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2.1.1.1 Values of Time for Road Commercial Vehicles

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2.2 FOREWORD

This is one of a series of papers prepared under DETR contract PPAD9/65/79, 'Revising The Values of Work and Non-Work Time Used for Transport Appraisal and Modelling'.

The views expressed in these papers are those of the authors and do not necessarily reflect the views of the DETR (now DTLR).

Working Papers 561-566 were originally prepared in May 2001 and formed the basis for Working Paper 567 which reports on the evidence and was prepared in August 2001. Working Papers 568 and 569 on policy and practicality were written subsequently.

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2.3 Working Papers

561   Size and Sign of Time Savings
562   Principles of Valuing Business Travel Time Savings
563   Values of Time for Road Commercial Vehicles
564   Public Transport Values of Time
565   Variations in the Value of Time by Market Segment
566   Intertemporal Variations in the Value of Time
567   Values of Travel Time Savings in the UK: A Report on the Evidence
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3. INTRODUCTION

The purpose of this note is to review the report of Accent/HCG (1994), referred to here as AHCG, and other sources, and make recommendations regarding future official Values of Time for road commercial vehicles. This note starts by discussing current DTLR practice, as set out in its Transport Economics Note (TEN). Section 3 presents a digest of the AHCG findings. Section 4 looks at the findings of other studies. Although these are very mixed, carried out for a variety of purposes and presented in a variety of forms, they can serve as a partial check on the AHCG work. Section 5 presents interim conclusions.

4. CURRENT PRACTICE

Currently, DTLR practice (as evidenced in its Transport Economics Note, dated March 2001) is to allow for the effect of travel time savings on the commercial vehicle sector in two ways. Firstly there is the value of the working time released, and secondly there are changes to vehicle operating costs. The value of saving a unit of time is the sum of those two elements. No allowance is made for the inventory value of saving time for the load.

For many years, the Department used the factor cost approach as the unit of account for cost-benefit analysis. In the recent TEN note (March 2001) and the accompanying method TUBA, a switch is made to market prices as the unit of account.

For travel time, this means that two sets of values are relevant - perceived costs and market prices. Perceived costs are relevant for modelling. For the appraisal of non-working time, the perceived cost is taken to be equal to the market value of the time saving and reflects the willingness to pay for time savings. For appraisal of working time, firms are assumed to sell their goods and services at the factor cost of production plus the rate of indirect tax in the economy. Therefore the market value of a unit time saving is taken as equal to the gross cost of labour inflated by the indirect tax rate (i.e. multiplied by 1.209).

For vehicle operating costs, a significant element of the perceived cost of fuel is duty. Changes in fuel duty need to be separated out since they appear twice in the CBA, once as an impact on travellers and once as an equal and opposite impact on Government.

When considering road commercial vehicles, passengers of buses and coaches (PSVs) may be in either Working or Non-Working Time, with the proportions determined from surveys, as may be occupants of light vans and taxis. For heavy lorries, however, occupancy is taken as 1.00 and it is assumed all travel time is Working Time. The Transport Economics Note refers to all goods vehicles that are not 'light' as 'OGV', taken here to refer to 'other goods vehicles' sometimes split into OGV1 and OGV2 according to definitions that are not given. DTLR values, in 1998 pence per minute are given in Table 1. All are derived as the appropriate average wage per minute in the 1992 Labour Cost Survey updated to 1998 and uprated by 24.1% to cover non-wage costs except for PSV passengers, where willingness to pay values from travel surveys are used.

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Table 1: Value of Time per person: Commercial Vehicles
(Average 1998 pence per minute)

	Perceived Cost	Market Price
Goods vehicle occupant	12.18	14.73
PSV driver	11.12	13.45
PSV passenger (in course of work)	18.48	22.34
PSV passenger (leisure)	7.53	7.53

Although allowance is made for the value of the vehicle time savings to rise with the number of passengers on a Public Service Vehicle (PSV, i.e. bus or coach), no allowance is made regarding the value of a load being transported by a lorry.

