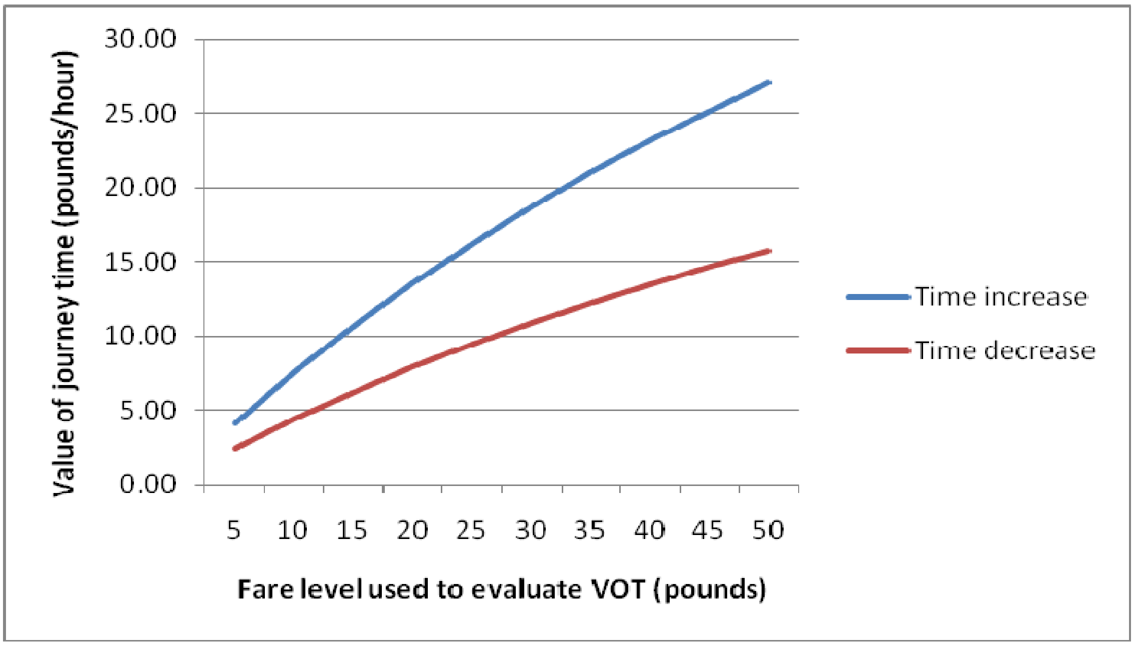
There is also a significant interaction of mobile reception with journey time. The base value of clear reception in Model C is only 63p, but that increases another 58p with every hour of journey time. Further segmentation effects noted were:

- If the fraction of time spent on the train doing paid work is 1.0, then the value of clear mobile reception is doubled. In other words, the value increases by about 1% for each percent of journey time spent working;
- First Class travellers are willing to pay about 80% more than Standard class travellers for clear reception;
- Older travellers are less willing to pay for clear reception, about 2.5% less for each year of age;

- Females are willing to pay about 40% more for mobile reception, relative to males; and
- Those travelling on the train with others are willing to pay about 40% less for mobile reception, relative to those travelling alone.

Model D in the table below shows the results of adding a logarithmic fare variable to the specification, along with the linear fare variable. Relative to Model A, this improves the model fit by 135 log-likelihood units (very significant). With this formulation, the imputed VOT depends on exactly which fare level the ratio is calculated for. Figure 7.3 below, based on the Model D coefficients, shows that VOT increases as the fare level increases, because the rate of change of the log component of the fare effect decreases. The values in the table are calculated at a fare level of 30 pounds. At a fare level of about £40, the values are roughly equal to those of Model A (about £13/hour for time savings and £24/hour for time losses). The values of crowding and mobile reception stay much the same as in Model A.

Figure 7.3: Value of time related to fare level



Finally, Model E is comparable to the segmented Model C, but now including the additional logarithmic fare effect. To estimate this model the ratio of the fare and log(fare) coefficients was fixed to be the same as in Model D, so that the fare segmentation variables could be applied to the full function including both the log and linear effects. Compared to Model C, the results are generally consistent, with a few notable changes:

- The interactions of crowding and mobile reception with journey time became insignificant and were dropped from the model. Since fare and total journey time tend to be correlated, this result suggests that the interaction effects found for total journey time were mainly due to an incomplete specification of the fare effect.
- The First Class segmentation effect on fare is now less significant. First Class passengers tend to pay higher fares, so this result is also due to a more complex specification for fare. Note that the First Class segmentation effects on crowding and mobile reception are now somewhat more significant than in Model C.

7.4 Conclusions

The Stated Preference models have been analysed allowing for both linear and non-linear coefficients. Particular testing was undertaken of non-linearity of time and costs increases and decreases, as well as the ‘halo effect’ of not wanting to move from the current experienced details, even where savings may be made in the SP games.

Based upon the ALOGIT analysis, the following key results are to be noted for application further in this study:

- A logarithmic function of fare provided the best results for the model, suggesting that travellers respond to fare differences not only according to the absolute magnitude of the difference, but also according to the percentage (proportional) difference;
- Business travellers personal valuation of time for the best performing model were of the order of £7.88/hour for time increases, and £13.69/hour for decreases, i.e. a willingness to pay more for a shorter journey;
- Crowding may be seen to have a major effect upon rail business travel, with steep increase in the negativity seen towards this where more than 75% of seats were occupied (up to £10.24 per journey);
- Provision of clear mobile phone reception has a fares equivalent of £1.60 per journey in the best performing model (model E);
- Clear evidence exists of personal VOT increasing with household income, and an increase in VOT is also evident for First Class compared to Standard Class travellers;
- Age effects the sensitivity to crowding, with older travellers placing more value of this attribute than those in younger age groups;
- London focussed trips value journey time more highly than those not travelling to the capital; and
- Personal valuations of time savings are greater on the return leg of the journey than the outward, showing a greater willingness to pay to save time for themselves when heading home.

These results have been carried forward into the analysis of the application of the study results, when combined with the Revealed Preference and Stated Intension analysis already reported.

8 Study Conclusions

8.1 Introduction to the 'Value of Time' context

Throughout this report, we have used the term 'Value of Time', or VOT, in connection with a rate at which money expenditure on transport projects (here, particularly projects which would result in faster services) can be justified as providing societal benefits in terms of travel time savings for travellers 'in the course of work'. These benefits can come from increased productivity, or from the personal satisfaction of the traveller, or from a mixture of both. The units we have used are £ per hour, and the number of 'hours' to which the VOT figure should be applied is those of the 'time saved' not those of the total travel time involved[29]. The experiments we have conducted are cross-sectional, based on current travel patterns, intentions, background circumstances and so on, but the aim is to use the results to infer *future* benefits over coming years, since investments in transport infrastructure can only be judged by recognising that they will have an impact over many years.

A first point to make is that VOT is not a simple concept. The term is used widely in the literature of both forecasting and evaluation of transport projects, but these are different areas of application: different techniques may be applied in estimating the values appropriate for demand forecasts and the values appropriate to economic appraisal[30]; different values may be obtained; and different considerations may arise as to how these values are adopted in practice[31]. This issue is discussed in Gunn (2000). For travel (such as commuting or leisure) in which the traveller is clearly making a free choice in terms of personally-experienced cost and travel time, it is reasonable to assume that their behaviour will reveal a justifiable 'personal value' of time (or set of values in different circumstances) which can be put forward not only in the demand forecasting context but also as an appropriate 'societal' value to compare with costs in the economic appraisal context. For travellers-in-the-course-of-work (henceforth, business travellers), the problem of inferring values from behaviour is more complex. In this case, it is unclear who is making the decision, as both employers and employees are involved (and indeed ex-employees may be relevant in terms of company travel policies). Whilst observed current behaviour may be the best guide to forecasting future behaviour in the demand forecasting context, it is not clear that it is the best guide to a 'societal' valuation of potential time savings in the economic appraisal context. So the first point to make is that the value of VOT we seek is not (necessarily) that which could be used in forecasting models. Instead, we are looking at the separate impacts on the traveller and the employer; how these translate to travel behaviour is not an objective of the current study.

[29] For this reason the term "Value of Travel Time Savings", or VTTS, is sometimes used, in order to emphasise that it is the marginal rate not the average rate that is required. The two are of course equivalent if VTTS is invariant to travel time. See also the discussion below of the concept of "Travel time savings".

[30] The demand forecasting context reflects the value to the individual (or rather the decision-maker concerning the trip); and the economic appraisal context reflects the value to society

[31] For example, for economic appraisal, equity considerations can suggest that the value of time should be a common value across the population, and not vary with income; whereas for demand forecasting, it is entirely appropriate that variations with income should be reflected in the adopted (behavioural) value of time.

Next, we come to the issue of ‘Travel Time Savings’. This too can be a misleading notion, especially when measurements are based in a currently experienced travel context. Consider the example of two possible transport projects: one a do-minimum maintenance of service, and another investing more to speed that service up. As Hawkins (1974) has observed, there is no sense in which the travellers in future years would experience a time-saving after the investment. In the short term, those who had used the service could well experience a time saving over the old service – but no-one would have experienced the conditions under the ‘rejected’ policy. This is important from a measurement viewpoint, since it introduces a new (and unwanted) aspect of human behaviour. When people are experimentally offered ‘time savings’ or ‘time losses’ (against cost differences) in the context of a recently experienced trip, it is routinely the case that the losses are valued higher (often by a factor of two) than time savings. This effect was reported and discussed in AHCG (1999), in the context of UK Road Users’ VOT. In that report, a rationalisation was offered in which the cause of this asymmetry was ascribed to the need to re-schedule non-travel activities, for which a tangible penalty would be immediately perceived if the journey times were to be increased, but for which the gains would not be immediately obvious if the journey times were to be reduced.

Experimentally, this bias can be offset quite simply by ensuring that the data set is balanced evenly between losses and gains; this was done in AHCG (1999) and has been repeated in SPURT 2008. However, it is worth noting that the issue is not so simply discarded for either forecasting or evaluation in the short-term. For both forecasting and evaluation, it would seem that increases in journey time (especially if perceived as unforeseen delay as opposed to planned rescheduling of service) are much more important in the short term than reductions in journey time. This ties into the importance of ‘reliability’ (if perceived as ‘delay’) or to ‘frequency of service’ (if perceived as ‘rescheduling’) in the perception of the quality of different travel options, and has implications for both choice of travel option and social/societal cost of unexpected or planned changes in service.

In our SPURT experiments we have ensured that the VOT measurements, where these apply to the employee and are taken from Stated Preference experimentation, are based on a balance of contexts in which gains and losses appear symmetrically. In this way, we have tried to avoid some of the problems associated with the ultimate aim of having ‘long-run’ values to use in cost-benefit analyses.

However, there are other issues to consider when looking at long-run valuations in the context of speeding up business travel. One such issue is that of the effect of any changes in productivity on the wage rate. We can (and do) measure the potential effects of reductions (and increases) in journey time to employer and employee separately in the current context, and assume these to be independent. Indeed, the experiment we have conducted has been devised to identify and measure these separate components. However, if, in the long run, wage rates change to reflect the change in the inconvenience of travel associated with the job, it can be argued that benefits from transport investment will transfer from the travelling employee to the employer (and conceivably from the employer to the consumer). But this process does not entail any loss of benefits; in the worst case, it merely redistributes them. The potential for reducing wages is similarly related to the personal utility gain that the employee enjoys from reduced travel time. Exactly the same issue applies to time savings in personal time, where increased accessibility to an area has the immediate impact of providing time savings to residents, but the longer-term impact is the raising of the cost of local housing. An investment is made; in the short-run, the traveller’s benefit; in the longer run, the landlord’s benefit. Here too, the issue is not of destruction of the benefit, but of re-distribution. The same effect is now recognised in the evaluation of time savings in the freight area, and attributed to the longer-term workings of the larger market.

Our results suggest that travel time savings do generate extra productive time for business travellers (though not as much as had been previously thought), but they generate even more leisure time. But this is in the short-run. In the longer run, and particularly given the flexibility of work-location now associated with working practices, would this leisure not be traded for additional work (for immediate wages or longer-term job prospects)? Which brings us back to a fundamental point in the discussion of value of time savings: namely that, as Harrison (1974, p71) remarked and then amplified, “There is an important difference between time and money, however, which derives from the fact that time cannot be stored”. So, savings in journey time actually lead only to a redistribution of time between activities, and each alternative distribution will be valued differently by the traveller and by society. The long term redistribution of activities is relatively much more difficult to forecast and to evaluate than those in the short term. Suitable approaches to that problem might come from General Equilibrium ideas (which are based on input-output representations of the economy), and the analysis over a period of years of an appropriate data set. In the meantime, as with time savings for personal travel, the immediate benefits remain a measurable (and minimum) estimate of benefit, and this is what the SPURT project has sought to value.

8.2 Study requirements

The study has had three main objectives;

- firstly to establish the nature of the activities undertaken by business travellers on rail journeys (and how these are affected by background circumstances such as characteristics of the traveller, of the journey, and of the railway carriage);

- secondly, to call for travellers' expectations of how changes in journey duration (particularly reductions) would affect their activities on-train and off; and

- thirdly to establish 'Values of Time' (VOTs) to attach to projected travel time savings for evaluation purposes.

The chosen research method has been to design and implement a large-scale survey, itself calling for three main types of information from the travellers;

- 'Revealed Preference' (RP) data, establishing the activity schedules the travellers chose on a particular journey, and details of the background circumstances

- 'Stated Intentions' (SI) data, calling for judgements of what would change in the way of activities if journey durations altered, and

- 'Stated Preference' (SP) data, calling for multiple choices between hypothetical travel alternatives, from which travellers' own personal welfare gains or losses could be deduced via a fitted mathematical model in which parameters were chosen to best replicate the decisions made.

Two other sources of information have been used, being

- Survey respondent judgemental data, specifically on how long a particular work task undertaken on-board the train would take if conducted in normal working surroundings, and

- An existing large-scale survey of rail passengers (the 2004 NPS) from which improved expansion factors could be derived.

The study approach to estimating evaluation VOT has been to establish values for variables in the so-called 'Hensher formula', which provides a breakdown of the possible sources of benefits of travel-time-savings to Employers and Employees (see Chapter 2). Under certain circumstances, this formula will reduce to the currently accepted evaluation approach (with VOTs set by wage rates and on-costs), but rather than assuming these circumstances, the experiment conducted sought to put them to the test.

The Employers' VOT has been derived from the RP and SI data, modified by the survey Judgemental data (which allowed us to estimate the relative efficiency of work done on-train as opposed to at the usual workplace).

The Employee's VOT is derived from the SP data, analysed in the context of the RP background variables, which basically results in estimates of Employee values of personal time gains from travel. These are then converted to evaluation VOTs by making allowance for the proportion of business rail travel-time savings which result in gains in personal time.

In this Chapter the valuation of Travel Time Savings has been estimated for the mix of travellers present on trains in Spring 2008. As shown in Chapter 5, there are two quite distinct factors contributing to this. One is the proportion of business travellers who spend some time working on trains (currently 80%); the other is the percentage of journey-time that they spend working (currently 57%). Since it might be relatively straightforward to monitor changes in those values over time (via the National Passenger Survey, for example), it may be appropriate to make separate estimates of the “Value of Time savings” for those who did not work on trains and those who do some work.

As set out in Chapter 1, the research method and results have been presented in some detail. The purpose of this Chapter is to isolate some of the key results, to draw these together in the context of the set of research objectives listed in Chapter 1, and to set out our conclusions at the end of the Study. These conclusions will include recommendations for topics which merit further investigation.

To repeat, as specified in the Invitation to Tender (ITT), the study was expected to cover the following elements of work:

- a) Survey rail business travellers to estimate the productive use of travel time (the percentage of travel time devoted to productive work), disaggregated by factors/journey characteristics which influence productive use of travel time (e.g. length of trip);
- b) Assess the productivity of work done while travelling relative to work done at workplace, which is influenced by the nature of the work undertaken as well as travel conditions (e.g. crowding);
- c) Examine distribution of productive work over the journey time, and assess how marginal travel time savings would impact on business travellers' productive use of travel time (the proportion of travel time saved at the expense of work done while travelling);
- d) In the light of findings in (a), (b) and (c) above, estimate value of travel time saving in business time;
- e) Examine the impact of crowding on productive use of travel time;
- f) Assess if a personal welfare element over and above the productivity impact should and can be identified, and if so, assess business travellers' willingness to pay for reduced levels of crowding;
- g) Survey employers to verify the robustness of the above findings and to assess their willingness to pay for business travel time saving;

- h) In the light of the above findings, assess if and how DfT's current approach on work value of travel time saving should be altered;
- i) In the light of the above, assess if and how DfT's current treatment of crowding benefits for business travellers should be altered;
- j) Examine the possible implications of the new estimates for rail appraisal and policy development; and
- k) Draft appraisal guidance on work value of travel time saving and treatment of crowding for In Work Time (IWT) travellers.

Prior to the award of the study to the "consortium", activity k) was removed from the study scope. Activity g), the employer's survey, was also reduced to that of a stakeholder consultation process rather than a survey.

We shall now consider each objective in turn.

8.3 Objective a) to survey rail business travellers to estimate the productive use of travel time (the percentage of travel time devoted to productive work), disaggregated by factors/journey characteristics which influence productive use of travel time (e.g. length of trip)

Chapter 4 describes the survey process, which led to 1,660 returned questionnaires. The productive use of travel time by rail business travellers (which, we recall, has been implicitly assumed to be zero in existing evaluation processes) can perhaps best be summarised by Table 8.1 and Table 8.2 (both Tables reproduced from Chapter 5).

Table 8.1: Proportion working by length of journey and direction of travel

From Table 5.10			Proportion, expanded data
Length of journey	Q1. Are you on the outward or return leg of your business trip?		Total
	Outward	Return	
Less than 45 minutes	0.73	0.73	0.73
45 mins to less than 90 mins	0.88	0.79	0.84
90 mins to less than 150 mins'	0.89	0.80	0.85
150 mins and over'	0.87	0.91	0.90
Total	0.82	0.77	0.80

Table 8.2: Key variations percentage of journey time spent working, by business travellers that spent some time working

From Table 5.20	Mean percentage, expanded data / (Standard error of mear							
	Senior management		Middle management		Junior management/ Manual/Other		All occupations	
	Outward	Return	Outward	Return	Outward	Return	Outward	Return
Less than 45 minutes	61% (4)	57% (3)	49% (8)	51% (6)	54% (20)	41% (8)	58%	53%
45 mins to less than 90 mins	65% (2)	58% (2)	56% (4)	54% (4)	52% (5)	44% (5)	61%	55%
90 mins to less than 150 mins'	64% (2)	56% (2)	59% (3)	55% (4)	51% (5)	39% (6)	61%	54%
150 mins and over'	62% (3)	57% (4)	57% (6)	49% (6)	34% (10)	26% (8)	58%	53%
All journey times	63%	57%	54%	53%	52%	41%	60%	54%
Sample count = 1,357								

From Table 8.1, we see that (after expansion) around 80% of the business rail travellers reported undertaking work during their journey. The longer the journey, the higher the percentage of travellers working. From Table 8.2, we see that, for those who stated that they did some work, on average, 57% of their travel time was spent undertaking work activities (with more working on the outward leg of tour than on the return). There is little variation between different journey durations here, but clearly seniority has an impact, with senior management spending more time than middle management, and middle more than junior/manual.

Across all rail business travellers, on average around 0.8 x 57% = 46% of the train travel time is allocated to work activities. This is considerably higher than the Dutch equivalent 10 years previously. The difference in trip lengths will account for some of this, but it is likely that the major reason can be attributed to the general availability of mobile telephones, PDAs and laptop computers in the latest sample.

In the UK a trend over time is discernible by comparison with the activities reported in the Autumn 2004 National Passenger Survey. A like-for-like comparison gave the proportion of business travellers who spend some time working/studying as 52% in Autumn 2004, 79% in Spring 2008 (Table 5.5). Whilst a like-for-like comparison of the percentage of time they spend working/studying has not yet been undertaken, the two surveys yield estimates of 43% in 2004, and 57% in 2008, again suggestive of a strong upward trend (see section 5.5.1).

Our research also demonstrates the importance of factors influencing the ease of working, and potentially the use of modern IT devices – good mobile phone reception, power supplies, tables etc. To what extent this is a result of intelligent management (provision of business facilities on lines where they are likely to be appreciated) or is a real causal factor in encouraging productive use of rail time, we cannot determine at this stage – and at any rate it is likely to be a mixture of these effects.

8.4 Objective b) to assess the productivity of work done while travelling relative to work done at workplace, which is influenced by the nature of the work undertaken as well as travel conditions (e.g. crowding)

Table 8.3 (reproduced from Chapter 6) sets out a measure of the productivity of the working time on the train, relative to that needed in the office, split by journey time band.

Table 8.3: Average absolute change in the amount of working time needed if the work was done at the office

From Table 6.1		Minutes, average of expanded data	
Journey time bands	Mean change (expanded)	Sample count	Standard error of sample mean
Less than 45 minutes	-1.12	115	0.8
45 mins to less than 90 mins	-1.88	499	0.5
90 mins to less than 150 mins'	-1.85	472	0.9
150 mins and over'	-4.02	160	1.5
Overall	-1.71	1,246	0.4
Sample count=1,246			

Table 8.4: Average relative productivity: the ratio of the amount of working time needed if the work was done at the normal place of work relative to that needed on-the train

From Table 6.2	Time-weighted average of individual factors
Journey time band	Mean
Less than 45 minutes	98%
45 mins to less than 90 mins	97%
90 mins to less than 150 mins'	98%
150 mins and over'	96%
All journey times	97%
Sample count = 1,190	

As seen in Table 8.4, the SPURT survey respondents are reporting that, for the type of work they are doing on the train, the productivity of the time they spend working is not much different from that in an office environment.

Table 8.5 (reproduced from Chapter 6) sets out this split by crowding bands, and indicates that increasing crowding does have an impact on productivity – but that productivity of the time spent working, relative to that in the office, remains high, even in the worst crowding conditions. It is clear that where standing is involved, productivity drops markedly, either through the inability to undertake work whilst standing or the lack of confidentiality in undertaking the work.

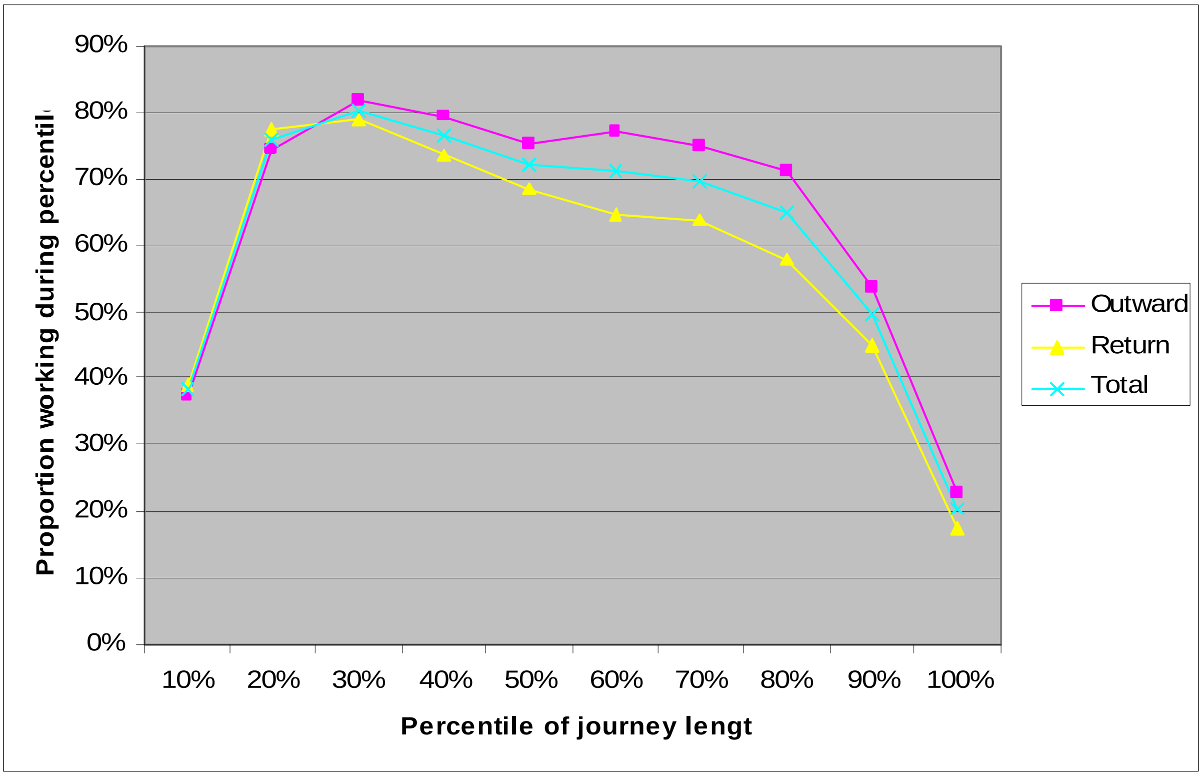
Table 8.5: Average change in the amount of working time needed by those working if the work was done at the office

From Table 6.3	Minutes, averaged for expanded data	
Level of crowding on boarding train	Mean change (unweighted)	Mean change (weighted)
25% seats occupied	-1	-1
50% seats occupied	-1.2	-0.8
75% seats occupied	-2.4	-0.9
90% of seats occupied nobody standing	-2.2	-2
90% of seats occupied a few people standing	-6.8	-5.6
100% of seats occupied	-2.7	-3.2
Total	-1.7	-1.4

8.5 Objective c) to examine distribution of productive work over the journey time, and assess how marginal travel time savings would impact on business travellers' productive use of travel time (the proportion of travel time saved at the expense of work done while travelling);

The distribution of productive work over the trip is best illustrated by Figure 8.1, reproduced below from Chapter 5,

Figure 8.1: Timing of work activities (expanded, subset of data)



As remarked in Chapter 5, Figure 8.1 illustrates the relatively low levels of working at the start and end of the trip, and the general pattern of reducing work activity after a peak (of around 80%) some 25% of the way into the trip.

In terms of the impact of a travel time saving on work-related activities, the Project Brief called for an examination of the effect of savings on work activities on the train. This was done, but in addition a question was asked to determine the use made of the time saving itself, and in particular whether or not it would be used for work purposes.

Table 8.6, reproduced below, summarises the results. For the four bands of journey times used to control the sampling and expansion, different levels of journey time savings were postulated. For the shortest journey duration band, up to 45 minutes, a 10 minute time saving was postulated. From 45 to 149 minutes, 15 minute savings were postulated, with 20 minutes offered for journeys of 150 minutes of more (note that, as mentioned in Chapter 6, practicalities prevented this allocation of journey-time saving level to journey duration band from being exact, so that on some occasions the match of saving to band varied.)

Table 8.6: Principal effects of journey-time reductions on amount of time working

From Table 6.16							Minutes, expanded data
	Q34. Suppose this rail journey was scheduled to be M (=10, 15 or 20) minutes shorter….						
		… how long would you have spent undertaking work (on the train)? (Q34)					
		About the same time		Less time		Total	
Journey time band	… would you work or not (off -train) in the M minutes of saved time? (Q35)	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in on-train working time	Weighted average maximal off-train working time
Less than 45 mins	Not worked off-train	.0	0.0	-11.4	0.0	-5.8	0.0
	Worked somewhere	.0	10.6	-10.2	11.4	-7.7	11.2
45-89 mins	Not worked off-train	.0	0.0	-13.0	0.0	-3.3	0.0
	Worked somewhere	.0	14.7	-13.8	14.9	-7.0	14.8
90-149 mins	Not worked off-train	.0	0.0	-14.4	0.0	-3.1	0.0
	Worked somewhere	.0	15.4	-14.7	15.6	-5.9	15.4
150 mins or more	Not worked off-train	.0	0.0	-16.1	0.0	-2.8	0.0
	Worked somewhere	.0	17.9	-15.0	17.5	-6.1	17.7
Overall	Not worked off-train	.0	0.0	-12.4	0.0	-4.1	0.0
	Worked somewhere	.0	14.0	-12.0	13.2	-7.1	13.5
Sample count		760		429		1,189	

Picking out the key results from Table 8.6, we can see that of the 1,189 responding to all the questions that contributed to this table, 760 (or around 64%) indicated that a travel-time reduction would not affect their allocation of travel time to work. Of these, around 37% said they would be using the time saving to work elsewhere. Thus, (0.64 x 0.37) or 23% of the sample would simply translate travel time savings into extra productive time, with no loss of productivity on the train. The 41% of our sample whose work on-train is unaffected by the travel time reduction and who do not intend to work elsewhere in the time saved would be unaffected in terms of productive use of time. Looking at those who would have to reduce on-train working time, around 60% indicated that they would use time savings to work somewhere else, so for (0.6 x 0.36), or 22% of our sample, the impact on total working time could be positive or negative, depending on how much was lost on-train and how much of the saving was diverted to working elsewhere. (0.4 x 0.36), or 14% of our sample, would actually work less following a reduction in travel time. Table 8.7 sets out these results, and also includes the expanded results.

Table 8.7: Overall effects of a Journey Time Reduction

Consequences of the JT Reduction	% of Sample	% of Expanded data
Extra Work Undertaken	23%	20%
Work Unaffected	41%	34%
Effect uncertain + / - on Work Time	22%	29%
Less Work Undertaken	14%	17%
Total	100%	100%

It should be noted that the Table implies that travel-time savings will have little effect on the total amount of work undertaken. The 'Effect uncertain' group reduce their work time on-train, but work extra elsewhere in the time saved. Detailed analysis showed that for this group there was a slight gain overall in the amount of time spent working. Together with the 'Unaffected' group, some 63% of the sample expect to spend the same or slightly more time working if journey times are reduced. The other two groups are those who would do more and those who would do less; they are approximately the same size (with a slight tendency for more work to be done).

In Table 8.8, we have calculated the 'maximal' gain, by assuming all of the time saving would be diverted back to work when respondents indicated they would work in the time saved.

Table 8.8: Summary results of the effects of journey time reduction on the mean time spent working

From Table 6.17			Minutes, all business travellers, expanded		
Journey time range	Weighted mean change in on-train working time	Weighted average maximal off-train working time	Weighted mean change in overall time spent working	Weighted mean reduction hypothesised in scheduled journey time	Weighted mean change per minute of reduced time
Less than 45 mins	-6.82	5.89	-0.93	11.30	-0.08
45-89 mins	-5.13	7.28	2.15	14.73	0.15
90-149 mins	-4.33	6.70	2.37	15.39	0.15
150 mins or more	-3.94	6.02	2.08	17.40	0.12
Total	-5.57	6.59	1.02	13.68	0.07

The net result of these positives, negatives and zeroes turns out to be only around +/- 0.1 minute for each minute of journey time saving offered, depending on journey duration band/size. This is in the context of offered travel time savings of 10, 15 or 20 minutes. Working time lost on the trip is only slightly less than working time created in the time saved.

8.6 Objective d) in the light of findings in (a), (b) and (c) above, estimate value of travel time saving in business time;

The conclusions of our research are that a realistic value of travel time saving in business time should not be estimated solely on the findings of (a), (b) and (c); both Employer and Employee take benefit from improved travel conditions. Below, in Table 8.9, we set out our findings for the average values to both Employer (the subject of (a), (b) and (c)) and Employee.

8.7 Objective e) to examine the impact of crowding on productive use of travel time

Table 8.9 shown over differentiates between crowding levels, for both Employer's VOT (productive use) and Employee's VOT. Neither are strongly affected by crowding in the sample we have achieved.

8.8 Objective f) to assess if a personal welfare element over and above the productivity impact should and can be identified, and if so, assess business travellers' willingness to pay for reduced levels of crowding;

The issue of whether or not a personal welfare element 'should' be identified has been dealt with in earlier Chapters dealing with the established theory. The size of this element could turn out to be negligible, but the argument that the wage rate already compensates for travel time fails as a reason for neglecting this aspect in evaluation. Possibly, perhaps probably, business traveller wage rates would be affected by the disutility of travel – but this would not remove the benefit conferred by better travel conditions, merely switch it from the business traveller to the business, and potentially from the business to the consumer (or most likely distribute the benefit between traveller, business and consumer). The implication of this is that the long-term benefit can be approximated by the short-term benefit, even if events are such that the ultimate recipient of the benefit changes.

The approach of approximating the societal benefit by the immediate benefit to the traveller is consistent with the approach to valuing travel time savings in personal time. The analogy is with investment to improve access to a given community, which then results in higher rents/land-values, re-distributing the benefits between travellers and land-owners. Here, the conventional approach is to take the immediate benefits to the travellers as the measure of societal benefit, regardless of the longer-term redistribution between travellers and land-owners.

Given that we recommend that this personal welfare element 'should' be taken into account, the question is 'can' we measure it? Our approach, as set out in our proposal, has been to use Stated Preference methods in the context of hypothetical situations in which the business traveller would not be compensated for extra expenditure, or could personally benefit from reduced expenditure. Chapter 7 sets out the analyses that have been performed on the resulting dataset. We have concluded that the results are consistent and credible, and from that that the personal welfare element can be measured, and is indeed substantial. In fact, much more important than the impact on productive time.

We have chosen to use Model C from amongst those reported in Chapter 7, for a number of reasons. Most importantly, this model is the best of those consistent with rational expectations concerning the impacts of crowding and telecommunications (specifically, that they should increase with the duration of the journey). Models D and E, although superior in terms of log-likelihood, do not have this feature, and in addition do not supply VOTs which are independent of journey duration, so that their use in evaluation would not be standard (this is a topic currently under research investigation).

The following Table (

Table 8.9) uses the average of the VOTs for time savings and losses from Model C, evaluated in the context of the traveller as recorded in the RP data. The reason for taking the average is as follows. It is common in SP experiments which include options one of which is the “status quo” that the analysis reveals a so-called 'halo effect', whereby the “status quo” option appears to be more attractive than would be explicable by its characteristics alone. This results in losses being more valued (dis-utile) than (utility-generating) gains. This effect is discussed in some detail in the Accent and Hague Consulting Group Report “The Value of Time on UK Roads”, where the effect is attributed to the essentially short-run nature of SP data. In brief, the argument is that, in the context of an actual past journey, the difficulty in re-scheduling activities around the trip (or imagining such a re-scheduling) lead to time savings being used sub-optimally, and time losses causing more disruption than would be the case if time allowed a full re-optimisation of activity schedules. A simple average is thus advised, whereby these two effects act to cancel each other out.

The Table sets out Employer VOT (EMR) per unit of travel time saved, adjusted to apply only to the proportion of journey time savings that go towards work. Also shown is the Employee VOT assuming 100% of travel-time reductions results in personal time gains (EME)[32]. The resulting total evaluation VOT is also given, being the sum of EMR and EME.

In Table 8.9 we have assumed that the minority of travellers who return part or all of the travel time savings offered to work, will not receive additional wages. This is partly in consideration of the relatively small amounts of time involved, and the small part that overtime payments play in relation to business salaries. There may well be expectations of financial consequences in terms of bonus entitlement, promotion prospects or simply job security. This assumption can be challenged, particularly in relation to forecast years where time savings may be larger and business practices may be different. Further research is indicated here.

[32] The robustness of this assumption is discussed in the following Chapter.

Table 8.9: Employer and Employee VOTs

							£/hr 2008
Time Band Crowding	*VOT*	Less than 45 mins	45-89 mins	90-149 mins	150+ mins	Average	No. of observations
0-25%	*EMR*	*-1.1*	*6.1*	*9.2*	*8.2*	*4.3*	
	EME	16.4	17.6	19.5	20.0	17.4	486
	Total	15.3	23.7	28.7	28.2	21.7	
50%	*EMR*	*-1.1*	*6.1*	*9.2*	*8.2*	*4.3*	
	EME	16.6	17.8	19.7	20.2	17.6	425
	Total	15.5	23.9	28.9	28.4	21.9	
75%	*EMR*	*2.9*	*7.2*	*3.5*	*6.8*	*4.8*	
	EME	16.8	18.0	19.9	20.4	17.8	328
	Total	19.7	25.2	23.4	27.2	22.6	
100%	*EMR*	*1.1*	*4.5*	*6.9*	*4.6*	*3.8*	
	EME	17.6	18.8	20.7	21.2	18.6	401
	Total	18.7	23.3	27.5	25.8	22.4	
Total	*EMR*	*0.7*	*6.2*	*7.3*	*7.5*	*4.4*	
	EME	16.8	18.0	20.1	20.4	17.8	1,640
	Total	17.5	24.2	27.4	27.9	22.2	

Notes

- EMR = EmployeR VOT
- EME = EmployeE VOT for leisure time
- Total = EMR + EME
- Nobs = number of observations
- VOT in 2008 pounds per hour
- Assumed 1755 work hours per year
- On-costs assumed at a factor 1.212

Definitions of crowding differed between RP and SP experiments, the RP measures being about the level of crowding experienced at a particular point in time, the SP measures being about the experience of change from one level to another

RP bands
(a) 0% - 50% crowding
(b) 75% - 90%(no standing) crowding
(c) 90%(some standing) plus
SP bands
(a) 0%-25% crowding.
(b) 50% crowding
(c) 75% crowding
(d) 100% crowding

- For the purposes of the Table, RP(a) was used with SP(a) and SP(b), RP(b) with SP(c) and RP(c) with SP(d).

The EMR values in Table 8.9 are the result of multiplying the values given in Table 6.25 by the on-cost factor (1.212). The values given in the "Total" row are the same as those previously shown in Table 6.21 for all but the last distance band; the difference here being due to changes in the sample count.

The EME values in Table 8.9 are the result of applying the SP model "C" to every individual in the sample to get individual-level VOTs, and then calculating an expanded average.

As may be noted from Table 8.9, the key result is that the ratio of Employers' gain to Employees' gain from a time saving is of the order of 1 to 4, meaning that employees gain four times as much from a minute of time saving as do employers.

8.9 Objective g) Survey employers to verify the robustness of the above findings and to assess their willingness to pay for business travel time saving;

This aspect of the study has not been carried forward and so is not reported.

8.10 Objective h) In the light of the above findings, assess if and how DfT's current approach on work value of travel time saving should be altered.

Firstly, it must be stressed that our research has focussed on travel time savings in the context of briefcase travellers, and on the rail mode. However, our findings do have implications for other modes of travel, and indeed for other groups of travellers (in particular, commuters, who were found to be also using rail journeys for work purposes).

Further, our remit is with VOTs for evaluation, not forecasting. In the case of non-work travel, it is usual to choose evaluation VOTs to equal forecasting VOTs (although there may be tax distortions to adjust for), but current UK practice departs from this in the case of work-travel. The cost savings approach, with its assumptions that travel time is unproductive, that all savings are converted into extra productivity, and that benefits to the traveller can be discounted implicitly also discounts any impact from crowding on evaluation VOTs (this despite the fact that we note that the WebTAG section on crowding points readers to the PDFH values, which are explicitly forecasting values and do make allowance for crowding).

Our findings, in summary, are that none of the assumptions supporting the cost-savings approach is defensible in the face of the data. Further, the cost-savings approach cannot even be justified as a 'good approximation' to more thoroughly worked-out calculations.

Accordingly, we would recommend that the current approach be replaced with a process based on estimated actual productivity gains for Employers (which are now much less than 100%) and actual welfare benefits to travelling Employees.

Forecasting VOT has in the past been linked almost exclusively with income growth (in the UK at least). Income elasticities (less than unity) have been developed for Employee's VOT in the course of the study; employer VOT can be assumed to be directly proportional to income growth as before.

8.11 Objective i) In the light of the above, assess if and how DfT's current treatment of crowding benefits for business travellers should be altered;

As mentioned in the previous section, the current cost-saving approach implies that crowding should not affect evaluation VOTs (it will affect overall benefits by reducing predicted demand, and thus the amount of time saved, but not the unit value of the time saved). Our results, as set out in Table 8.9, also indicates that crowding (at current levels) can be neglected for evaluation purposes.

We would also recommend that the apparent ambiguity in WebTAG (referring to forecasting values in PDFH) be removed.