The second way a journey time saving might be seen as a benefit, for evaluation purposes, is if it reduced the Vehicle Operating Cost. The Transport Economics Note gives cost formulae for fuel and non-fuel costs. Investigation of earlier versions of these formulae, using the old $a + \dfrac{b}{V} + cV^2$ for fuel costs, gave the following which is presented here for illustrative purposes. For a journey taking T hours at an average speed of V km per hour, the expression for the value (in pence) of reducing travel time by ΔT hours was given as:

$$\text{VALUE} = \Delta T [pb + b' - 2pcV^3]$$

Where p is the net of duty cost of fuel in pence per litre, V is speed in kph, and p, b, b′ and c are parameters given in TEN.

This value of saving per minute for a vehicle of class OGV2 is calculated to be the following.

At zero kph	Value (p/min)	= 6.33
At 40 kph	Value (p/min)	= 5.73
At 80 kph	Value (p/min)	= 1.48
At 87 kph	Value (p/min)	= 0.09

If a survey of freight vehicles operators' Willingness To Pay were conducted, we would expect responses to be the sum of the driver's wages, any related employment costs plus Perceived Vehicle Operating costs. Repeating the above calculation of vehicle operating costs for Perceived values gives the following:

At zero kph   Value (p/min)   = 12.97
At 40 kph   Value (p/min)   = 10.13
At 60 kph   Value (p/min)   =   3.40
At 66 kph   Value (p/min)   =   0.23

The minimum VOC occurs at 66.4 kph, where the time related and speed related terms exactly balance each other.

The implication from this investigation of vehicle operating costs is that we can expect to find freight operators' WTP values up to 10p/min above the gross wage costs. Using the TEN, and converting back to 1998 prices, values up to £15/hour (25p/min) would be consistent with the value of driver's time plus operating cost savings by this method.

5. THE AHCG RESULTS

5.1 Bus and Coach

The AHCG survey covered 166 HGVs, 104 LGVs, 28 chartered coaches, 9 scheduled coaches and 10 scheduled buses. The freight interviews were conducted in Nov/Dec 1994 and the bus/coach interviews in Jan/Feb 1995. The number of scheduled buses and coaches interviewed is clearly far too small to provide any reliable values of time. Pooling all the results for bus/coach together in a crude average gives 29.4p/min. An adjustment to combat policy response bias reduces the value to 26.9p/min. Within this value scheduled bus was about 17p/min, charter coach about 22p/min and scheduled coach about 55p/min. An earlier Accent/HCG study for the DOT had found a mean VOT for the coach segment of 75p/min, considerably above this latest result. Clearly, there is scope for debate as to whose time is being valued here. Is it just the driver's or is some allowance being made for the passengers? AHCG concluded that the (new) values could be used for forecasting, but that for evaluation the COBA approach should be retained, rather than adding on passenger VOTs to the operator's VOT. They say:

> "This difference is due to the expectation that the operator's VOT will include the expected fare increase that could be charged for a faster service, which will in turn be some fraction of the passengers' VOTs. Simply adding the two would then result in double counting".

We agree with this, and devote the rest of this note to the consideration of freight.

5.2 Freight

It is worth noting that deriving reliable values of time savings for freight transport from willingness to pay based approaches is a notoriously difficult task.

- the industry is heterogeneous, and there is a problem of finding a suitable sampling frame from which to ensure a representative sample is taken.

- the respondent, who might be a transport manager, is unlikely to have a comprehensive perspective of the impact of time savings on the overall value to the logistics chain; this is particularly true of respondents from the Hire and Reward sector.
- there are difficulties in presenting designs and choices which are relevant to the respondents' situations; some researchers have sought to overcome this problem by using Adaptive SP methods.
- ideally we would like to separate out the value of a unit time saving or loss which is fully understood and anticipated in advance, from the value of unexpected delays. In practical experiments, this can be problematic.