8.12 Objective j) Examine the possible implications of the new estimates for rail appraisal and policy development; and

A first result must be that the economic case for speeding up rail services will be reduced considerably by the adoption of the new values. WebTAG advised rail VOTs of £36.82 in 2002, which would convert to £44.60 in 2008 prices simply on correction for RPI change. Income growth would add considerably to this. Our average value of £22.20 (Table 8.9) implies a reduction to 50% of the previously calculated contribution to the economic case from time savings from the business sector.

8.13 Objective k) Draft appraisal guidance on work value of travel time saving and treatment of crowding for In Work Time (IWT) travellers.

This objective has been withdrawn, to be replaced by a planned industry/DfT workshop.

8.14 Overall Conclusions

The research reported in this study has provided, for the first time, a picture of the journey activities of UK rail business travellers together with estimates of the impact that journey time savings would have on their productive use of time, and on their personal welfare. By so doing it has provided a basis for new estimates of VOT in 2008 for evaluation purposes. The suggested changes are substantial, and would reduce the estimated benefits of a speedier rail system to this segment of the market by more than 50%. However, there are other market segments, not covered in this survey, where, from the NPS 2004 survey, it is known that work is undertaken on the train, and for a complete assessment of the impact on productivity of changes in journey time, the impact on these segments should also be taken into account.

The substantial benefits now afforded by rail as a potential working environment are evident, as is possible connection of developments in the last decade (in terms of work practiced and IT devices) to that growth in rail demand which is unexplained by most current demand models.

However, in addition to these results, our data has shown that crowding, as measured by % of seats occupied, is not a strong influence on evaluation VOT. Journey duration, on the other hand, does have a significant impact. The difference between our longest duration band (150+ minutes) and the shortest (up to 45 minutes) is not quite a doubling of VOT, but a 60% increase on average.

In comparison with comparable studies in the Netherlands in the late 1990s, the major change seems to have been in the Employer's VOT. Rail Business travellers in the UK are now using travel time highly efficiently. Marginal reductions in travel time (10, 15, 20 minutes) are not guaranteed to lead to much extra productive time at work, whether in the 'usual workplace' or elsewhere.

Table 8.9 shows that, in total, the ratio of Employers gain to Employees gain from a time saving is around 1 to 4 (£4.40 vice £17.80 per hour). This is another important conclusion from the study, and it underlines the need to identify the split of monetarised travel time savings between those of financial consequence and those primarily in terms of welfare benefits. It also underlines the degree to which the cost-saving approach, which assumed 100% of time savings accrued to the Employer at the wage rate plus on-costs, could distort evaluations.

9 Recommendations for Further Areas of Study

The following recommendations for further work are designed to provide further evidence on the productive use of travel time and how that might be taken into account in the development and appraisal of transport schemes. The recommendations have been broken down under a series of headings, ranging between further analysis of the SPURT data to wider DfT/Rail industry matters.

9.1 Additional analysis of the SPURT data

- The SPURT data-base could be further enhanced by (1) the coding up of (a) the additional 104 responses received after the cut-off-date; (b) any uncoded "written in " responses, these being the stations boarded (Q5) and left (Q9), and the "other" responses to Q35 and Q38; and (c) any further verification/validation checks that are identified; and by (2) being documented appropriately such that it can then be deposited in the national Data Archive and available for use by other researchers.

- It is recommended that further checks are carried out to ensure that the expansion of the SPURT 2008 data to the Autumn 2007 NPS wave is reasonably consistent with that implied by the contemporaneous NPS Spring 2008 data now that that is available; that further check be undertaken on the sensitivity of the national estimates to different ways of expanding the sample data; and that consideration be given as to the whether, in association with other government departments, in particular ONS, there is a need for an advisory manual on best practice in expansion procedures and in estimating the accuracy of the expanded data.

- Consideration should be given to valuing the time spent on “work NOT related to employment” and the value of travel-time saving for such work (the SPURT data shows that one-in-six of those who do no work related to employment do other kinds of work or study. Whether that is work for a voluntary body such as a charity, and whether it is fee-based, is not known; or it might be personal study.

- Further investigations be undertaken to understand the effect of different factors on the impact of reduced journey time on-train and off-train amounts of work, possibly using the twice a year National Passenger Survey as a vehicle.

- In linking the RP and SP data together above, we have assumed that the SP valuations could be taken in full for each unit of time saved from travel. This assumption is based on the expectation that the traveller would have formed a view on the impact of the time savings on his/her activity mix by the time the SP questions were posed. This issue could be studied in more detail, from the existing data, looking for variations in the responses of those with different mixes of wok and leisure activities, on- and off-train.

9.2 Additional rail data capture

- The productive use of travel time by rail commuters and others should be estimated in a similar study, and the value of that use be taken into account in appraisals. This is based on the evidence in the NPS 2004 study that commuters as well as business travellers spend travel time working productively; and the evidence in the present (SPURT 2008) study that the proportion of business travellers who spend some time working has increased since 2004.

- Further comparisons with the NPS 2004 data should be undertaken to establish on a like-for like basis the extent of the change over time in the percentage of time spent working (by business travellers who do some work on the train); and to appraise whether any of the differences over time (in either this percentage or in the proportion of business travellers who spend some time working) might be explained by differences in other variables.

- In order to improve results related to crowding, consideration should be given to increasing the sample size for trains with high crowding levels, whether for further studies of the SPURT kind or studies of the NPS kind.

- Agreement should be sought with those responsible for on-going surveys (such as NPS or the Omnibus Survey) for the inclusion, perhaps every two or three years, of a set of activity-related questions similar to those asked in the NPS Autumn 2004 wave, but taking into account experience gained in SPURT 2008, in order to monitor trends over time.

- Behavioural studies should be undertaken to assess the extent to which travel demand for a particular mode is influenced by the ease or difficulty of being able to work productively (or relax productively), given the evidence in this study that being able to sit all the time; that availability of a fixed table and of a power socket all have some influence on the proportion undertaking work.

- Additional analysis and surveys to focus upon inter-metropolitan rail business trips (these form a segment of the SPURT data set, but it is not sufficiently large for a focused analysis to be undertaken at the present time).

9.3 Assessment of other modes of transport

- We recommend that a scoping study on the productive use of travel time by car travellers be undertaken, which would review studies such as the 1999 AHCG report on "The Value of Time on UK Roads" and any reports and data availability issues from mobile phone operators and those concerned with the safety aspects of in-car mobile phone use, to assess the need and requirements for further work in this area.

- An assessment for other forms of business travellers' transport (car drivers, passengers and local public transport users) of the value users would ascribe to time savings, and the impact these would have on their intentions and ability to work during the journey.

- A similar scoping study on the productive use of travel time by air travellers should also be undertaken, taking into account the opportunities for both in flight and in-terminal working and such studies as airport and airline operators may be able to provide, with the aim of identifying how a more detailed assessment may be made of productive time use.

- A similar study to SPURT focusing on airport access as an important market segment in its own right allied to air travellers outlined above.

9.4 Wider DfT/Rail industry consideration

- It is recommended that an assessment be made of whether for the rail industry the information obtained (by for example Passenger Focus) on the Occupation of the Chief Wage Earner can best be related to the Occupation of the individual traveller; and whether information on the latter should be sought as well as or instead of information on the former.

- Consideration should be given to changing the basis of assessing the effects of crowding by using as an indicator the proportion of people who can sit all the time on their journey, rather than estimates of crowding levels; and to the inclusion of a question on the ability to sit all the time on the particular journey they are on in the routine questions in NPS (in replacement of the current question about sitting/standing on “a typical trip over the past month”).

- We consider it worthwhile that a seminar be convened to which market researchers and train operators concerned with such issues such as the provision of WiFi, power sockets, and mobile phone access are invited where (subject to commercial confidentiality) findings in this study can be shared and discussed.

- A behavioural study to establish whether and how the ability to spend travel time productively affects traveller’s choice of mode and what changes in demand modelling practice may be needed.

- Finally, we recommend that there should be an investigation of implications of the reported results on forecasting demand for rail travel, in both a mode choice and elasticity based environment, and also for generating future year value of time for evaluation purposes.

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Appendix A Main Survey Questionnaires

Train Operators Working Together

First
Standard

Run number

A1

Research into Business Travel on Trains

This questionnaire concerns how you spend your time on the train. Therefore, please don't complete it until the end of your rail journey.

Thank you for agreeing to take part in this short survey on rail travel. It is being conducted by Accent on behalf of Department of Transport and should take no more than 10 minutes to complete. Any answer you give will be treated in confidence in accordance with the Code of Conduct of the Market Research Society.

Please complete this questionnaire towards the end of the train journey you are making when this was handed to you, and send back to us in the provided envelope. Returned questionnaires will be entered into a prize draw for £500. Thank you for your help.

Please complete this questionnaire even if you did not work on this train.

UNLESS OTHERWISE SHOWN PLEASE ENTER 'X' IN ONE BOX ONLY

Details of train trip

Q1. Are you on the outward or return leg of your business trip?

- ☐ Outward
- ☐ Return

Q2. What is or was the **main** purpose of your business trip?

- ☐ Visiting a branch office for management purposes
- ☐ Visiting a client
- ☐ Attending a business meeting
- ☐ Attending a seminar, course, etc
- ☐ Delivering or picking up supplies
- ☐ Other (please write in) ________

Q3. Thinking about this leg of your business trip, what type of location did you start from?

- ☐ Home
- ☐ Usual workplace
- ☐ Another workplace of employer
- ☐ Education/Training/Conference centre
- ☐ Client/customer workplace
- ☐ Hotel/guest house/restaurant
- ☐ Other type of location (please write in) ________

Q4 At what time did you start **this** leg of your business trip? **(ie TIME LEFT LOCATION IN Q3). PLEASE USE 24 HOUR CLOCK** ☐☐ : ☐☐

Q5 At what station did you board **this** train? ________

Q6. How did you get from your starting point to this station? **ENTER 'X' FOR ALL THAT APPLY**

- ☐ Another train
- ☐ Bus / coach
- ☐ Underground/metro
- ☐ Car/motorbike/van
- ☐ On foot / walked all the way
- ☐ Taxi
- ☐ Bicycle
- ☐ Other (please write in) ________

Q7 What was the scheduled departure time of **this** train? **PLEASE USE 24 HOUR CLOCK** ☐☐ : ☐☐

Q8. When is **this** train scheduled to reach the station you get off at? **PLEASE USE 24 HOUR CLOCK** ☐☐ : ☐☐

Q9. At which station will you get off **this** train? ☐

Q10. How will you get from that station to your destination? **ENTER X FOR ALL APPROPRIATE**

- ☐ Another train
- ☐ Bus / coach
- ☐ Underground/metro
- ☐ Car/motorbike/van
- ☐ On foot / walk all the way
- ☐ Taxi
- ☐ Bicycle
- ☐ Other (please write in) ☐

Q11. Thinking about **this** leg of your business trip, what type of location are you going to?

- ☐ Home
- ☐ Usual workplace
- ☐ Another workplace of employer
- ☐ Education/Training/Conference centre
- ☐ Client/customer workplace
- ☐ Hotel/guest house/restaurant
- ☐ Other type of location (please write in) ☐

Q12. At what time did you or will you finish **this** leg of your business trip? (**ie TIME ARRIVED AT LOCATION IN Q11). PLEASE USE 24 HOUR CLOCK** ☐☐ : ☐☐

Q13. Are you travelling alone or with other adults in a group?

- ☐ Alone
- ☐ With one other
- ☐ With two others
- ☐ With 3+ others

Your ticket

Q14. Do you have a single, return or season ticket for **this** rail journey?

- ☐ Single
- ☐ Return
- ☐ Season ticket

Q15. How much did your ticket cost?

£ ☐☐☐ . ☐☐ p

FOR OFFICE USE ONLY ☐☐☐ . ☐☐

Q16. How will the costs of **this** rail journey be paid for?

- ☐ Paid by employer/business
- ☐ Claimed from employer/business
- ☐ Paid out of own pocket
- ☐ A combination

Seating

Q17. For what proportion of **this** rail journey were you able to sit?

- ☐ All of it
- ☐ About three quarters
- ☐ About half
- ☐ About a quarter
- ☐ None of it

Q18. Were you in Standard or First Class?

- ☐ Standard Class
- ☐ First Class

Q19. Which if any of the following were available to you during **this** rail journey? **PLEASE ENTER 'X' FOR ALL APPROPRIATE**

- ☐ Pull down/lift up table
- ☐ Fixed table
- ☐ Power socket
- ☐ WiFi
- ☐ None of the above

Crowdedness

Q20. How crowded would you say the carriage was when **this** train departed your boarding station?

- ☐ 25% of seats occupied
- ☐ 50% of seats occupied
- ☐ 75% of seats occupied
- ☐ 90% of seats occupied, nobody standing
- ☐ 90% of seats occupied, a few people standing
- ☐ 100% of seats occupied

Q21. Did the level of crowding change significantly during your journey on **this** train?

- ☐ Yes
- ☐ No **GO TO Q24**

Q22. What was the **most** crowded that the carriage became?

- ☐ 25% of seats occupied
- ☐ 50% of seats occupied
- ☐ 75% of seats occupied
- ☐ 90% of seats occupied, nobody standing
- ☐ 90% of seats occupied, a few people standing
- ☐ 100% of seats occupied, nobody standing

Q23. What was the **least** crowded that the carriage became?

- ☐ 25% of seats occupied
- ☐ 50% of seats occupied
- ☐ 75% of seats occupied
- ☐ 90% of seats occupied, nobody standing
- ☐ 90% of seats occupied, a few people standing
- ☐ 100% of seats occupied, nobody standing

Q24. Did the level of crowding have any impact on the work you undertook or wished to undertake on the train?

- ☐ No, level of crowding had no impact **GO TO Q26**
- ☐ Yes, level of crowding meant that I found it difficult to undertake some work **GO TO Q26**
- ☐ Yes, level of crowding meant that I actually could not undertake **some** work
- ☐ Yes, level of crowding meant that I actually could not undertake **any** work

Q25. Given that you could not undertake any or as much work on **this** train as intended, did you have to undertake this work later on today after this train journey?

- ☐ Yes, had to complete the tasks after leaving the train
- ☐ No, did not have to complete the work today

Activities on the train

Q26. How long did you spend on **this** train itself? **ENTER HOURS AND MINUTES. IF DON'T KNOW PLEASE GIVE BEST ESTIMATE** ☐ hr ☐☐ mins

Q27. Have you or do you intend to do any of the following on **this** train? **PLEASE ENTER 'X' FOR ALL THAT APPLY IN COLUMN A**

	A (Q27)	B (Q28)
01. Working related to employment (reading/writing/typing/thinking)	☐	☐
02. Studying related to employment (reading/writing/typing/thinking)	☐	☐
03. Working/studying **unrelated** to employment (reading/writing/typing/thinking)	☐	☐
04. Talking to other passengers - work related	☐	☐
05. Talking to other passengers - personal social	☐	☐
06. Text messages/phone calls - work related	☐	☐
07. Text messages/phone calls - personal/social	☐	☐
08. Eating/drinking	☐	☐
09. Leisure activity (playing games/reading/listening to music/radio etc)	☐	☐
10. Relaxing (sleeping/snoozing/window gazing/people watching etc)	☐	☐
11. Being bored	☐	☐
12. Being anxious about journey (eg delays or where to get off)	☐	☐
13. Planning onward or return journey	☐	☐
14. None of the above **GO TO Q29**	☐	

Q28. And which one of the above activities did you spend **most** time on? **ENTER A SINGLE 'X' IN COLUMN B ABOVE**

Q29. Could you please estimate the amount of time you spent on **this** train doing each of the following activities. **IF YOU PREFER, YOU CAN ENTER THE PERCENTAGE OF TIME. IF YOU DON'T KNOW PLEASE GIVE BEST ESTIMATE**

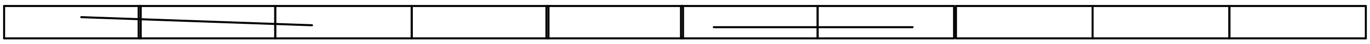
	Minutes	Percentage
Settling down	☐☐☐	☐☐
Work activities related to employment (eg reading, writing/typing, discussion, thinking, business meals etc)	☐☐☐	☐☐
Personal activities (eg reading, listening to music, chatting, thinking, eating, drinking etc)	☐☐☐	☐☐
Preparing to disembark	☐☐☐	☐☐
TOTAL TIME ON TRAIN	☐☐☐	**100%**

Q30. Which, if any, of the following work activities related to your employment did you do on **this** train?
PLEASE ENTER 'X' FOR ALL THAT APPLY

- ☐ None - I didn't work on **this** train **GO TO Q35**
- ☐ Prepare for a meeting
- ☐ Make/receive business calls/text messages
- ☐ Talk to colleagues/others travelling with me
- ☐ Use laptop
- ☐ Use PDA/Blackberry
- ☐ Other work related to employment

Q31. Can you please indicate when during **this** rail journey you undertook work-related activities.
PLEASE DRAW A LINE OR LINES IN THE GRID BELOW

THE EXAMPLE BELOW INDICATES WORK DONE IN FIRST 30% OF TRIP, AND AGAIN BETWEEN 60% AND 70% OF TRIP



Start Middle End

Please can you now complete the grid for **this** rail journey

Start Middle End

Q32. Approximately how long would the same work-related activity have taken you if you had done it at your normal place of work? Please refer back to your answer to Q29 for work activities.

- ☐ About the same time
- ☐ More time **PLEASE WRITE IN HOW MANY MINUTES LONGER**
- ☐ Less time **PLEASE WRITE IN HOW MANY MINUTES LESS**

☐☐ minutes

Q33. Suppose **this** rail journey was scheduled to last 10 minutes **longer** how long would you have spent undertaking work-related activity on train?

- ☐ About the same time
- ☐ More time **PLEASE WRITE IN HOW MANY MINUTES LONGER**
- ☐ Less time **PLEASE WRITE IN HOW MANY MINUTES LESS**

☐☐ minutes

Q34. Suppose **this** rail journey was scheduled to last 10 minutes **shorter** how long would you have spent undertaking work-related activity on train?

- ☐ About the same time
- ☐ More time **PLEASE WRITE IN HOW MANY MINUTES LONGER**
- ☐ Less time **PLEASE WRITE IN HOW MANY MINUTES LESS**

☐☐ minutes

Q35. If **this** train was scheduled to arrive at your destination station 10 minutes **earlier,** do you think you would have worked or not in the 10 minutes saved time?

- ☐ Not worked
- ☐ Worked in usual workplace
- ☐ Worked in other workplace
- ☐ Worked at home
- ☐ Worked elsewhere eg, cafe, hotel etc
- ☐ Other (please write in)

Q36. If **this** train was scheduled to arrive at your destination station 10 minutes **later,** would you have spent the additional time working on train?

- ☐ Yes, spent **all** of the additional time working on train
- ☐ Yes, spent **some** of the additional time working on train
- ☐ No, spent **none** of the additional time working on train
- ☐ Don't know

Q37. Did you undertake any work activity whilst waiting for and/or when changing trains during **this** leg of your business trip? **PLEASE ENTER 'X' FOR ALL THAT APPLY IN BOTH COLUMNS**

	Before train	Changing trains
No work related activity	☐	☐
Make/receive business calls/text messages	☐	☐
Work on company business	☐	☐
Use laptop	☐	☐
Use PDA/Blackberry	☐	☐
Talk to colleagues/others travelling with me	☐	☐
Not Applicable (did not change trains)		☐

Q38. Would the overall amount of work you do over the whole day be affected if this rail journey was 10 mintues shorter?

☐ No, it would make no difference to the amount of work I do over the whole day
☐ Yes, I would do less work over the whole day
☐ Other (please write in)

Choice between trains

We would now like to get you to consider the trade-off between your personal time and that of time saved on the rail journey. Please imagine that two different trains are available to make the current rail trip you have just described for us, and you are allowed by your company to spend a maximum of **£15** for the one way journey, with any **money saved from this being a personal gain**, and **any greater fare having the cost borne by yourself.**

The two trains may differ in terms of fare and journey time, as well as the availability of seats and mobile phone reception. In all other aspects, you may assume that both of the train services are identical to the train you actually took, and are both scheduled to **depart** from the origin at the same time. It doesn't matter if the scenarios presented are different to those of the train you have used today.

EXAMPLE: You have the choice of taking the train as today using the full £15 allowed, or that of using a 10 minutes faster train but costing £4 more which **YOU have to pay yourself**.

Train A	or	Train B
Fare: £15		**Fare:** £19 (so YOU PAY extra £4)
Journey Time: current		**Journey Time:** 10 minutes shorter
Crowding: 75% of seats taken		**Crowding:** 100% of seats taken
Mobile Phone reception: Clear		**Mobile Phone reception:** Poor
Train A ☐		Train B ☐

For each of the scenarios below, please indicate which of the two trains you would have preferred if these were the only two available for your rail journey. **PLEASE ENTER 'X' IN ONE BOX THAT APPLIES**

1.

Train A	or	Train B
Fare: £13 (so **YOU** GAIN £2)		**Fare:** £15
Journey Time: current		**Journey Time:** 5 minutes SHORTER
Crowding: 50% of seats taken		**Crowding:** 25% of seats taken
Mobile Phone reception: Poor		**Mobile Phone reception:** Clear
Train A ☐		Train B ☐

2.

Train A	or	Train B
Fare: £17 (so **YOU** PAY extra (£2) **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear		**Fare:** £15 **Journey Time:** 10 minutes LONGER **Crowding:** 75% of seats taken **Mobile Phone reception:** Clear

Train A ☐ Train B ☐

3.

Train A	or	Train B
Fare: £15 **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear		**Fare:** £14 (so **YOU** GAIN £1) **Journey Time:** 15 minutes LONGER **Crowding:** 75% of seats taken **Mobile Phone reception:** Poor

Train A ☐ Train B ☐

4.

Train A	or	Train B
Fare: £11 (so **YOU** GAIN £4) **Journey Time:** 5 minutes LONGER **Crowding:** 100% of seats taken **Mobile Phone reception:** Clear		**Fare:** £15 **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear

Train A ☐ Train B ☐

5.

Train A	or	Train B
Fare: £15 **Journey Time:** current **Crowding:** 100% of seats taken **Mobile Phone reception:** Poor		**Fare:** £21 (so **YOU** PAY extra £6) **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear

Train A ☐ Train B ☐

6.

Train A	or	Train B
Fare: £15 **Journey Time:** current **Crowding:** 50% of seats taken **Mobile Phone reception:** Clear		**Fare:** £16 (so **YOU** PAY extra £1) **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear

Train A ☐ Train B ☐

7.

Train A	or	Train B
Fare: £15 **Journey Time:** 15 minutes SHORTER **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear		**Fare:** £9 (so **YOU** GAIN £6) **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear

Train A ☐ Train B ☐

8.

Train A	or	Train B
Fare: £19 (so **YOU** PAY extra £4) **Journey Time:** 10 minutes SHORTER **Crowding:** 25% of seats taken **Mobile Phone reception:** Clear		**Fare:** £15 **Journey Time:** current **Crowding:** 25% of seats taken **Mobile Phone reception:** Poor

Train A ☐ Train B ☐

Q39. In answering these choices did you ignore any of the values presented?

- ☐ fare
- ☐ journey time
- ☐ crowding
- ☐ mobile phone
- ☐ didn't ignore any

Q40. Do you agree or disagree with the following statements?

	strongly disagree	disagree	neither	agree	strongly agree	not applicable
I choose to travel by train and valued the fact that I can work on the train	☐	☐	☐	☐	☐	☐
If the train journey was shorter I would reduce the amount of work I do on the train	☐	☐	☐	☐	☐	☐

Respondent characteristics

Q41. Are you regularly employed, occasionally employed or self-employed?

- ☐ Regularly employed
- ☐ Self employed
- ☐ Occasionally/part time employed

Q42. Which of the following best describes your occupation?

- ☐ Professional/Senior Managerial
- ☐ Middle Managerial/Technical
- ☐ Junior Managerial/Clerical/Supervisory/Technical
- ☐ Skilled Manual (With professional qualifications/ served an apprenticeship)
- ☐ Unskilled manual (No qualifications/ not served an apprenticeship)
- ☐ Other

Q43. How many cars or vans does your household own or have available for use by one or more members of a household?

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more

Q44. Which of the following age groups are you in?

- ☐ 16-25
- ☐ 26-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-59
- ☐ 60-64
- ☐ 65+

Q45. Are you ...

- ☐ Male?
- ☐ Female?

Q46. What is your total income from employment, including from investment before tax and other deductions?

- ☐ Less than £10,000
- ☐ £10,000 - £19,999
- ☐ £20,000 - £34,999
- ☐ £35,000 - £49,999
- ☐ £50,000 - £74,999
- ☐ £75,000 - £99,999
- ☐ £100,000 or more
- ☐ Prefer not to say

Q47. What is your total annual **household** income, including from investment, before tax and other deductions?

- ☐ Less than £10,000
- ☐ £10,000 - £19,999
- ☐ £20,000 - £34,999
- ☐ £35,000 - £49,999
- ☐ £50,000 - £74,999
- ☐ £75,000 - £99,999
- ☐ £100,000 or more
- ☐ Prefer not to say

Thank you for your co-operation

PLEASE POST THIS QUESTIONNAIRE BACK IN THE FREEPOST ENVELOPE PROVIDED

To thank you for your help we are offering you the opportunity of taking part in a prize draw with a prize of £500 cash. If you wish to take part, please tell us your name (full name or first name only, if preferred), address, email or phone number where we can contact you. These details will only be used for the prize draw and will not be passed to a third party.

Name:	
Address	
email address:	
telephone number:	

Appendix B Main Survey Train Rosters

Run num	TOC	Orig	Time orig	Dest	Time dest	Train dest	Type	To London	From London	Not London
601	FGW	Swindon	08:27	Paddington	09:29	Paddington	1	1	0	0
602	FGW	Paddington	10:00	Bath Spa	11:25	Weston Super Mare	1	0	1	0
603	FGW	Bath Spa	11:43	Paddington	13:15	Paddington	1	1	0	0
604	FGW	Paddington	13:45	Swindon	14:40	Swansea	1	0	1	0
609	FGW	Swindon	09:35	Paddington	10:39	Paddington	1	1	0	0
610	FGW	Paddington	11:00	Bath Spa	12:25	Bristol Temple Meads	1	0	1	0
611	FGW	Bath Spa	12:43	Paddington	14:15	Paddington	1	1	0	0
612	FGW	Paddington	14:45	Swindon	15:40	Swansea	1	0	1	0
605	FGW	Swindon	13:34	Paddington	14:39	Paddington	1	1	0	0
606	FGW	Paddington	15:00	Bath Spa	16:25	Bristol Temple Meads	1	0	1	0
607	FGW	Bath Spa	16:43	Paddington	18:15	Paddington	1	1	0	0
608	FGW	Paddington	18:30	Swindon	19:31	Weston Super Mare	1	0	1	0
701	FGW	Oxford	07:52	Paddington	08:51	Paddington	4	1	0	0
702	FGW	Paddington	09:21	Oxford	10:18	Oxford	4	0	1	0
703	FGW	Oxford	10:55	Paddington	12:30	Paddington	4	1	0	0
704	FGW	Paddington	12:51	Oxford	13:47	Oxford	4	0	1	0
711	FGW	Oxford	09:06	Slough	09:51	Paddington	4	1	0	0
712	FGW	Slough	10:07	Oxford	10:47	Oxford	4	0	1	0
713	FGW	Oxford	11:30	Slough	12:09	Paddington	4	1	0	0
714	FGW	Slough	12:37	Oxford	13:18	Oxford	4	0	1	0
715	FGW	Oxford	14:00	Slough	14:40	Paddington	4	1	0	0
716	FGW	Slough	15:07	Oxford	15:47	Oxford	4	0	1	0
705	FGW	Oxford	13:00	Paddington	13:58	Paddington	4	1	0	0
706	FGW	Paddington	14:21	Oxford	15:18	Oxford	4	0	1	0
707	FGW	Oxford	16:00	Reading	16:25	Paddington	4	1	0	0
708	FGW	Reading	16:53	Oxford	17:23	Oxford	4	0	1	0
709	FGW	Oxford	18:00	Reading	18:25	Paddington	4	1	0	0
710	FGW	Reading	18:50	Oxford	19:17	Oxford	4	0	1	0
717	FGW	Oxford	13:00	Paddington	13:58	Paddington	4	1	0	0
718	FGW	Paddington	14:21	Oxford	15:18	Oxford	4	0	1	0
719	FGW	Oxford	16:00	Reading	16:25	Paddington	4	1	0	0
720	FGW	Reading	16:53	Oxford	17:23	Oxford	4	0	1	0
721	FGW	Oxford	18:00	Reading	18:25	Paddington	4	1	0	0
722	FGW	Reading	18:50	Oxford	19:17	Oxford	4	0	1	0
801	FSR	Edinburgh	09:00	Glasgow Queen St	09:15	Glasgow Queen St	3	0	0	1
802	FSR	Glasgow Queen St	10:41	Dundee	12:00	Aberdeen	3	0	0	1
803	FSR	Dundee	12:50	Glasgow Queen St	14:14	Glasgow Queen St	3	0	0	1
804	FSR	Glasgow Queen St	14:45	Edinburgh	15:35	Edinburgh	3	0	0	1
809	FSR	Edinburgh	09:30	Glasgow Queen St	10:21	Glasgow Queen St	3	0	0	1
810	FSR	Glasgow Queen St	10:41	Dundee	12:00	Aberdeen	3	0	0	1
811	FSR	Dundee	12:50	Glasgow Queen St	14:14	Glasgow Queen St	3	0	0	1
812	FSR	Glasgow Queen St	14:45	Edinburgh	15:35	Edinburgh	3	0	0	1
805	FSR	Glasgow Queen St	12:41	Dundee	14:00	Aberdeen	3	0	0	1
806	FSR	Dundee	14:50	Glasgow Queen St	16:14	Glasgow Queen St	3	0	0	1
807	FSR	Glasgow Queen St	17:00	Edinburgh	17:50	Edinburgh	3	0	0	1
808	FSR	Edinburgh	18:15	Glasgow Queen St	19:06	Glasgow Queen St	3	0	0	1
813	FSR	Glasgow Queen St	12:41	Dundee	14:00	Aberdeen	3	0	0	1
814	FSR	Dundee	14:50	Glasgow Queen St	16:14	Glasgow Queen St	3	0	0	1
815	FSR	Glasgow Queen St	16:45	Edinburgh	17:38	Edinburgh	3	0	0	1
816	FSR	Edinburgh	18:00	Glasgow Queen St	18:50	Glasgow Queen St	3	0	0	1
817	FSR	Glasgow Queen St	12:41	Dundee	14:00	Aberdeen	3	0	0	1
818	FSR	Dundee	14:50	Glasgow Queen St	16:14	Glasgow Queen St	3	0	0	1
819	FSR	Glasgow Queen St	17:00	Edinburgh	17:50	Edinburgh	3	0	0	1
820	FSR	Edinburgh	18:15	Glasgow Queen St	19:06	Glasgow Queen St	3	0	0	1
W01	SWT	Southampton Central	08:00	Waterloo	09:25	Waterloo	2	1	0	0
W02	SWT	Waterloo	10:05	Southampton Central	11:22	Weymouth	2	0	1	0
W03	SWT	Southampton Central	11:55	Farnborough	12:58	Waterloo	2	1	0	0
W04	SWT	Farnborough	13:13	Southampton Central	14:13	Poole	2	0	1	0
W09	SWT	Southampton Central	09:00	Waterloo	10:23	Waterloo	2	1	0	0
W10	SWT	Waterloo	11:05	Southampton Central	12:22	Weymouth	2	0	1	0
W11	SWT	Southampton Central	12:55	Farnborough	13:58	Waterloo	2	1	0	0
W12	SWT	Farnborough	14:13	Southampton Central	15:15	Poole	2	0	1	0
W17	SWT	Southampton Central	08:00	Waterloo	09:25	Waterloo	2	1	0	0
W18	SWT	Waterloo	10:05	Southampton Central	11:22	Weymouth	2	0	1	0
W19	SWT	Southampton Central	11:55	Farnborough	12:58	Waterloo	2	1	0	0
W20	SWT	Farnborough	13:13	Southampton Central	14:13	Poole	2	0	1	0
W05	SWT	Waterloo	13:09	Basingstoke	13:58	Portsmouth	2	0	1	0
W06	SWT	Basingstoke	14:41	Waterloo	15:34	Waterloo	2	1	0	0

W07 SWT	Waterloo	16:05 Southampton Central	17:22 Weymouth	2	0	1	0
W08 SWT	Southampton Central	18:00 Waterloo	19:20 Waterloo	2	1	0	0
W13 SWT	Southampton Central	13:30 Waterloo	14:49 Waterloo	2	1	0	0
W14 SWT	Waterloo	15:09 Basingstoke	15:58 Portsmouth	2	0	1	0
W15 SWT	Basingstoke	16:41 Waterloo	17:34 Waterloo	2	1	0	0
W16 SWT	Waterloo	18:05 Southampton Central	19:17 Weymouth	2	0	1	0
W21 SWT	Waterloo	13:09 Basingstoke	13:58 Portsmouth	2	0	1	0
W22 SWT	Basingstoke	14:41 Waterloo	15:34 Waterloo	2	1	0	0
W23 SWT	Waterloo	16:05 Southampton Central	17:22 Weymouth	2	0	1	0
W24 SWT	Southampton Central	18:00 Waterloo	19:20 Waterloo	2	1	0	0
N01 NT	Manchester Piccadilly	06:29 Preston	07:26 Blackpool North	5	0	0	1
N02 NT	Preston	07:50 Manchester Piccadilly	08:47 Manchester Airport	5	0	0	1
N03 NT	Manchester Piccadilly	09:33 Preston	10:27 Blackpool North	5	0	0	1
N04 NT	Preston	11:08 Manchester Piccadilly	11:57 Manchester Airport	5	0	0	1
N05 NT	Manchester Piccadilly	12:30 Preston	13:24 Blackpool North	5	0	0	1
N06 NT	Preston	13:41 Bolton	14:12 Buxton	5	0	0	1
N07 NT	Bolton	14:51 Preston	15:24 Blackpool North	5	0	0	1
N08 NT	Preston	15:41 Manchester Piccadilly	16:35 Buxton	5	0	0	1
N09 NT	Manchester Piccadilly	16:52 Preston	17:50 Preston	5	0	0	1
N10 NT	Preston	18:41 Manchester Piccadilly	19:36 Buxton	5	0	0	1
N11 NT	Manchester Piccadilly	12:30 Preston	13:34 Blackpool North	5	0	0	1
N12 NT	Preston	13:41 Bolton	14:12 Buxton	5	0	0	1
N13 NT	Bolton	14:51 Preston	15:24 Blackpool North	5	0	0	1
N14 NT	Preston	15:41 Manchester Piccadilly	16:35 Buxton	5	0	0	1
N15 NT	Manchester Piccadilly	16:52 Preston	17:50 Preston	5	0	0	1
N16 NT	Preston	18:08 Manchester Piccadilly	18:59 Manchester Airport	5	0	0	1
F54 FCC	Peterborough	08:45 Kings Cross	10:02 Kings Cross	4	1	0	0
F55 FCC	Kings cross	10:22 Biggleswade	10:59 Peterborough	4	0	1	0
F56 FCC	Biggleswade	11:18 Kings Cross	12:00 Kings Cross	4	1	0	0
F57 FCC	Kings Cross	12:22 Biggleswade	13:01 Peterborough	4	0	1	0
F58 FCC	Biggleswade	13:18 Kings Cross	14:00 Kings Cross	4	1	0	0
F59 FCC	Kings Cross	14:22 Peterborough	15:01 Peterborough	4	0	1	0
F50 FCC	Peterborough	13:18 Potters Bar	14:29 Kings Cross	4	1	0	0
F51 FCC	Potters Bar	14:51 Peterborough	16:04 Peterborough	4	0	1	0
F52 FCC	Peterborough	16:45 Kings Cross	17:48 Kings Cross	4	1	0	0
F53 FCC	Kings Cross	18:07 Peterborough	19:06 Peterborough	4	0	1	0
F60 FCC	Peterborough	11:14 Kings Cross	12:49 Kings Cross	4	1	0	0
F61 FCC	Kings Cross	13:06 Cambridge	14:27 Cambridge	4	0	1	0
F62 FCC	Cambridge	14:55 Kings Cross	16:19 Kings Cross	4	1	0	0
F63 FCC	Kings Cross	16:40 Peterborough	17:41 Peterborough	4	0	1	0
F01 FCC	Brighton	07:50 Blackfriars	09:08 Bedford	4	1	0	0
F02 FCC	Blackfriars	09:34 Burgess Hill	10:33 Brighton	4	0	1	0
F03 FCC	Burgess Hill	10:51 Blackfriars	11:52 Bedford	4	1	0	0
F04 FCC	Blackfriars	12:20 Brighton	13:26 Brighton	4	0	1	0
F05 FCC	Brighton	13:34 Blackfriars	14:37 Bedford	4	1	0	0
F06 FCC	Blackfriars	15:05 Burgess Hill	16:01 Brighton	4	0	1	0
F07 FCC	Burgess Hill	16:21 Blackfriars	17:25 Bedford	4	1	0	0
F08 FCC	Blackfriars	17:46 Brighton	19:02 Brighton	4	0	1	0
F09 FCC	Brighton	13:34 Blackfriars	14:37 Bedford	4	1	0	0
F10 FCC	Blackfriars	15:05 Burgess Hill	16:01 Brighton	4	0	1	0
F11 FCC	Burgess Hill	16:21 Blackfriars	17:25 Bedford	4	1	0	0
F12 FCC	Blackfriars	17:46 Brighton	19:02 Brighton	4	0	1	0
501 TPE	Manchester Piccadilly	07:11 Preston	08:06 Blackpool North	3	0	0	1
502 TPE	Preston	08:34 Manchester Piccadilly	09:20 Manchester Airport	3	0	0	1
503 TPE	Manchester Piccadilly	09:45 Chorley	10:17 Oxenholme Lake District	3	0	0	1
504 TPE	Chorley	10:47 Manchester Piccadilly	11:20 Manchester Airport	3	0	0	1
505 TPE	Manchester Piccadilly	11:45 Chorley	12:17 Oxenholme Lake District	3	0	0	1
506 TPE	Chorley	12:47 Manchester Piccadilly	13:20 Manchester Airport	3	0	0	1
507 TPE	Manchester Piccadilly	12:45 Chorley	13:17 Barrow in Furness	3	0	0	1
508 TPE	Chorley	13:47 Manchester Piccadilly	14:20 Manchester Airport	3	0	0	1
509 TPE	Manchester Piccadilly	14:45 Preston	15:27 Barrow in Furness	3	0	0	1
510 TPE	Preston	16:08 Bolton	16:34 Manchester Airport	3	0	0	1
511 TPE	Bolton	17:05 Preston	17:27 Barrow in Furness	3	0	0	1
512 TPE	Preston	18:08 Manchester Piccadilly	18:59 Manchester Airport	3	0	0	1
513 TPE	Manchester Piccadilly	12:45 Chorley	13:17 Barrow in Furness	3	0	0	1
514 TPE	Chorley	13:47 Manchester Piccadilly	14:20 Manchester Airport	3	0	0	1
515 TPE	Manchester Piccadilly	14:45 Preston	15:27 Barrow in Furness	3	0	0	1
516 TPE	Preston	16:08 Bolton	16:34 Manchester Airport	3	0	0	1
517 TPE	Bolton	17:05 Preston	17:27 Barrow in Furness	3	0	0	1
518 TPE	Preston	18:08 Manchester Piccadilly	18:59 Manchester Airport	3	0	0	1
301 TPE	Leeds	08:25 Manchester Piccadilly	09:23 Manchester Airport	3	0	0	1
302 TPE	Manchester Piccadilly	09:42 Huddersfield	10:15 Hull	3	0	0	1
303 TPE	Huddersfield	10:46 Manchester Piccadilly	11:22 Manchester Airport	3	0	0	1