AHCG devote just 4 pages of their final report to the analysis of values of time in their road freight survey. There were two different experiments, one of which was analysed with and without the exclusion of some respondents, see Table 2. Log-normal models were applied to one of the experiments, but the report does not say which. Except for the log-normal model, results are available for four segments, being the combinations of LGV v HGV and Hire & Reward v Own Account.

Table 2:   The AHCG Models for the Freight SP Experiments

Segments	LGV Hire and Reward	LGV Own Account	HGV Hire and Reward	HGV Own Account
Freight Experiment 1				
Observations	362	425	812	381
Rho-square (C)	0.16	0.19	0.18	0.14
VOT (p/min)	43.5	35.5	47.1	35.5
5.3 Freight Experiment 2				
Observations	381	453	833	401
Rho-square (C)	0.44	0.36	0.42	0.45
VOT (p/min)	19.3	20.8	19.5	33.3
Freight Experiment 2 (excluding those always rejecting current route)				
Observations	273	337	631	311
Rho-square (C)	0.38	0.24	0.24	0.27
VOT (p/min)	15.1	17.7	20.5	59.3

Notes (i)   'Observations' are not the same as 'respondents'. There were a total of 270 respondents, and so an average of 7.33 observations per respondent to Experiment 1 and 7.66 to Experiment 2.
(ii)   VoTs are in end-1994 prices

The first experiment considered the choice between two untolled roads, having different times and costs, as well as differences in other attributes. Estimated values of time were 45p/min for Hire and Reward and 35p/min for Own Account. Without having seen the experiment, the appendices to the report merely giving the MINT syntax, we would suggest that respondents might have considered the cost changes in Experiment 1 unrealistic and so ignored them relatively to the time changes.

Generally, all else equal, longer routes should cost more and have longer journey times. Fast roads, such as motorways, will go against this, attracting traffic to travel further, at higher cost, but with shorter journey times. However, depending on the interview context, this will not always appear realistic to respondents in particular situations.

The second experiment overcame that problem by charging a toll to use the quicker (current) route as against a slower, free, alternative route. This is believable, but causes a different problem, an anti-toll bias. This appears to be the case in this experiment since the untolled alternative always has a Alternative Specific Constant, that implies it is preferred over the current route all else equal.

The results from Experiment 2, therefore, must be treated with some caution. Except for the HGV Own Account sector, the typical VOT found is about 20p/min. The HGV Own Account value is 33p/min, with a 95% Confidence Interval of 20p/min to 46p/min. The overall average over the 4 categories used is 22.4p/min. This is consistent with the reported value of 21.1p/min for a similar 1993 Accent/Hague study (see Accent/HCG, 1994) and with our interpretation of current appraisal practice described in section 2.

However, there are some important features of this data. 25 percent of the sample refused to trade time for money at any of the rates offered in the SP. The above results depend critically on the plausibility of the responses of this low time value group. If the non-traders are dropped, the precision of the estimates is reduced, and the HGV Own Account Value raises to 59 pence/min, while the other categories change little.

5.4 Our View of the AHCG Freight Work

Our overall view of the AHCG freight work is that:

− there are reservations about the plausibility of the SP questions and possible response bias, but that
− there is no support for values lower than these implied by DTLR's traditional approach and there is some evidence to support higher values
− however, we question the jump from Table 120 to Table 132 of the AHCG report, which recommends values of 45 pence/min for Hire and Reward and 35 pence/min for Own Account. We understand that the results from freight Experiment 2 have been rejected, without discussion of why this is the correct thing to do. The reported Rho-square statistics suggest that the Experiment 2 models were considerably superior in fit, and the discussion at the bottom of p232 of AHCG implies that Experiment 2 results are to be recommended, supported by Accent/HCG (1994) results. Subsequently, it appears that they decided to only accept results from non-toll experiments, although the arguments given for that decision all relate to car travel.