304 TPE	Manchester Piccadilly	11:42 Huddersfield	12:15 Hull	3	0	0	1
305 TPE	Huddersfield	12:46 Manchester Piccadilly	13:22 Manchester Airport	3	0	0	1
306 TPE	Manchester Piccadilly	13:57 Leeds	14:52 Middlesbrough	3	0	0	1
307 TPE	Manchester Piccadilly	13:27 Huddersfield	13:56 Newcastle	3	0	0	1
308 TPE	Huddersfield	14:28 Manchester Piccadilly	15:05 Liverpool Lime St	3	0	0	1
309 TPE	Manchester Piccadilly	15:27 Huddersfield	15:56 Newcastle	3	0	0	1
310 TPE	Huddersfield	16:16 Manchester Piccadilly	16:53 Manchester Airport	3	0	0	1
311 TPE	Manchester Piccadilly	17:12 Leeds	18:09 Scarborough	3	0	0	1
312 TPE	Leeds	18:52 Manchester Piccadilly	19:50 Manchester Airport	3	0	0	1
313 TPE	Leeds	09:55 Manchester Piccadilly	10:50 Manchester Airport	3	0	0	1
314 TPE	Manchester Piccadilly	11:12 Huddersfield	11:44 Scarborough	3	0	0	1
315 TPE	Huddersfield	12:16 Manchester Piccadilly	12:50 Manchester Airport	3	0	0	1
516 TPE	Manchester Piccadilly	13:12 Huddersfield	13:44 Scarborough	3	0	0	1
317 TPE	Huddersfield	14:16 Manchester Piccadilly	14:50 Manchester Airport	3	0	0	1
318 TPE	Manchester Piccadilly	15:12 Leeds	16:10 Scarborough	3	0	0	1
319 TPE	Manchester Piccadilly	13:27 Huddersfield	13:56 Newcastle	3	0	0	1
320 TPE	Huddersfield	14:28 Manchester Piccadilly	15:05 Liverpool Lime St	3	0	0	1
321 TPE	Manchester Piccadilly	15:27 Huddersfield	15:56 Newcastle	3	0	0	1
322 TPE	Huddersfield	16:16 Manchester Piccadilly	16:53 Manchester Airport	3	0	0	1
323 TPE	Manchester Piccadilly	17:12 Leeds	18:09 Scarborough	3	0	0	1
324 TPE	Leeds	18:52 Manchester Piccadilly	19:50 Manchester Airport	3	0	0	1
325 TPE	Leeds	08:25 Manchester Piccadilly	09:23 Manchester Airport	3	0	0	1
326 TPE	Manchester Piccadilly	09:42 Huddersfield	10:15 Hull	3	0	0	1
327 TPE	Huddersfield	10:46 Manchester Piccadilly	11:22 Manchester Airport	3	0	0	1
328 TPE	Manchester Piccadilly	11:42 Huddersfield	12:15 Hull	3	0	0	1
329 TPE	Huddersfield	12:46 Manchester Piccadilly	13:22 Manchester Airport	3	0	0	1
330 TPE	Manchester Piccadilly	13:57 Leeds	14:52 Middlesbrough	3	0	0	1
331 TPE	Manchester Piccadilly	13:27 Huddersfield	13:56 Newcastle	3	0	0	1
332 TPE	Huddersfield	14:28 Manchester Piccadilly	15:05 Liverpool Lime St	3	0	0	1
333 TPE	Manchester Piccadilly	15:27 Huddersfield	15:56 Newcastle	3	0	0	1
334 TPE	Huddersfield	16:16 Manchester Piccadilly	16:53 Manchester Airport	3	0	0	1
335 TPE	Manchester Piccadilly	17:12 Leeds	18:09 Scarborough	3	0	0	1
336 TPE	Leeds	18:52 Manchester Piccadilly	19:50 Manchester Airport	3	0	0	1
337 TPE	Manchester Piccadilly	13:27 Huddersfield	13:56 Newcastle	3	0	0	1
338 TPE	Huddersfield	14:28 Manchester Piccadilly	15:05 Liverpool Lime St	3	0	0	1
339 TPE	Manchester Piccadilly	15:27 Huddersfield	15:56 Newcastle	3	0	0	1
340 TPE	Huddersfield	16:16 Manchester Piccadilly	16:53 Manchester Airport	3	0	0	1
341 TPE	Manchester Piccadilly	17:12 Leeds	18:09 Scarborough	3	0	0	1
342 TPE	Leeds	18:52 Manchester Piccadilly	19:50 Manchester Airport	3	0	0	1
S01 SR	Brighton	07:47 Clapham Junction	08:44 London Victoria	2	1	0	0
S02 SR	Clapham Junction	09:12 Brighton	09:58 Brighton	2	0	1	0
S03 SR	Brighton	10:19 Clapham Junction	11:05 London Victoria	2	1	0	0
S04 SR	Clapham Junction	11:23 Haywards Heath	12:00 Hove/Lewes	2	0	1	0
S05 SR	Haywards Heath	12:43 Clapham Junction	13:20 London Victoria	2	1	0	0
S06 SR	Clapham Junction	13:42 Brighton	14:27 Brighton	2	0	1	0
S07 SR	London Victoria	11:17 Haywards Heath	12:00 Hove/Lewes	2	1	0	0
S08 SR	Haywards Heath	12:43 Clapham Junction	13:20 London Victoria	2	1	0	0
S09 SR	Clapham Junction	13:42 Brighton	14:27 Brighton	2	0	1	0
S10 SR	Brighton	14:49 London Victoria	15:40 London Victoria	2	1	0	0
S11 SR	London Victoria	16:06 Brighton	17:00 Brighton	2	0	1	0
S12 SR	Brighton	17:19 London Victoria	18:11 London Victoria	2	1	0	0
S13 SR	London Victoria	12:36 Brighton	13:27 Brighton	2	0	1	0
S14 SR	Brighton	13:49 Clapham Junction	14:33 London Victoria	2	1	0	0
S15 SR	Clapham Junction	14:54 Haywards Heath	15:42 Brighton	2	0	1	0
S16 SR	Haywards Heath	16:13 Clapham Junction	16:52 London Victoria	2	1	0	0
S17 SR	Clapham Junction	17:13 Haywards Heath	17:51 Brighton	2	0	1	0
S18 SR	Haywards Heath	18:13 London Victoria	18:59 London Victoria	2	1	0	0
101 ONE	Colchester	09:03 Shenfield	09:29 London Liverpool St	1	1	0	0
102 ONE	Shenfield	10:02 Colchester	10:37 Lowestoft	1	0	1	0
103 ONE	Colchester	11:01 Shenfield	11:29 London Liverpool St	1	1	0	0
104 ONE	Shenfield	12:02 Colchester	12:37 Lowestoft	1	0	1	0
105 ONE	Colchester	13:03 Shenfield	13:29 London Liverpool St	1	1	0	0
106 ONE	Shenfield	14:02 Colchester	14:37 Lowestoft	1	0	1	0
107 ONE	Colchester	12:17 Shenfield	12:51 London Liverpool St	1	1	0	0
108 ONE	Shenfield	13:23 Colchester	13:19 Norwich	1	0	1	0
109 ONE	Colchester	14:17 Shenfield	14:51 London Liverpool St	1	1	0	0
110 ONE	Shenfield	15:23 Colchester	15:49 Norwich	1	0	1	0
111 ONE	Colchester	16:17 Shenfield	16:51 London Liverpool St	1	1	0	0
112 ONE	Shenfield	17:24 Colchester	18:03 Harwich International	1	0	1	0
113 ONE	Colchester	09:17 Shenfield	09:54 London Liverpool St	1	1	0	0
114 ONE	Shenfield	10:23 Colchester	10:49 Lowestoft	1	0	1	0
115 ONE	Colchester	11:17 Shenfield	11:51 London Liverpool St	1	1	0	0
116 ONE	Shenfield	12:23 Colchester	12:49 Lowestoft	1	0	1	0

117	ONE	Colchester	13:17 Shenfield	13:51 London Liverpool St	1	1	0	0
118	ONE	Shenfield	14:23 Colchester	14:49 Lowestoft	1	0	1	0
119	ONE	Colchester	11:17 London Liverpool St	12:16 London Liverpool St	1	1	0	0
120	ONE	London Liverpool St	12:38 Colchester	13:38 Peterborough	1	0	1	0
121	ONE	Colchester	14:03 Shenfield	14:29 London Liverpool St	1	1	0	0
122	ONE	Shenfield	15:02 Colchester	15:38 Peterborough	1	0	1	0
123	ONE	Colchester	16:03 Shenfield	16:29 London Liverpool St	1	1	0	0
124	ONE	Shenfield	16:54 Colchester	17:26 Peterborough	1	0	1	0
125	ONE	Colchester	09:03 Shenfield	09:29 London Liverpool St	1	1	0	0
126	ONE	Shenfield	10:02 Colchester	10:37 Lowestoft	1	0	1	0
127	ONE	Colchester	11:01 Shenfield	11:29 London Liverpool St	1	1	0	0
128	ONE	Shenfield	12:02 Colchester	12:37 Lowestoft	1	0	1	0
129	ONE	Colchester	13:03 Shenfield	13:29 London Liverpool St	1	1	0	0
130	ONE	Shenfield	14:02 Colchester	14:37 Lowestoft	1	0	1	0
131	ONE	Colchester	12:17 Shenfield	12:51 London Liverpool St	1	1	0	0
132	ONE	Shenfield	13:23 Colchester	13:49 Norwich	1	0	1	0
133	ONE	Colchester	14:17 Shenfield	14:51 London Liverpool St	1	1	0	0
134	ONE	Shenfield	15:23 Colchester	15:49 Norwich	1	0	1	0
135	ONE	Colchester	16:17 Shenfield	16:51 London Liverpool St	1	1	0	0
136	ONE	Shenfield	17:24 Colchester	18:03 Harwich International	1	0	1	0
137	ONE	Colchester	09:17 Shenfield	09:54 London Liverpool St	1	1	0	0
138	ONE	Shenfield	10:23 Colchester	10:49 Lowestoft	1	0	1	0
139	ONE	Colchester	11:17 Shenfield	11:51 London Liverpool St	1	1	0	0
140	ONE	Shenfield	12:23 Colchester	12:49 Lowestoft	1	0	1	0
141	ONE	Colchester	13:17 Shenfield	13:51 London Liverpool St	1	1	0	0
142	ONE	Shenfield	14:23 Colchester	14:49 Lowestoft	1	0	1	0
143	ONE	Colchester	11:17 London Liverpool St	12:16 London Liverpool St	1	1	0	0
144	ONE	London Liverpool St	12:38 Colchester	13:38 Peterborough	1	0	1	0
145	ONE	Colchester	14:03 Shenfield	14:29 London Liverpool St	1	1	0	0
146	ONE	Shenfield	15:02 Colchester	15:38 Peterborough	1	0	1	0
147	ONE	Colchester	16:03 Shenfield	16:29 London Liverpool St	1	1	0	0
148	ONE	Shenfield	16:54 Colchester	17:26 Peterborough	1	0	1	0
X0	XC	Birmingham New St	07:40 Cheltenham Spa	08:21 Bristol Temple Meads	1	0	0	1
X1	XC	Cheltenham Spa	08:42 Birmingham New St	09:26 Edinburgh	1	0	0	1
X2	XC	Birmingham New St	10:10 Bristol Temple Meads	11:41 Plymouth	1	0	0	1
X3	XC	Bristol Temple Meads	12:00 Birmingham New St	13:26 Newcastle	1	0	0	1
X4	XC	Birmingham New St	09:27 Cheltenham Spa	10:21 Cardiff	1	0	0	1
X5	XC	Gloucester	10:46 Birmingham New St	11:45 Nottingham	1	0	0	1
X6	XC	Birmingham New St	12:10 Bristol Temple Meads	13:41 Plymouth	1	0	0	1
X7	XC	Bristol Temple Meads	14:00 Birmingham New St	15:26 Newcastle	1	0	0	1
X8	XC	Birmingham New St	14:30 Gloucester	15:21 Cardiff	1	0	0	1
X9	XC	Gloucester	15:46 Birmingham New St	16:45 Nottingham	1	0	0	1
X10	XC	Birmingham New St	17:30 Gloucester	18:29 Cardiff	1	0	0	1
X11	XC	Gloucester	18:46 Birmingham New St	19:46 Nottingham	1	0	0	1
X12	XC	Birmingham New St	14:10 Bristol Temple Meads	15:41 Penzance	1	0	0	1
X13	XC	Bristol Temple Meads	16:00 Birmingham New St	17:26 Newcastle	1	0	0	1
X14	XC	Birmingham New St	15:40 Bristol Temple Meads	17:11 Plymouth	1	0	0	1
X15	XC	Bristol Temple Meads	17:30 Birmingham New St	18:57 Newcastle	1	0	0	1
X16	XC	Birmingham New St	16:40 Bristol Temple Meads	18:11 Plymouth	1	0	0	1
X17	XC	Bristol Temple Meads	18:30 Birmingham New St	19:57 York	1	0	0	1
900	TPE	York	09:03 Newcastle	10:12 Newcastle	3	0	0	1
X50	XC	Newcastle	10:40 York	11:41 Bournemouth	1	0	0	1
X51	XC	York	12:34 Darlington	13:00 Edinburgh	1	0	0	1
901	TPE	Darlington	13:45 York	14:22 Manchester Airport	3	0	0	1
902	TPE	York	12:01 Darlington	12:33 Newcastle	3	0	0	1
X52	XC	Darlington	13:00 York	13:27 Plymouth	1	0	0	1
903	TPE	York	13:54 Newcastle	15:06 Newcastle	3	0	0	1
X53	XC	Newcastle	15:40 York	16:41 Plymouth	1	0	0	1
X54	XC	York	13:50 Darlington	14:16 Newcastle	1	0	0	1
904	TPE	Darlington	14:45 York	15:25 Manchester Airport	3	0	0	1
X55	XC	York	15:44 Newcastle	16:52 Newcastle	1	0	0	1
905	TPE	Newcastle	17:10 York	18:24 Manchester Airport	3	0	0	1
E1	NXCE	York	07:00 Peterborough	08:03 Kings Cross	1	1	0	0
E2	NXCE	Peterborough	08:21 York	09:39 Newcastle	1	0	1	0
E3	NXCE	York	10:29 Peterborough	11:48 Kings Cross	1	1	0	0
E4	NXCE	Peterborough	12:21 York	13:39 Newcastle	1	0	1	0
E5	NXCE	York	13:36 Doncaster	14:03 Kings Cross	1	1	0	0
E6	NXCE	Doncaster	15:03 Newcastle	16:31 Edinburgh	1	0	1	0
E7	NXCE	Newcastle	16:55 York	17:53 Kings Cross	1	1	0	0
E8	NXCE	York	15:55 Newcastle	16:53 Aberdeen	1	0	1	0
E9	NXCE	Newcastle	17:30 York	18:28 Kings Cross	1	1	0	0
E10	NXCE	York	18:53 Newcastle	19:52 Edinburgh	1	0	1	0
E11	NXCE	Newcastle	20:37 York	21:36 Kings Cross	1	1	0	0

E12	NXCE	York	15:28 Newcastle	16:31 Edinburgh	1	0	1	0
E13	NXCE	Newcastle	16:55 York	17:53 Kings Cross	1	1	0	0
E14	NXCE	York	18:39 Newcastle	19:49 Newcastle	1	0	1	0
E15	NXCE	Newcastle	20:37 York	21:36 Kings Cross	1	1	0	0
E50	NXCE	Peterborough	08:33 Kings Cross	09:26 Kings Cross	1	1	0	0
E51	NXCE	Kings Cross	10:10 Grantham	11:15 Leeds	1	0	1	0
E52	NXCE	Grantham	11:54 Kings Cross	13:10 Kings Cross	1	1	0	0
E53	NXCE	Kings Cross	13:35 Peterborough	14:24 Leeds	1	0	1	0
E54	NXCE	Peterborough	09:29 Kings Cross	10:25 Kings Cross	1	1	0	0
E55	NXCE	Kings Cross	11:10 Peterborough	11:56 Leeds	1	0	1	0
E56	NXCE	Peterborough	12:29 Kings Cross	13:22 Kings Cross	1	1	0	0
E57	NXCE	Kings Cross	14:10 Peterborough	14:56 Leeds	1	0	1	0
E58	NXCE	Peterborough	14:10 Kings Cross	15:05 Kings Cross	1	1	0	0
E59	NXCE	Kings Cross	15:35 Peterborough	16:25 Leeds	1	0	1	0
E60	NXCE	Peterborough	16:48 Kings Cross	17:41 Kings Cross	1	1	0	0
E61	NXCE	Kings Cross	18:03 Peterborough	18:53 Skipton	1	0	1	0
E62	NXCE	Peterborough	13:45 Kings Cross	14:44 Kings Cross	1	1	0	0
E63	NXCE	Kings Cross	15:10 Peterborough	15:56 Leeds	1	0	1	0
E64	NXCE	Peterborough	16:17 Kings Cross	17:15 Kings Cross	1	1	0	0
E65	NXCE	Kings Cross	17:50 Peterborough	18:38 Leeds	1	0	1	0
M0	EMT	Leicester	07:57 St Pancras	09:12 St Pancras	1	1	0	0
M1	EMT	St Pancras	09:55 Leicester	11:05 Nottingham	1	0	1	0
M2	EMT	Leicester	08:05 Luton Airport Park Way	09:21 St Pancras	1	1	0	0
M3	EMT	Luton Airport Parkway	10:22 Leicester	11:24 Derby	1	0	0	1
M4	EMT	Leicester	08:14 St Pancras	09:29 St Pancras	1	1	0	0
M5	EMT	St Pancras	10:00 Leicester	11:23 Derby	1	0	1	0
M6	EMT	Leicester	09:30 St Pancras	10:48 St Pancras	1	1	0	0
M7	EMT	St Pancras	11:25 Leicester	12:34 Nottingham	1	0	1	0
M8	EMT	Leicester	12:35 St Pancras	14:04 St Pancras	1	1	0	0
M9	EMT	St Pancras	14:30 Market Harborough	15:38 Nottingham	1	0	1	0
M10	EMT	Market Harborough	16:19 Bedford	16:51 St Pancras	1	1	0	0
M11	EMT	Bedford	17:08 Leicester	17:57 Nottingham	1	0	1	0
M12	EMT	Leicester	13:00 St Pancras	14:13 St Pancras	1	1	0	0
M13	EMT	St Pancras	14:55 Leicester	16:04 Nottingham	1	0	1	0
M14	EMT	Leicester	16:30 Bedford	17:12 St Pancras	1	1	0	0
M15	EMT	Bedford	18:10 Leicester	18:57 Sheffield	1	0	1	0
M16	EMT	Leicester	13:30 St Pancras	14:44 St Pancras	1	1	0	0
M17	EMT	St Pancras	15:25 Leicester	16:40 Sheffield	1	0	1	0
M18	EMT	Leicester	16:56 Nottingham	17:26 Nottingham	1	0	1	0
M19	EMT	Nottingham	18:07 Leicester	18:35 St Pancras	1	1	0	0
C0	CH	Birmingham Snow Hill	07:45 Leamington Spa	08:27 Marylebone	2	1	0	0
C1	CH	Leamington Spa	08:53 Birmingham Snow Hill	09:41 Birmingham Snow Hill	2	0	1	0
C2	CH	Birmingham Snow Hill	10:12 Banbury	11:13 Marylebone	2	1	0	0
C3	CH	Banbury	11:56 Birmingham Snow Hill	13:02 Birmingham Snow Hill	2	0	1	0
C4	CH	Birmingham Snow Hill	09:52 Banbury	10:47 Marylebone	2	1	0	0
C5	CH	Banbury	11:35 Birmingham Moor St	12:35 Birmingham Snow Hill	2	0	1	0
C6	CH	Birmingham Moor St	12:55 Banbury	13:47 Marylebone	2	1	0	0
C7	CH	Banbury	14:35 Birmingham Snow Hill	15:41 Birmingham Snow Hill	2	0	1	0
C8	CH	Birmingham Snow Hill	14:12 Banbury	15:12 Marylebone	2	1	0	0
C9	CH	Banbury	15:35 Birmingham Moor St	16:35 Birmingham Snow Hill	2	0	1	0
C10	CH	Birmingham Moor St	17:13 Banbury	18:11 Marylebone	2	1	0	0
C11	CH	Banbury	19:03 Birmingham Snow Hill	20:01 Kidderminster	2	0	1	0
V50	VWC	Stoke-on-Trent	07:53 Euston	09:45 Euston	1	1	0	0
V51	VWC	Euston	10:05 Milton Keynes Central	10:36 Manchester Piccadilly	1	0	1	0
V52	VWC	Milton Keynes Central	11:28 Euston	12:07 Euston	1	1	0	0
V53	VWC	Euston	12:35 Stoke-on-Trent	14:06 Manchester Piccadilly	1	0	1	0
V54	VWC	Stoke-on-Trent	07:24 Euston	09:07 Euston	1	1	0	0
V55	VWC	Euston	09:46 Rugby	10:39 Carlisle	1	0	1	0
V56	VWC	Rugby	11:23 Milton Keynes Central	11:45 Euston	1	1	0	0
V57	VWC	Milton Keynes Central	12:36 Stoke-on-Trent	13:41 Manchester Piccadilly	1	0	1	0
V58	VWC	Stoke-on-Trent	09:24 Watford Junction	10:46 Euston	1	1	0	0
V59	VWC	Watford Junction	11:20 Stoke-on-Trent	12:41 Manchester Piccadilly	1	0	1	0
V60	VWC	Stoke-on-Trent	12:23 Euston	14:04 Euston	1	1	0	0
V61	VWC	Euston	14:35 Stoke-on-Trent	16:06 Manchester Piccadilly	1	0	1	0
V62	VWC	Stoke-on-Trent	12:50 Euston	14:26 Euston	1	1	0	0
V63	VWC	Euston	15:05 Stoke-on-Trent	16:41 Manchester Piccadilly	1	0	1	0
V64	VWC	Stoke-on-Trent	14:50 Euston	16:28 Euston	1	1	0	0
V65	VWC	Euston	17:05 Stoke-on-Trent	18:41 Manchester Piccadilly	1	0	1	0
V66	VWC	Stoke-on-Trent	15:50 Euston	17:27 Euston	1	1	0	0
V67	VWC	Euston	18:05 Stoke-on-Trent	19:39 Manchester Piccadilly	1	0	1	0
V68	VWC	Stoke-on-Trent	16:23 Euston	18:07 Euston	1	1	0	0
V69	VWC	Euston	18:35 Stoke-on-Trent	20:06 Manchester Piccadilly	1	0	1	0
V0	VWC	Birmingham New St	07:15 Euston	08:43 Euston	1	1	0	0

V1	VWC	Euston	09:10	Birmingham New St	10:41	Birmingham New Street	1	0	1	0
V2	VWC	Birmingham New St	08:30	Euston	10:03	Euston	1	1	0	0
V3	VWC	Euston	10:40	Birmingham New St	12:09	Wolverhampton	1	0	1	0
V4	VWC	Birmingham New St	09:30	London Euston	11:00	Euston	1	1	0	0
V5	VWC	Euston	11:40	Birmingham New St	13:09	Wolverhampton	1	0	1	0
V6	VWC	Birmingham New St	14:30	Euston	16:00	Euston	1	1	0	0
V7	VWC	Euston	16:51	Birmingham New St	18:29	Birmingham New Street	1	0	1	0
V8	VWC	Birmingham New St	13:00	Euston	14:33	Euston	1	1	0	0
V9	VWC	Euston	15:10	Birmingham New St	16:41	Birmingham New Street	1	0	1	0
V10	VWC	Birmingham New St	15:30	Euston	17:00	Euston	1	1	0	0
V11	VWC	Euston	17:30	Birmingham New St	18:57	Wolverhampton	1	0	1	0

Type

1	Intercity	FGW, VWC, EMT, One, NXEC, XC
2	Interregional-London	SWT, CH
3	Interregional-non London	TPE, FSR
4	Suburban-London	SWT
5	Suburban-non London	Northern

Appendix C Survey Data Validation

C.1 Journey time estimates

For journey-time estimates: the respondent's estimate of the time spent on the train (reported in Q26) was tested against:

- the time implied by the scheduled times of departure and arrival of the train (Q7 and Q8), where the most suspect cases were of course where the reported time was much less than the scheduled time, as train delays could be the reason for a discrepancy in the opposite direction; and
- the "total time on train" developed from the responses in Q29a following the validation checks.

Based upon the above comparisons a new variable was formed (JTime_com) as a composite "best estimate" of journey time, with a separate variable describing the source of this estimate (which was mainly Q26).

C.2 The time spent on activities undertaken during the journey

For the minutes of time spent on different activities (provided by Q29a_1-4), the total amount recorded by the respondent (Q29a_5) was compared with the sum of Q29a_1-4.

This identified additional checks against individual data records. Once corrections were made an indicator variable was created (Q29a_0) that identified the suitability of the Q29a responses taken together as a source for an estimate of the total time on the train. The best estimate (from Q29a) of the total travel time on the train was placed in a variable Q29a_TTT that was later itself compared with the estimates from Q26, as reported in section C.1.

For the percentage of time spent on different activities (Q29b_1-4), the percentages recorded by the respondent were checked for consistency with:

- their sum, which should equal 100%; and
- those calculated from the stated number of minutes working where response were also given in Q29a_1-4.

Again an indicator variable (Q29b_0) was formed to identify records where the sum of the percentages in Q29b_1-4 was less than 50%; from 50% but less than 100%; equalled 100%; and more than 100%, with the "< 50%" group deemed as an unsuitable reliable source of a percentage estimate. Another indicator variable (Q29ab_0) identified whether Q29a alone or Q29b alone or neither or either could be used as the source for a composite estimate of the percentages. Where "either" could be used, that derived from the stated number of minutes in Q29a was preferred, and in this way the composite percentage variable Q29ab_1-4 was formed.

C.3 Activity data and indicators of whether or not work was undertaken

The questionnaire provided three main ways in which estimates could be formed of the proportion of business travellers who worked on the train, these being

- the respondent's indication (at Q30_1) that he/she did not work on the train;

- the composite response at Q29ab_2 that showed whether there was some non-zero percentage of time spent working; and
- whether or not some work-related activity, related to employment, was undertaken at Q27 (using various combinations of Q27_1 (work related to employment), Q27_2 (study related to employment), Q28_3 (work/study not related to employment), Q27_4(work related talking to other passengers) and Q27_6 (work-related texting/phone calls).

The differing bases were checked against each other for consistency, at both an aggregate level and a grouped disaggregate level. It was concluded that Q30 should not be trusted as a reliable indicator of those who did no work related to employment on the train. At the aggregate level it appeared that the Q27 and Q29 responses were in broad agreement with each other, if time spent on "work related to employment" in Q29 was taken to be represented by a composite of Q27_1, Q27_2 and Q27_4 (that is, texting/phone calls were neglected).

A problem of inconsistency between the Q27 and Q29 responses had been noted in the pilot study, but the reason deduced was that Q29 made the point about work being "related to employment" but Q27 at that time did not. This led to a refinement of Q27, and a departure from the exact replication of the NPS 2004 questions on the activities undertaken on board trains.

From the results of the full survey, it was perceived that there could still be differences in interpretation of what constituted "work" by respondents as they moved from one question to another. To make a distinction between those activities related to employment and those that were not had not been possible across all questions without unduly complicating the questionnaire. This led to the following internal anomalies that complicated the checks for consistency and their interpretation:

- Q27_04 and 06 sought "work related" responses, whether or not related to employment;
- Q29a_2 did not specify that "work activities related to employment" should include "studying related to employment";
- Q29a_3 did not specify that "personal activities" should include "work/study unrelated to employment";
- "Business meals" were included at Q29a_2 as an example "work activities related to employment" but were not distinguished from "eating/drinking" in Q27_08; which was identified under "personal activities" in Q29a_3;
- Whilst "related to employment" was use in the covering question in Q30, the response in Q30_1 "None – I didn't work on this train" (and others in the question) might have been marked by some whose work not related to employment; and
- Q31-Q38 all referred to "work-related activities" or "work(ing)" but only Q31-Q34 (which were by-passed by some given their response at Q30_1) were under the caveat that this was work "related to employment".

A final set of data-checking needs were identified as between the "work-related" response in Q27 and the "time spent working" responses in Q29. No further scanning errors were found that reduced the discrepancy. Rather than discard any discrepant responses a further review was undertaken with the aim that it would increase the consistency. This involved the following.

- Re-estimating the composite "best estimates" of the percentage time spent on the different activities (Q29ab_1-4). The reason for treating some of the Q29b responses as "ignorable" was retained (the provisional acceptance criterion being that their sum exceed 50%) but a new and simpler basis for accepting a percentage estimate based on Q29a responses was set (such that the sum of the journey times in Q29a or the overall estimate in Q29a_5 would be 10 mins or more). In that process the overall Q29a estimate of total travel time on train, Q29a_TTT, was also revised.

- Given the Q29ab revisions, comparison of Q27 activities with the Q29ab_2 responses showed that consistency was greatest (on the Q29 convention that work was that which “related to employment" if it included not only Q27_1 but Q27_2 (study related to employment), Q27_4 (work-related talking to passengers) and Q27_6 (work related text messaging/phone calls).
- Despite this, there were still 33 people whose (credible) responses in Q29 showed they had spent some time working that was not identified as such in Q27_1, 2, 4 or 6. As this is a logical mis-match, it was judged reasonable to create a new variable (Q27_U) to identify these. Whilst the original Q27_1 variable was retained in the data-set, a new version was also created that combined it with Q27_U. An alternative approach to reducing the discrepancy would have been to have dropped the “related to employment” distinction altogether, and thus subsume Q29_3 (work/study unrelated to employment). But that would not have been consistent with the emphasis of many of the questions; nor would it have reduced the discrepancy by much.

One overall consequence is that the Q30_1 response is now not used for indicating those who did or did not work on the train. The most reliable indicator is that from the revised percentage response in Q29ab_2, from which the Q29ab_2YN variable was created to provide a simple Yes/No indicator of whether the respondent worked or not on the train.

For the one activity on which most time was spent (from Q28), a check was made that the respondent had also marked (in Q27) that as an activity as one on which some time was spent.

Appendix D Data Expansion Process

The set of factors initially suggested were based upon categories used in the NPS dataset, and involved 6 categories of occupation, 6 categories of journey time band, 7 age bands and 2 categories of direction of travel. However, such a fine level of categorisation would have meant that many categories in the survey would have been poorly populated, resulting not only in very large (and not very robust) expansion factors but very untrustworthy estimates in the ensuing analyses. To avoid this scenario, a statistical basis for developing the categorisation scheme was proposed, based on its effects on the resulting estimates for the standard error of the mean (at the level of the sample data) in each cell. The intention was to obtain both reasonably small and reasonable uniform estimates of this statistic across all the cells. This process led to a 4x3x2 matrix of expansion factors, covering:

- 4 Age bands (16-34, 35-44, 45-54 and over 55);
- 3 Occupation bands (Professional/Senior managerial, Middle managerial/technical, Junior/Manual/Other); and
- 2 Time bands (up to 2 hours, over 2 hours).

and so designated the “A4O3T2” set. Average values of the expansion factors were assigned for any cells for which data were “missing”, in order that an expansion factor could be applied to other data in the record.

Differences in the way variables were defined in the two data-sets led to some uncertainty as to how best to match some of the variables used in the expansion process. The main one arose due to differences in the recording of occupation. The National Passenger Survey asked about the occupation of the Chief Wage Earner in the household; the new survey asked for the respondent’s own occupation. Given that the business traveller has perhaps a high probability of being the chief wage earner, this may not matter, particularly for those in our study at senior and middle management levels. However, for the junior management, manual and other levels, it is likely that the response in this survey understates the occupation level that would enable a good match to the corresponding data in the National Passenger Survey; or rather that expansion to the NPS data would over-estimate the numbers in that group in the survey that conformed to these definitions. The risk was reduced by excluding the NPS “other” category from the data to which the “junior management/manual/other” category would be grossed up to. The NPS “other” category had been defined to be those in the “full-time student”, “retired” “unemployed/between jobs” and “housewife/ house husband” categories. There were a surprisingly large number of these, 9,135 when expanded (compared with just 53 in our survey’s “other” category), all apparently on “company business”, compared with the 12,601 reported to be in the “junior management/clerical/supervisory”, “skilled manual” and “unskilled manual” categories in NPS, so their inclusion would have greatly changed the expansion factors for the combined “junior management/manual/other” set. Fortunately, as the number in this set was small (about 10% of the total), any bias still present in the weighting scheme should not have a marked effect.

There were differences too in the extent to which the journey time bands could (in the earlier stages of analysis) be made compatible in the two data-sets. In principle of course, as the survey design had been based on a 4-fold categorisation of journey times, the classification used for the expansion factors should have been consistent with that; but it was necessary to depart from these boundaries because although the National Passenger Survey (Autumn 2007) had obtained from respondents estimates of the amount of time they spent on the train, to the nearest minute, that data was not coded into the SPSS data-base that had been supplied, but instead was classified into the six time-bands that had been customarily used in previous NPS waves. Hence, it was at that stage necessary to base the categorisation of journey times on the set of 6 bands used by NPS. As already mentioned, using all 6 of these bands would have spread the new survey data too thinly, so groupings of these bands was necessary

However, the expansion process is intended to be such that the weighting leads to a more representative “national” estimate of certain quantities. The comparison shown in Figure D1 of the frequency distributions (in 15-minute intervals) of unexpanded and expanded NPS07and SPURT08 data show that, even after expansion, there remain big differences between the two in the lowest time ranges. Expansion to more than just two journey-time bands seemed justified. To achieve this, Passenger Focus were asked to supply the original data, in minutes, of the responses to their Q28 on how long people were on the train.

After validation, the new data were used to provide expansion factors related to journey times in the range 1-44 minutes, 45-89 minutes, 90-149 minutes, and 150 or more minutes, consistent with the ranges specified at the survey design stage. Sensitivity testing was carried out on a range of different sets of expansion factors. The 4 age bands adopted previously were reduced to three (with the upper band becoming 55+), partly because there appeared to be little sensitivity to age, and partly to allow for trials to be carried out with 4 occupation bands rather than three (the fourth being the “junior” category which, as noted above, had a disproportionately large percentage number of respondents in the NPS data compared with the new dataset. These trials led to the conclusion that 3 occupation bands should be retained but expanded to NPS figures that excluded the numbers in the junior occupation category.

By this stage exploratory analyses of the factors that might explain the variability in the proportion of business travellers working on the train, and the percentage of time they spent working, had been undertaken using the Answer Tree package. The results obtained (reported in sections 5.4.5, 5.5.3 and 5.5.4) showed that Occupation was the most important factor; that age did not feature in explaining the variation; and that the direction of travel (outward or return) was important in some cases. Accordingly it was decided to replace Age by Direction of travel in the set of factors by which to expand. Thus the set of expansion factors eventually used, D2O3T4, had two categories of direction, three of occupation and four of time.

It has also been noted (see Figure D1) that the first 15 minutes of journey time contained very few SPURT records (just 10 in fact) but very many NPS records, and it was decided to exclude journeys in the range 0-14 minutes from the NPS total to which the SPURT “less than 45 minutes” group were expanded (the survey design had in fact sought to ensure that the journeys covered were 15 or more minutes, since some of the questions asked respondents reactions to a reduction in journey time of 10 minutes or more.). In the set finally adopted, D2O3T4aC, the “a” denoted the adjustment made by dropping the NPS records whose journey time was less than 15 minutes; the “C” denoted that some cells were combined in estimating expansion factor, due to the small sizes involved. The expansion factors used in this final set are given in Table D.1.

Figure D.1: Journey time distributions for unexpanded and expanded NPS and SPURT data

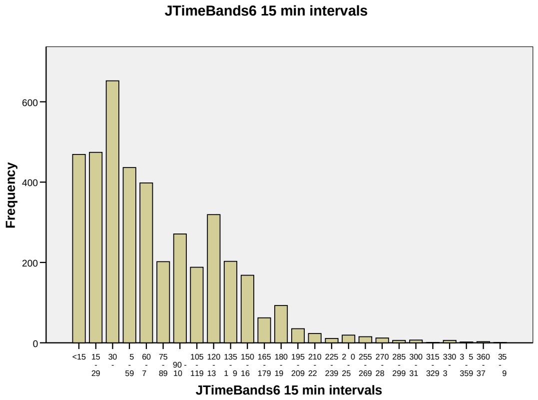
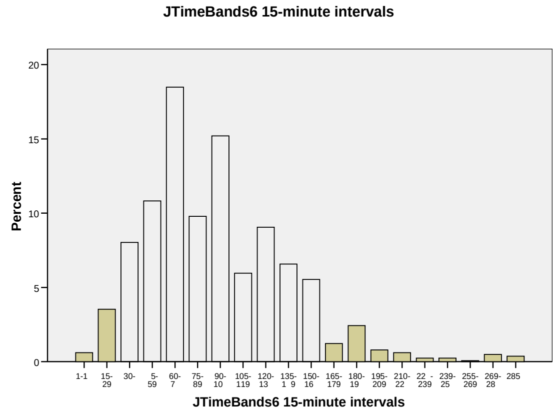
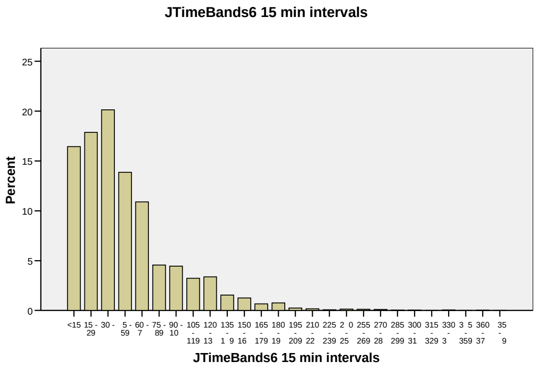
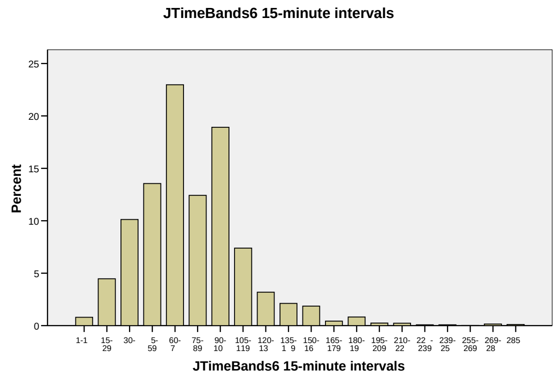
	National Passenger Survey Autumn 2007 (Wave 17)	**Survey on the Productive Use of Rail Travel 2008**
Before expansion		
After expansion	 Cases weighted by Weighting factor 1	 Cases weighted by Weight (expansion to NPS totals by age, occupation and trip length)

Table D.1: Expansion factors in final set (D2O3T4aC)

Occ_Band	JT_Band	Direction of Travel		
		Outward	Return	Missing
Professional/Senior managerial	15-44 mins	357.0	227.9	284.1
	45-89 mins	64.6	52.8	59.4
	90-149 mins	26.1	31.7	28.6
	150 mins and over	20.8	36.4	28.8
	Missing	75.2	68.0	72.0
Middle managerial/technical	15-44 mins	297.6	162.5	220.8
	45-89 mins	111.2	57.7	79.6
	90-149 mins	32.3	19.1	25.9
	150 mins and over	19.4	21.8	20.6
	Missing	96.0	58.7	75.7
Junior/Manual/Other	15-44 mins	198.7	232.5	331.4
	45-89 mins	198.7	63.5	83.3
	90-149 mins	46.6	70.5	59.3
	150 mins and over	24.7	40.3	31.5
	Missing	140.2	109.6	124.1
Missing	15-44 mins	78.9	78.9	78.9
	45-89 mins	78.9	78.9	78.9
	90-149 mins	78.9	78.9	78.9
	150 mins and over	78.9	78.9	78.9
	Missing	78.9	78.9	78.9

Finally, returning to the question of the effect of the expansion on the standard errors of the mean of some variable, simple estimates of these standard errors (at the level of the sample) are included in Table 5.18 and Table 5.20. We note however that such a statistic should in principle be estimated by a more sophisticated approach than that used here. It is in general more appropriate that the value be that which is appropriate at the grossed up level, so should take account of the weights used in the expansion process (noting in passing that SPSS does not calculate the standard error of the weighted mean correctly for these kinds of data). Ideally it should also take account of the fact that the sample data was not a simple random sample but a stratified sample of train services and within those a clustered sample of trips. More important still is the fact that the data to which the sample is expanded may also be subject to error. Making proper estimate of these effect is however outwith the scope of this study.