6. RESULTS FROM OTHER STUDIES

A useful review of studies up to that time was prepared by Gerard de Jong, of HCG, for the Easthampstead conference in 1996 (de Jong, 1996). The thrust of the results from the other studies reviewed there is that (in 1995 prices):

i.   for road, the factor cost (wage rates plus vehicle operating cost) gave a per lorry load value of time of about £15/hour (=25p/min), based on Dutch studies, while the SP studies of willingness to pay gave values around £24/hour (= 40p/min), i.e. 60% higher;

ii.   for rail and inland waterways, lower values of time per tonne were indicated (the switch to per tonne values being because rail wagons and barges have different carrying capacities to lorries).

We should note that there is great spread in the results presented by de Jong, who had to use best judgement to convert between currencies at different points in time, and regarding other matters, to enable £/hr/lorry-load figures to be obtained. Nevertheless, the factor cost values are similar to those assumed by current UK practice (see Section 2 above) and the SP values are similar to AHCG Experiment 1.

One aspect of the range of values from studies was demonstrated by Fowkes, Nash and Tweddle (1989) who, in a study of shippers, disaggregated by commodity type. Their study used a mode choice experiment between road and intermodal. Converted to 1995 monetary values, the range found was as follows (per vehicle):

Table 3:   Value of Time by Commodity

	VOT per vehicle	
	(£/hr)	**(p/min)**
Fertiliser	1.3	2
Cement	4.0	7
Domestic Appliances	3.2	5
Chocolate	6.5	11
Beer	7.7	13
Oil	7.5	13
Tubes	13	22
Paper products	15	25

Source: Fowkes, Nash and Tweddle (1989) with additional calculations

These values are below the AHCG values, and, indeed, mostly below the factor cost values for movement by road. It may be that where the goods were being moved by Hire and Reward hauliers, the shipper was considering only the value to him of a faster delivery, and not any benefit to the haulier (which might ultimately be reflected in a lower rate). More important than the level of the values here is the wide range of results. This is confirmed in subsequent work.

Tweddle, Fowkes and Nash (1996) report results from a survey of Anglo-Continental freight movement prior to the opening of the Channel Tunnel. As usual, values of time were presented as percentage reductions in the freight rate required to

compensate for a unit of extra travel time (of which there were 9 per day). Additional calculations, presented for the first time here, give the implied values of time in 1995 prices, per vehicle, as:

Median:	£33/hour	55p/min
First quartile:	£9/hour	15p/min
Third quartile:	£108/hour	180p/min

Naturally, only the higher valued commodities tend to get transported internationally, so high values are to be expected. Some element of the reported spread will represent residual variation of commodity type, but much will be due to other sources (eg urgency).

Finally, we present here the latest results from an ongoing project at ITS funded by the Highways agency under their Understanding Travel Behaviour programme. Respondents were road freight shippers or Hire and Reward hauliers. Each was told that the cost for one of their current movements would double due to the imposition of a toll, but that a cheaper (also tolled) alternative was available via a slower route, giving a later arrival. As the possibility of starting out earlier was not allowed, we expect values higher than pure VOT. We called them Value of Delay Time (VDT). Also estimated was VSH, a schedule delay not involving a longer journey time, but including the penalties for late arrival present in VDT. By subtracting VSH from VDT we can hope to get a rough estimate of pure VOT. The overall value of delay time (VDT), for 40 such interviews, was 107p/min in end-2000 prices. The overall value of the schedule delay time (VSH) was 66p/min in end-2000 prices. The derived VOT is therefore 107-66 = 41p/min.

The split by commodity suggests that the values may only be as high as they are because of some specialist products involved (some becoming difficult to unload if on the lorry for too long), i.e.