Appendix E Relation between Occupation and Income

The total income from employment (including from investment before tax and other deductions) was sought in Q46 for 7 income bands (with an eighth band available to indicate "Preferred not to say"). A representative average figure for each income band, given in Table E.1 below was used as the basis for estimating the mean income in each Occupation band given in Table E.2.

Table E.1: Assumed average income income in each income band

Q46. Income band	Average	Unexpanded count
Less than £10,000	£7,500	18
£10,000 to £19,999	£15,000	66
£20,000 to £34,999	£27,500	284
£35,000 to £49,999	£42,500	348
£50,000 to £74,999	£62,500	352
£75,000 to £99,999	£87,500	172
£100,000 or more	£115,000	225
Overall	£59,150	1465

Table E.2:Mean income for each occupation group

Mean , personal income from employment (from Q46), expanded data

	Mean	Unweighted Count
Senior management	£64,842	1011
Middle management	£43,934	307
Junior management/Manual/Other	£34,523	144
Total	£56,076	1462

It is of interest to see how these average income figures (for business travellers on trains) compare with those for the population as whole. Data for 2008 from the Annual Survey of Hours and Earnings (ASHE) (Office for National Statistics 2008, Table 2.7a) became available in the finalisation stage of this report, and the comparison is shown in Table E3. In comparing the data, it should be born in mind that figures are not on the same basis. The SPURT questionnaire was addressed to business travellers in the course of a train journey, and asked: "What is your total income from employment, including from investment before tax and other deductions?" whereas the ASHE questionnaire was addressed to employers, and sought information on gross pay of their employees in the "pay period" covering 16th April 2008. Hence the ASHE figures do not include income from investments; and may underestimate the gross annual pay of part-time employees (as some of these may have more than one job).

Table E.3: Comparison of mean income for rail business travellers with mean annual pay across GB 2008

SPURT Occupation, Summary grouping (Business travellers)	Mean, personal income from employment	ASHE 2008 Gross Annual Pay (all employees)
Senior management	£64,842	£42,604
Middle management	£43,934	£28,521
Junior management/Manual/Other	£34,523	£16,343
Total	£56,076	£26,020

The occupation bands in the ASHE were defined in a different manner from those in the SPURT survey, but at the 3-band level of aggregation used here they map across fairly well, as shown in Table E4 (in which the mapping of each of the second and third columns is across to the first column).

Table E.4: Mapping of SPURT and ASHE occupation bands

SPURT Occupation, Summary bands	SPURT Occupation group, as recorded	ASHE Occupation (top-level group)
Senior management	Professional/ Senior Managerial	Managers and senior officials Professional occupations
Middle management	Middle Managerial/ Technical	Associate professional and technical occupations
Junior management/Manual/Other	Junior Managerial/ Clerical/ Supervisory/ Technical Skilled Manual (With professional qualifications/ served an apprenticeship) Unskilled manual (No qualifications/ not served an apprenticeship)	Administrative and secretarial occupations Skilled trades occupations Personal service occupations Sales and customer service occupations Process, plant and machine operatives Elementary occupations

Appendix F Definition of 'Productivity

The term "productivity" in this Report may be perceived three quite different senses. The main one that the Report focuses on is that of the productivity of the time spent travelling. The greater the proportion of time spent working, the more productive that travel time has been.

But another, more customary, sense is that of the productivity of the time spent working. The more widgets produced in a given time spent working (strictly, person-hours), the more productive that working time has been.

So the first, the '***Productivity of travel time',*** is defined as:

$$\frac{TimeSpentWorkingOnTrain}{JourneyTimeOnTrain}$$

and the second, the '***Productivity of working time',*** is defined as

$$\frac{Output}{TimeSpentWorking}$$

In the first, the "time spent working" is in the numerator; in the second, in the denominator. It is important to bear in mind this difference in definition as it is different from that conventionally used (although the two definitions are consistent in concept).

In discussing the concept of the "Productivity of work done on the train relative to doing the same amount of work in the office" in Section 6.2, we see that this should strictly be the following ratio:

$$\frac{OutputOnTrain}{TimeSpentWorkingOnTrain} \bigg/ \frac{OutputInOffice}{TimeSpentWorkingInOffice}$$

which, as the outputs posed in the study are the same, reduces to:

$$\frac{TimeSpentWorkingInOffice}{TimeSpentWorkingOnTrain}.$$

This then is the formal definition of the term "***Relative Productivity***" used in Section 6.2, which is the same name that was used for this parameter in other descriptions of the Hensher approach.

Appendix G Consistency of Marginal and Average Estimates of the Time Spent Working on Trains

The Stated Intentions (SI) data described in Chapter 6 yielded estimates of the extent to which the amount of time spent working on the train might be changed, if the scheduled journey time were to be changed by either 10, 15 or 20 minutes (depending on journey length). As a proportion of the time available, the SI data could thus provide marginal estimates, whereas the Revealed Preference (RP) data provided average estimates. This Appendix compares estimates from the two surveys in three ways, to assess:

A. whether the SI data imply different averages for the whole journey than the RP data;
B. whether the SI data imply a different average at the margin than the RP for the whole journey; and
C. whether averaging RP data over the "usable time" of the journey (i.e. excluding time for settling down and preparing to disembark) is a more appropriate basis for comparison.

To make these comparisons, the SI data and RP needed to be compared on an internally consistent basis. This involved using the SI data to create, together with the RP data, a new set of "changed journey time" and "percent of journey time spent working" variables. (this was done only for the decreases in scheduled journey time.[33]). Initially, a "common set" was established by, where appropriate, (1) excluding 60 records with any "non-stated" responses to selected variables[34]; (2) excluding 248 records in which the minutes worked on the train were zero in the RP data; (3) excluding 151 records where the amount by which the working time was reduced (in the SI data) was not stated; (5) excluding 96 records in the RP+SI data-set that led to the "reduced" working time exceeding the "reduced" journey time; and (6) excluding records in which the minutes worked on the train became zero (8 records) or even negative (9 records) in the RP+SI data-set (since non-working travellers in the RP data-set would not have been asked these questions in the SI part of the questionnaire)[35]. With all exclusions applied, a "common set" of 1088 records were then used as the starting point for the subsequent comparisons.

However, each of the comparisons (A), (B) and (C) implied or generated further exclusions to ensure consistency appropriate to the particular way in which the comparison was carried out, some for which involved the calculation of new secondary variables, some of whose values showed further signs of internal inconsistency.

[33] In Chapter 6 of the main report the effect on the productivity of travel time of both an increase and of a decrease in travel time is discussed. The findings given for a decrease are summarised in a later footnote in this Appendix. The findings given there for an increase probably underestimate the effects on on-train productivity, as some of those who had not previously undertaken any work on the train might choose to do so given the extra journey time; but any such travellers were asked to by-pass the question (Q33) that asked them to state their intentions.

[34] The variables for which a non-stated response resulted in the exclusion of the record were: composite journey time (JTime_com); occupation band (OccBand_1); direction of travel (Q1); class of travel (Q18), the minutes worked on train (MinsWk_OnTrain), and the numbers of minutes less spent working on train were the scheduled journey time to be reduced (Q34a_conYN). The alternative of investigating the effects of an increase in scheduled journey time (using Q33a_conYN) was allowed for in data extraction but not analysed.

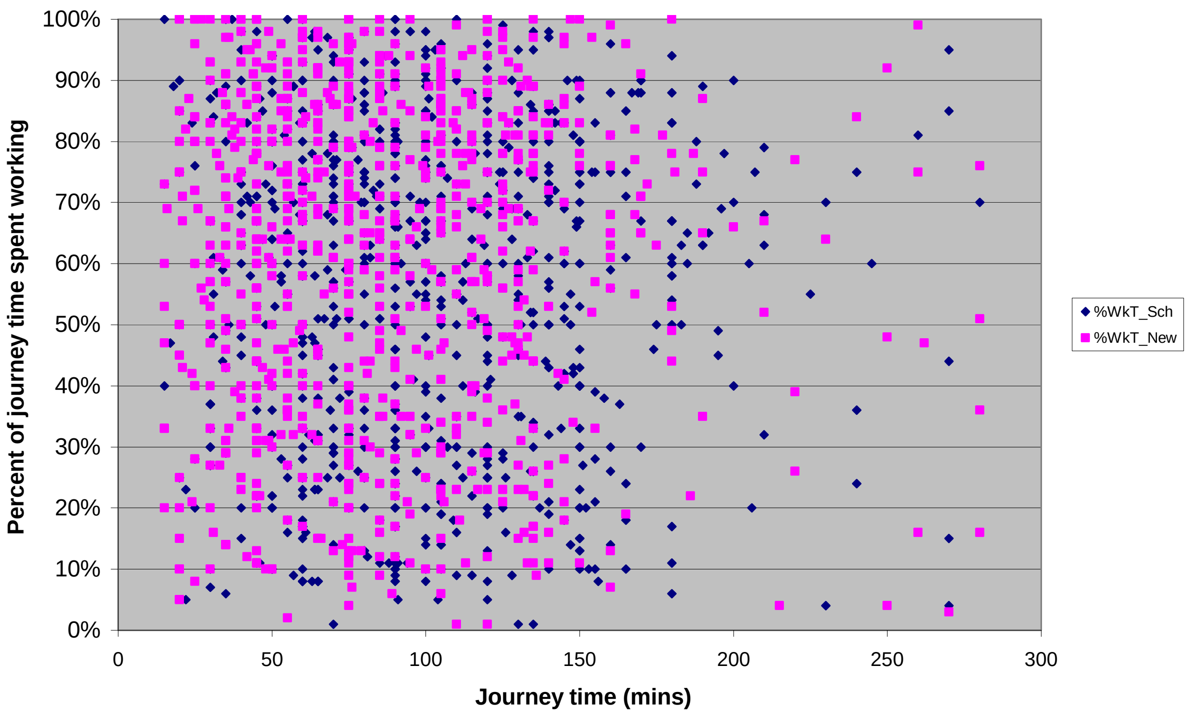
[35] Note that the exclusions were made in the order given here, and the numbers reported as excluded at a given stage are affected by the placement in that order.

Thus, the comparison described at (A) implied not a common data base, but a comparison of two data bases, each of which should reflect the same survey conditions for obtaining the data. This implied that the boundary conditions for the two sets should be the same. For this reason, the “RP+SI” data set had 15 records removed that would have reduced the “new journey-time” below the 15 minute threshold above which the RP data was obtained, yielding a data base of 1073 records. Similarly, as the RP+SI data set led to a maximum new journey time of 280 minutes, 6 records were removed from the RP data-base, which then contained 1082 records in total. Other changes are described on in the appropriate section.

G.1 Comparison for the whole journey of the marginal changes implied by Stated Intentions data

For (A), a visual comparison of these two data sets for the whole journey was initially undertaken, as shown in Figure G1. The dark blue diamonds represent the RP estimates, with the journey time that scheduled; the pink squares represent the percentage of journey time spent working when the RP data was amended by the SI changes, with the journey time that obtained by reducing the RP value by the hypothesised SI change in scheduled time.

Figure G1: Whole-journey comparison of the percentage of journey time spent working as a function of journey-time



From the scatter apparent in Figure G.1 it is not obvious whether systematic differences between the SI marginal data and the RP average data might exist. To investigate this, the cumulative frequency distributions of the sample data in the two data sets were compared. Using the same 10% intervals of percentage journey time shown by the horizontal grid in Figure G1, led to the comparison shown in Table G1.

Table G1: Cumulative frequency distributions of travellers by the proportions of journey time spent working

Range	Per cent of journey time devoted to work (by all who do some work on the train, whether or not affected by the hypothesised reduction in scheduled time)										N
	0+ to 10	10+ to 20	20+ to 30	30+ to 40	40+ to 50	50+ to 60	60+ to 70	70+ to 80	80+ to 90	90+ to 100	
RP	2.7%	9.2%	18.9%	26.9%	34.2%	45.7%	60.7%	77.0%	92.6%	100.0%	1082
RP+SI	1.6%	7.8%	16.4%	24.0%	32.1%	41.3%	55.8%	70.1%	87.9%	100.0%	1073
Diff	1.1%	1.4%	2.5%	2.9%	2.1%	4.4%	4.9%	**6.9%**	4.7%	0.0%	

From the differences between two cumulative frequency distributions, the largest value is 6.9%. This is the statistic that is used in the Kolmogorov-Smirnov test for testing the null hypothesis that two independent samples have been drawn from the same population (or from populations with the same distribution). This statistic is sensitive to any kind of difference in the distributions from which the two samples are drawn, such as differences in central tendency, dispersion or skewness. Given the scatter shown in Figure G, a test with such sensitivity would be particularly appropriate. In principle of course the Kolmogorov-Smirnov test is not applicable, because the two samples are not here independent. However it is straightforward to apply and so provides a first indication of how close the two data sets might be deemed to be. Given the sample sizes in the last column of the above table, the critical value appropriate to the test is 1.36 $\sqrt{(1082+1073)/(1082*1073)}$ = 5.9% at the 0.05 level of significance (Siegel, 1956). This is somewhat lower than the highest value of the difference, 6.9%. Hence this suggests that the two sets of estimates might not be deemed to be consistent.

The above result was derived for the data-sets as a whole. However, the data-sets – which were extracted from the SPSS file to Excel for ease of analysis – included the SPSS variables on direction of travel, occupation band and journey-time band (and the final set of weights) to enable investigation of the effect of disaggregating by different segments. This investigation has been done for journey time band segments, with the results summarised in Table G2. Again, bearing in mind that the data-sets are not independent, the results do not suggest inconsistency between the SI estimates and the RP estimates.

Table G2: Result of applying the Kolmogorov –Smirnov test when the two sets of estimates are segmented by Journey-time band

Journey time range	Number of records (RP/RP+SI)	The range in which the "Percent of journey time devoted to work" gave the highest difference in cumulative frequency	Highest difference in cumulative frequency	Critical value at 0.05 level of significance
15-44 mins	90/75	30+ to 40	5.6%	21.3%
45-89 mins	416/416	50+ to 60	6.7%	9.4%
90-149 mins	436/436	70+ to 80	10.1%	9.2%
150-280 mins	140/146	60+ to 70	6.6%	16.1%

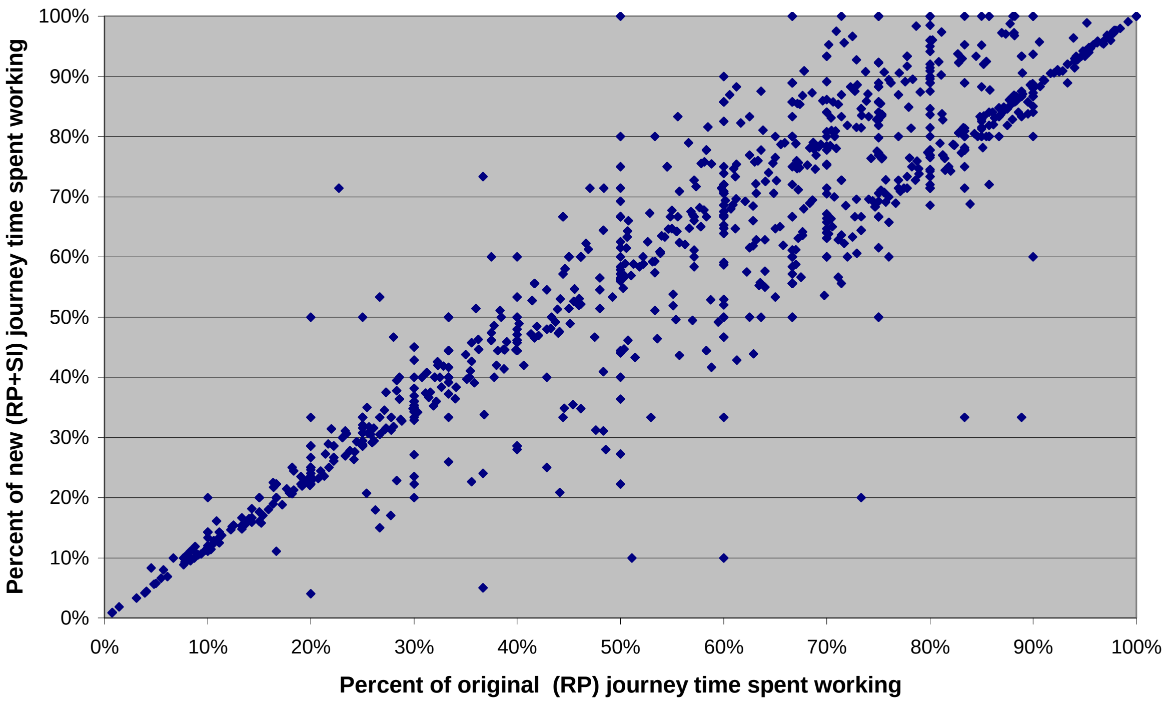
Thus the conclusion from comparative analysis (A) is that, for the journey as a whole, the average percentage of time spent working implied by the SI outcomes might not be consistent with those obtained from the RP data alone, for journeys in the 90-149 minute range.

G.1.1 Direct comparison for individuals of whole-journey estimates of productivity of travel time

The preceding analysis compared the distributions of estimates of the productive use of travel time, relative to variations in journey time, treating the RP estimates and RP+SI estimates for the whole journey as two distinct data-sets. Here, we compare the two estimates directly against each other, for all individuals that answered Question 34. For this comparison, the data needs to be not just as if derived on the same survey basis (as above) but for the same set of individuals, for which the common set of 1088 records is appropriate[36].

A plot of the percentages obtained with the RP+SI estimates versus the RP data alone, shown in Figure G2 for all 1088 records, suggest strongly that there may be two clusters of people: those whose productive use of travel time improves as the journey time reduces, and those for whom it remains approximately unchanged.

Figure G2: Effect on productivity of journey time of stated intentions estimates for all business travellers



One reason of course for the appearance of two distinct lines is that the response to Q34 made a clear distinction between those who spent “about the same” time working and those who reduced the time spent working. For the former group, a higher value for the productive use of travel time is obviously obtained when an undiminished number of minutes spent working is divided by a reduced number of minutes of journey time. The next two graphs therefore distinguish between the 663 business travellers whose working time was not affected (Figure G.3) and the 425 who were (Figure G4).

[36] The exclusion of certain records, in order to obtain a common boundary consistent with a common survey methodology, is not appropriate to the direct comparisons made in this and later sections.

Figure G3: Effect on productivity of journey time of stated intentions estimates for those whose work would not be affected

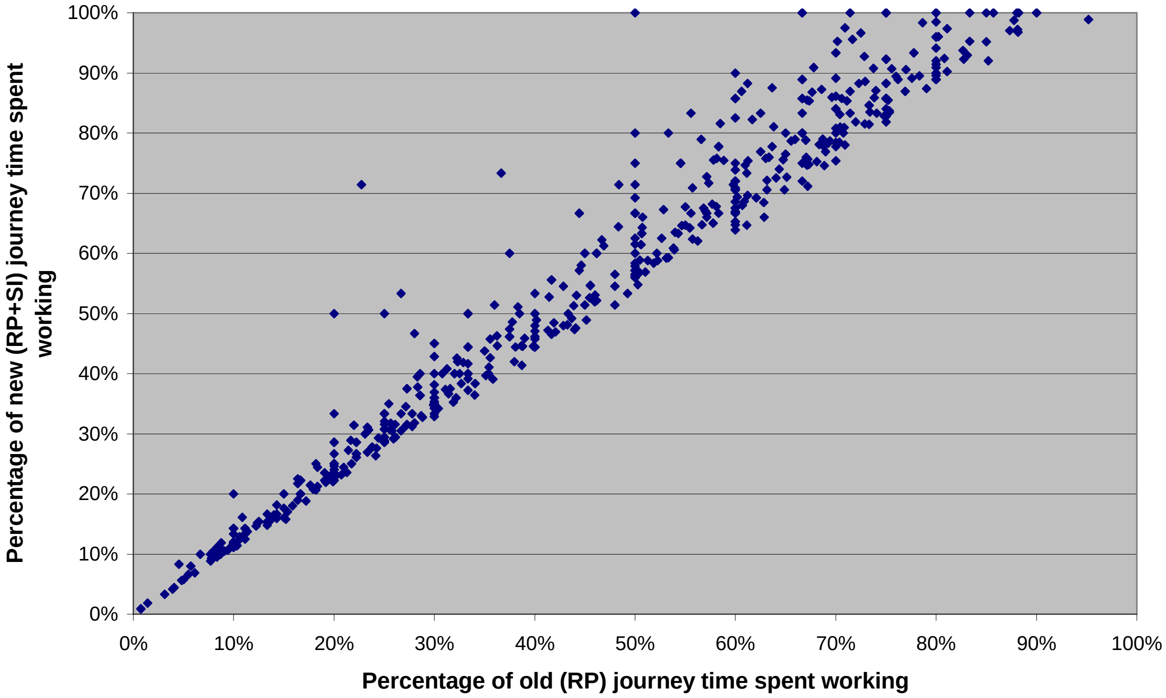
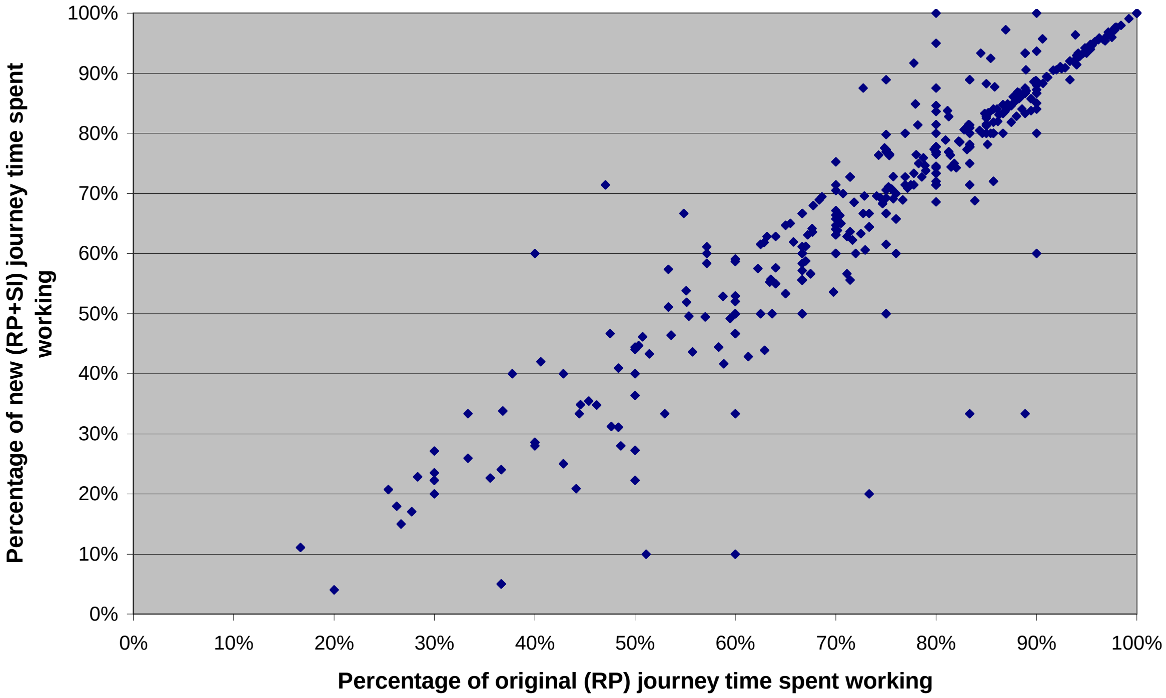


Figure G4: Effect on productivity of journey time of stated intentions estimates for those whose work would be affected



These two figures suggest the following.

- For those whose work is unaffected by the journey time reduction, the productivity of travel time increases for all, by *at least* 10% of the original percentage value (so an original value of 50% becomes 50*1.10 = 55%), with an average effect of 20% (this average coming from a simple linear regression in which heteroscedasticity and other data artefacts are ignored).
- For those whose work is affected by the journey time reduction, the productivity of travel time remains at about the same high level for those at the highest levels but is reduced at the lower levels of productive use of travel time; the plot suggests a linear relationship might be adequate over most of the range, for which a simple linear regression (expressed as proportions) is y = 1.19x – 0.19. So when x=30%=0.3, y= 0.17=17%.

The dichotomy apparent in Figure G2 and the subsequent explanation strongly suggest that a procedure to estimate the effects of a marginal reduction in journey time on the productive use of travel time should focus initially on estimating the proportion of working travellers whose working time is affected by the change.

G.2 Comparison of marginal estimates from SI data with average estimates from RP data

For the comparative analysis (B), the question is whether the percentages of time spent working, inferred from the SI data alone over the period of the changed journey time, are similar enough to those for the average journey as a whole, inferred from RP data; that is to say, whether the marginal productivity of travel time differs from the average productivity of travel time.

One indication comes from the (unweighted) mean percentages of journey time spent working (by those who do some work), derived for the common set of 1088 records used in section G.1.1 above. These are, for the whole journey, 56.8% in for the original RP data and 60.8% for the implied “new” RP+SI data. That is to say, a reduction in the time needed for the journey increases the productivity of the new journey time. This arises because the loss of productive working time due to a reduction in journey time is (on average) only about 35% of the reduction in journey time. Hence, in forming the average (minutes worked on train/journey time), the numerator has decreased by less than the denominator: in this case from (unweighted) means of 55 minutes working to 49 minutes, relative to journey time changes from 96 minutes to 81 minutes.

This 35% loss in working time as a percentage of the journey time reduction implies that the remaining 65% of the journey time reduction leads to a loss in leisure time. The low figure of 35% arises because most of the working travellers (here, 61%) are unaffected by the reduction; having finished their on-train work.

Of the 39% whose on-train work is affected, the loss in time spent working amounted on average to 92% of the amount by which their journey time reduced (the average reduction being 14.7 minutes). The loss was very slightly higher at 93% for those with a journey time reduction of 10 or 15 minutes, but much lower at 86% for the small number (37 people) affected by a journey time reduction of 20 minutes.[37]

[37] These figures differ slightly from those that can be derived from Chapter 6, on the effects of a decrease in journey time. From Table 6.11, for the 452 business travellers who said they spent “less time” working, the average reduction in time spent working was 12.1 minutes. Given that the (weighted) average value of the reduction in scheduled time was, from Table 6.12, just 13.7 minutes, this implies that the “productivity” of this lost travel time would for them have been 12.1/13.7 = 88%. Those who managed still to do “about the same” amount of work despite the reduction meant that, when averaged over all those who worked at some point in the journey, the average amount of working time lost was 5.6 minutes, leading to an average loss in productivity of 5.7/13.7 = 42% of the reduction in journey time. The difference in estimates are partly due to the exclusions applied in forming the data set used in this Appendix, and partly because the averages given in Chapter 6 are weighted averages rather than unweighted ones.

It should by the way be noted that of the 425 respondents whose working time was affected, 13 reported a value for the minutes of working time lost that exceeded the hypothesised reduction in journey time. These were treated not as a logical inconsistencies (although some might be recording errors), but as genuine estimates of the loss of productive working time, given that some work might need a quantum of effort, so might not be started in a preceding period should the journey time be reduced.

G.3 The concept of "usable time" and its affect on estimates of the productivity of travel time

The 92% or so level of loss of productive use of travel-time when the latter reduced, shown in the preceding section, should in principle be compared not with the average productivity of those working on the journey as whole (as above, 57% before the reduction in journey time, 61% afterwards), but with an average based on the amount of the journey time that is available for working. From Q29, which had sought estimates of the time in either minutes or as a percentage of the amount of time spent on the train for both "settling down" and "Preparing to disembark" (as well as for "Work activities" and "Personal activities"), a composite estimate of the percentage of journey time spent on these activities had been prepared of the estimates, as described in Appendix C, section C2. By subtraction from the composite journey-time estimate, these led to estimates of the number of "usable" minutes available (usable that is for either working or personal activities).

G.3.1 Defining and validating the usable time variable

The process of preparing estimates of usable time exposed more inconsistencies in the data set, and led to further exclusions from the common set of 1088 records, as follows: (a) 5 records in which the "usable time" went negative (either for the RP data or the RP+SI estimates); (b) 12 records in which the usable time became less than the number of minutes recorded as worked on the train; (c) 92 records in which exceeded the "new" usable time (using the original figures for the time spent settling down or preparing t disembark) became less than the number of "new" (RP+SI) minutes spent working on the train journey as a whole.[38]. This left 979 records, of which 396 (40% of the total) were of respondents whose working time was affected by the reduction in journey time, and 583 were not.

There could be several reasons for the number of inconsistencies found at this stage. One might be inconsistencies in the time (or percentage of journey time) reported by the respondent for settling down or preparing to disembark, another might be scanning errors in coding those times; and a third might be that the choice of "composite journey time" following the review of several estimates (see Appendix C), was not the in the end the most appropriate, given this analysis. This might merit a further review of data before release of the data-set; if that were to be done, the whole data-set of 1660 records should be subject to these checks. But since the data reported is often "lumpy", reported in 5- or 10-minute chunks, with respondents not necessarily ensuring consistency in their own answers, complete consistency cannot be expected of the source data.

[38] Whilst some of the inconsistencies here may be due to errors or inconsistencies in the time (or percentage of journey time) recorded for settling down or preparing to disembark, it is also possible that some might be pointing up an inappropriate choice of "composite journey time", which had been based on a review of several sources. This might merit a further review of data; if that were to be done, the whole data-set of 1660 records should be subject to these checks.

One of the potential causes of an inconsistency was the occurrence of surprisingly high values for the number of minutes spent "settling down" and sometimes "preparing to disembark"; there were many that were very much more than the 5 minutes or so one might have expected. Inconsistencies in the reported time might in part be due to inadequate perception by some respondents of how many minutes were implied when reporting a "percentage of journey time" for some activity: a small percentage for settling down might imply a large number of minutes for a long journey. Moreover, what is meant by "settling down" might be interpreted differently by different people. In particular, it seems reasonable to conjecture that if one has to stand before being able to do any work (or any leisure activities for that matter), then all that standing time might be included in "Settling down" time. Initial analysis (of the entire data set of 1660 records) lent some support to that idea, but disaggregation according to whether people spent time working or not showed (Table G3) that for those who did some work, the average percentage of time spent settling down was only two percentage points higher if one did not have a seat all the time; whereas it was significantly higher (by 14 percentage points) for those not working. Table G4 shows that there is very little difference in the time required when preparing to disembark.

Table G3: Time spent "Settling-down" by seating ability and work profile

Composite percentage of journey time spent (expanded data)				
	Seated all the time		Not seated all the time	
	Mean	Unweighted Count	Mean	Unweighted Count
No time spent working on train	9%	233	23%	18
Some time spent working on train	7%	1329	9%	35

Table G4: Time spent "Preparing to disembark" by seating ability and work profile

Composite percentage of journey time spent (expanded data)				
	Seated all the time		Not seated all the time	
	Mean	Unweighted Count	Mean	Unweighted Count
No time spent working on train	7%	233	7%	18
Some time spent working on train	6%	1329	5%	35

Returning to the main theme, the values of productivity of travel time with usable time as the basis will first be compared with the ordinary RP estimates for the whole data set, and then compared with the estimates from SI data.

G.3.2 Comparisons with RP data fro the whole journey

For all the 979 records with valid "usable time" estimates, Figure G5 illustrates the variation of the "minutes worked on-train/ minutes of usable journey time" with those for "minutes worked on-train/journey time". Detailed analysis by both journey length and the average proportion of journey time spent working revealed some systematic differences between the percentages obtained, as shown in Table G5.

Figure G5: Productivity of usable time relative to that of the whole journey time

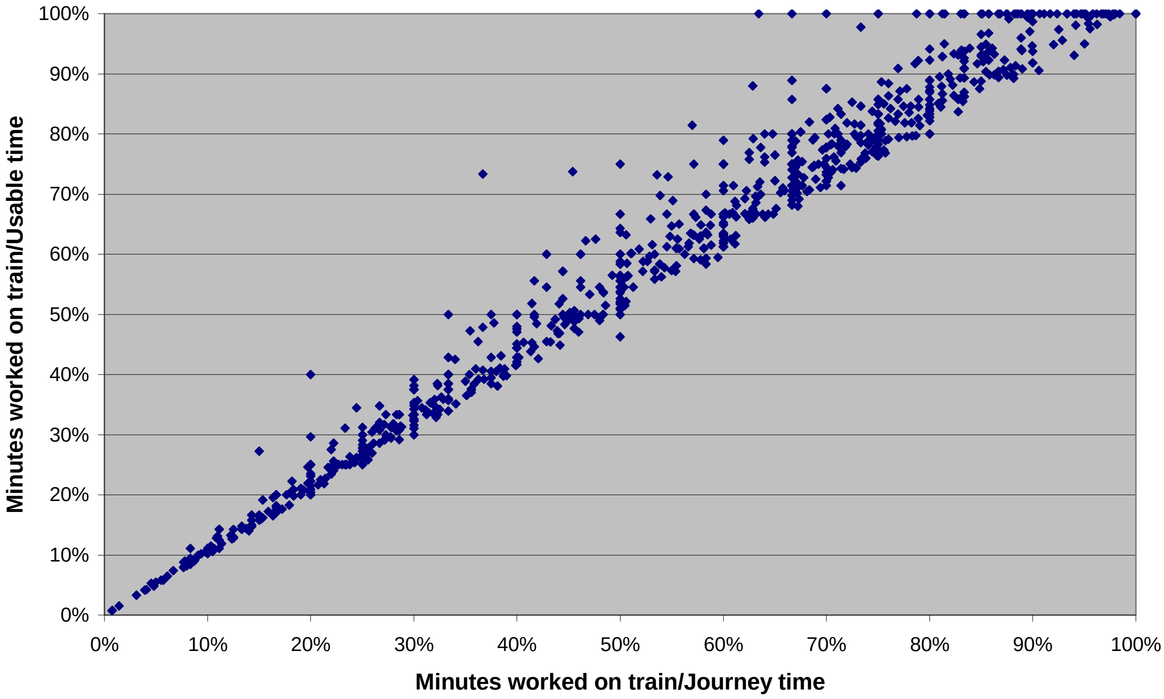


Table G5: Difference between two bases of estimating the average productivity of travel time

(% minutes worked/usable time) - (%minutes worked/journey time)					
Percentile Range	Journey Time Band (mins)				
(for the percentage of journey time spent working)	15-45	45-90	90-150	150-280	All
0+ to 20	3%	2%	1%	1%	1%
20+ to 40	8%	4%	3%	3%	4%
40+ to 60	8%	7%	6%	5%	7%
60+ to 80	10%	9%	7%	5%	8%
80+ to 100	10%	8%	6%	6%	7%
Total	76	372	398	133	979

Table G5 shows that, when the time spent settling down and preparing to disembark is disregarded, the productivity of the usable time might be as much as 10 percentage points higher than would have been estimated on the basis of the whole journey; but that the difference is smaller for lower levels of this productivity and for longer journey times.

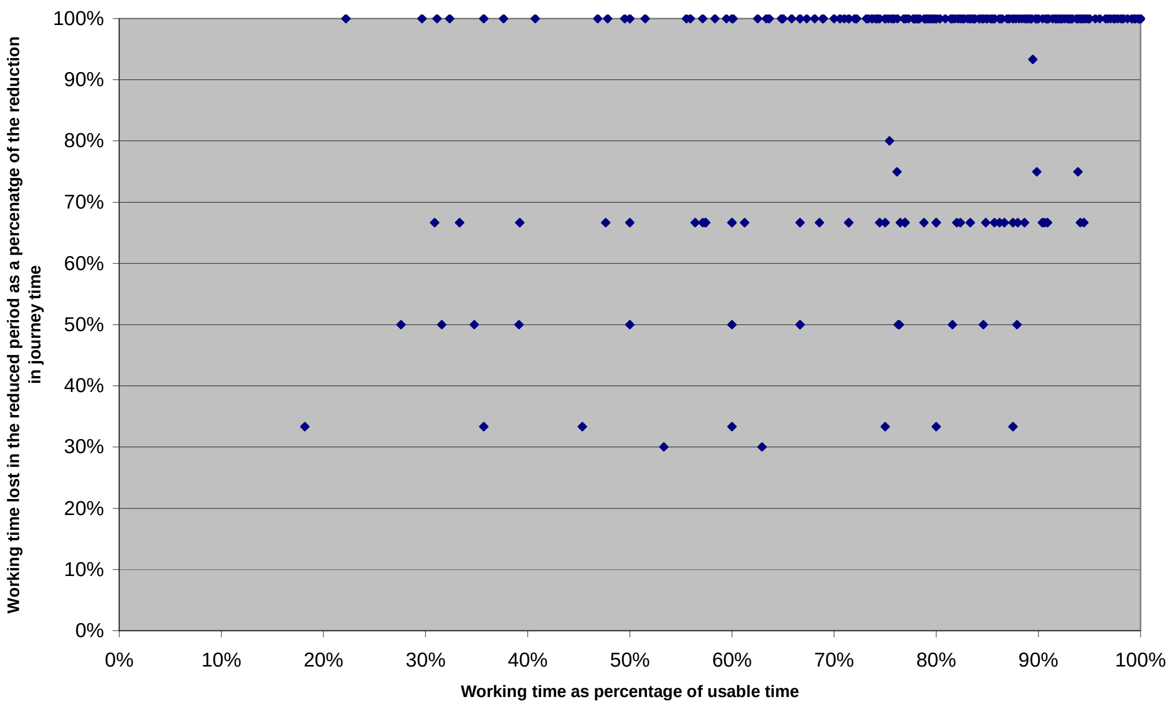
G.3.3 Comparisons with SI data for the change in journey-time

The final comparison is that of the "productivity" that might be inferred from the SI data for the period by which the journey time is hypothesised to be reduced. As previously noted, the average loss in working time is high, at 92% for the 396 respondents affected by the change in this analysis. The productivity of an individual over the period of time by which the journey time is reduced is not necessarily measured by the working time lost, for as shown above, in some cases (13 in all) the latter can exceed the reduction in journey time that is experienced. For these cases, the "productivity of travel time" calculations over that period is set at 100% rather than an unattainable higher percentage.

With that amendment, values of the "marginal productivity of travel time", derived from SI data alone, are plotted in Figure G6 against the corresponding values of the average productivity, derived from RP data, with the latter based on usable time as the denominator rather than journey time. The only discernible patter is a bunching of the 100% marginal productivity values as the average productivity exceeds 60%. In fact, only 6% of the affected respondents imply a productivity in this period of less than 60%, and after further 11% report values in the range 60+ to 70% productivity. There is then a gap until over 82% of the affected respondents imply 100% productivity of working in the period concerned.

It is clear from the above that the average productivity of travel time for working business travellers is not an appropriate predictor of the productivity that occurs at the margin of those affected, even when the average is calculated by excluding that part of the journey time that is spent on settling down or preparing to disembark. It is also clear that, if one is affected by the reduction in journey time, then nearly all those affected lose all that time to work.

Figure G6: Marginal productivity of travel time relative to average productivity



G.4 Conclusions

The principle conclusion arising from the preceding analyses is that the effect of a marginal change in the scheduled journey time of a train on the productive use of on-train travel time should not be estimated by applying a measure of “marginal productivity of travel time”, nor should it be estimated by applying a measure of the “average productivity of travel time”. The effect should instead be estimated directly, by estimating the loss in productive working time.

For a given journey of a given length, given the number of business travellers, this requires three parameters, being:

- proportion of business of travellers who do some work on the train;
- proportion of these whose work will be reduced; and
- percentage to be applied to the journey time reduction to estimate the loss in working time of those affected.