(p/min)	Delay time	Schedule delay	Value of Time
CHEMICALS, CHEM PRODUCTS, PAINTS	225	94	130
FOOD, DRINK, GROCERY	91	48	43
OTHER COMMODITIES	146	97	49

Another relevant point to be borne in mind is that the traffic was predominantly long distance, averaging at 282km. The distance split is as follows.

(p/min)	Delay time	Schedule delay	Value of Time
DISTANCE <250 km (av. 133 km)	90	59	31
DISTANCE >250 km (av. 362 km)	125	74	51

In the UK in 1995 the average length of haul for a HGV was 88km. Extrapolating the above figures suggests a VOT of 27p/min for an average UK HGV movement.

The most interesting split, though, was probably by respondent type, where (for the first time we know of) third party was split according to whether the shipper or haulier was interviewed. The third party shipper evinced a low value of time, presumably ignoring any effects on lorry utilisation, driver effects, or the possibility of knock-on effects on other movements. Hauliers and Own Account operators gave much higher valuations, despite shorter and cheaper journeys being involved.

	Av. Cost	Av. Dist	Delay time (p/min)	Schedule delay (p/min)	Value of Time (p/min)
OWN ACCOUNT	£227	237 km	169	126	43
HAULIER	£298	287 km	155	87	68
3rd PARTY SHIPPER	£327	321 km	37	31	6

Our interpretation of the above is that shippers tend to use third party Hire and Reward haulage for longer distance less time sensitive loads. However, there is evidence of another factor at work, namely whether any night operation was involved. This was where the biggest difference for a binary split was found.

	Av Dist	Delay Time (p/min)	Schedule delay (p/min)	Value of Time (p/min)
DAY MOVEMENT ONLY	286 km	97	61	36
SOME NIGHT MOVEMENT	326 km	432	178	254

It should be pointed out, though, that the number of movements including night work was quite small.

To summarise, most of the values reported in this section have been derived by Stated Preference methods, rather than by studying actual behaviour. Nevertheless, the methods are thought to be reliable. A literature review of the methodology used is contained in NERA/MVA/STM/ITS (1997). A more recent survey of freight transport demand analysis by means of Stated Preference data has been provided by Danielis and Rotaris (1999). Both give additional results, but it is difficult to convert them to meet our needs.

7. CONCLUSIONS

i. Buses and Coaches

We conclude that the current method of using the cost saving approach to value the driver's time and the operating cost savings, together with values of non-working time savings for passengers in line with the general principles used elsewhere in the evaluation should be continued. We can see no basis for change.

ii. Heavy Goods Vehicles

We conclude that

(a) the cost, saving approach, yields a value of around 25 pence/minute in 1998 prices in combined time plus VOC savings.

(b) this may, in its own terms, be "too low", since it is most unlikely that the mean vehicle occupancy is as low as 1.00.

(c) some of the empirical evidence from AHCG and others broadly supports values of this order.

(d) however, other evidence suggests significantly higher values. Given the heterogeneity of the traffic and the range of values encountered, it is difficult to know whether this is merely the result of sampling disproportionately from the higher quality, time sensitive, or long distance parts of the market.

(e) with some reservations, for forecasting we are inclined to think that the current values may be a reasonable basis for short distance, low value traffic, but we are minded to propose a higher value, perhaps 40 pence/minute, as a reasonable average for long distance traffic in line with de Jong's 1996 review and close to AHCG's recommendations. Nevertheless, the advantages of simplicity suggest that the current values should be used unaltered for evaluation purposes.

(f) there is probably a significant difference between the unit value of a time saving which is anticipated and planned for and the value of changes in unexpected delays.

iii. Small Goods Vehicles

This is an important sector of the market, about which least is known. Researchers have found that such vehicles rarely turn up in surveys without deliberately aiming for them. The AHCG survey found some 100, and their value of time was found to be not too dissimilar to HGVs. It would be very difficult to recommend a change to current practice on the basis of the very limited knowledge that exists about the behaviour of this sector. Accordingly we recommend that they are treated the same as HGV's.

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