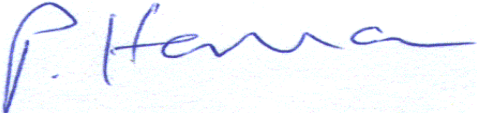


A9 Driver Frustration Stated Preference Research Final Report

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A9 Driver Frustration Stated Preference Report

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1 Introduction

The Stated Preference (SP) work that this report relates to was carried out as part of the wider TRL/AECOM study to explore understanding of driver frustration on A9 between Perth & Inverness following an earlier literature review carried out by TRL for Transport Scotland (Grayson, Kinnear, Helman (2012)¹.

This literature review found that driver frustration is influenced by not being able to drive at desired speed due to slow moving traffic. This can be usefully defined as

‘Driver frustration is the psychological state that occurs when a driver is blocked from making progress towards the goals of their journey’ Helman and Kinnear (2014).

The purpose of the study was to attempt to quantify the value that drivers place on frustration in order to provide relative values of time for use in modelling the impacts of dualling the A9. This work focussed on the A9 so use of the results for other schemes should be treated with caution in case there are contextual factors specific to the A9. The value that drivers place on travel time is influenced by travel conditions. Pleasant driving conditions are assigned a lower ‘cost’ in terms of value of time than unpleasant driving conditions as evidenced by previous research work (*Wardman & Ibanez (2012)*), which has quantified how drivers value time spent in congested conditions, for example, by valuing free flow and stop-start time, where the latter is valued more highly than the former.

The value that drivers place on time spent travelling can be taken as a proxy for the levels of driver frustration, which is influenced by not being able to travel at the desired speed and a number of other factors².

The objective of the SP exercise was to derive value of time multipliers, for time spent in different driving conditions. These conditions accounted for a number of factors, based on the TRL experimental work including:

- Not being able to drive at the desired speed;
- Being stuck behind a platoon of traffic made up of cars and HGVs; and
- Whether or not there is oncoming traffic³.
-

The multipliers derived from the analysis would be applied to a base value of time to provide actual values of time for these different driving conditions. This does raise the issue of whether there is a degree of double counting of benefits and this depends on what benefits are included in the base value of time that the results of this work are applied to. This issue has been further explored in AECOM (2014) Driver Frustration – Technical Note 14

Surveys and simulation experiments were carried out in Perth and Inverness with 183 drivers. These were recruited locally and the surveys took place in central facilities. The survey consisted of two elements. The first involved a driver simulator experimental exercise facilitated by TRL where respondents viewed video clips showing different driving conditions and they were asked to assess how frustrated they felt after seeing each clip. The second element of the survey involved a Stated Preference survey. This involved respondents completing a self complete route choice exercise for part of a journey they make. It was decided to look at part of their journey only as we felt it would be difficult for respondents to comprehend being stuck behind the same platoon of traffic for their entire journey particularly if their journey was quite long.

The experimental work undertaken by TRL for Transport Scotland is documented in a separate report: Helman and Kinnear (2014).⁴

After this Introduction Section 2 outlines the SP design. The survey fieldwork is described in Section 3. Section 4 discusses the survey results and the application of the model is outlined in Section 5. References are included in Section 6. Appendix A outlines the SP modelling process in more detail. Copies of the questionnaire are contained in Appendix B.

¹ Grayson, G., Kinnear, N. and Helman, S. (2012). A review of the effects of frustration on driving behaviour and the propensity to overtake. Published Project Report (RPN2135). Crowthorne: Transport Research Laboratory.

² I thought it worth adding a footnote here about the work Mark is undertaking.

³ These factors were determined to be significant following the SP modelling work; the original list of factors considered is set out in more detail in the Driver Frustration report Helman and Kinnear (2014) Factors associated with driving frustration and overtaking intentions

⁴ Helman and Kinnear (2014) Factors associated with driving frustration and overtaking intentions

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2 Stated Preference Design

To keep the Stated Preference and Simulation experimental approaches broadly consistent, the factors used in the Simulation exercise, developed by TRL to describe frustration, were the starting point for the SP. These factors are listed below:

- *Speed;*
- *Platoon length - number of vehicles;*
- *Platoon type - proportion of HGVs;*
- *Length of time behind platoon;*
- *Road type - single vs. dual carriageway; and*
- *Oncoming Traffic - whether there was oncoming traffic or not.*

Although these variables are generic and could be seen to apply to any road context, the results derived are based on the A9 therefore use of the results outside of the A9 should be treated with caution in case there are contextual factors specific to the A9.

The driver context in terms of driver goal ie whether they were time pressured or not was also included by allocating respondents to a time pressured or non-time pressured group. It was considered that whether someone was time pressured or not may influence their valuations of the different attributes.

In order to derive valuations of the different factors that influence driver frustration, it was necessary to present respondents with a choice between two alternatives in which the different factors were traded off. This was presented as a choice between two different options: a free flow route and a route which had a platoon of traffic ahead (the congested route).

To ensure a high quality SP design, in particular ensuring there were suitable trade-offs between the variables presented in which one alternative is not clearly better than the other, a number of considerations were taken into account. These are outlined below:

- **Use of Cost as a Variable** - Initially, thought was given to including cost as a variable. In some SP surveys, including cost as a variable can be useful in presenting respondents with a time/cost trade-off; for example, drivers having to pay a toll to use a higher quality or faster route. Also by estimating a time and a cost parameter it is possible to derive a local value of time. However, participants can be very sensitive to the issue of cost (especially if tolls are involved), and this can introduce bias which is undesirable. This is particularly the case if there is no prospect of tolls being introduced, which is the case here. In addition, as it is intended to use National Standard rather than local values of time, it was not necessary to derive a local value of time. With these considerations in mind it was decided not to include cost as a variable in the SP survey.
- **Use of Journey time for Trade-offs** Participants were presented with a trade-off between two routes with different journey times. In order to present journey time trade-offs between the alternatives, it was necessary to say the free flow route had a longer journey time than the route with a platoon of traffic. This on the face of it would seem counter intuitive but the novel way that this was done was to say the free flow route was a longer distance so although it had a higher speed it had a longer journey time. The choice context was presented as being for only part of the participants' journey, as it would be unrealistic for people to believe that they could be stuck behind the same platoon of vehicles for their whole journey particularly as some of the journeys on the A9 can be quite long.
- **Single Carriageway versus Dual Carriageway** The choice presented was between two single carriageway routes. Introducing dual carriageway routes would introduce ambiguity into the exercise since it would introduce the option of the respondent passing slower moving traffic in the outside lane, which could not be controlled for in the experiment. Overtaking and passing were not explicitly considered in the survey. Respondents were asked to make a choice between the two alternatives, as presented. These are discussed later.
- **Time Pressured or Not** Respondents were segmented on the basis of whether they were making a time-pressured journey or not.

After careful consideration of the issues above, the following variables were included in the SP experiment:

- **Speed:** this was the desired speed on the free flow route (assumed to be 60mph), but was constrained to be below this on the congested route. Although it is recognised that some drivers do speed on the A9 but it was felt it would not be acceptable to present respondents with a speed higher than 60mph as their desired speed.

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- **Platoon type and length:** this was the composition of the platoon of vehicles directly in front of the respondent's vehicle. This was described in terms of the number of cars and HGVs in the platoon ahead on the congested route. There was no platoon on the free flow route.
- **Oncoming Traffic:** this was whether there was oncoming traffic or not.
- **Journey time:** the journey time for part of the respondents' journey using each route. The journey time on the free flow route was longer than the journey time on the congested route because it is longer in distance. On the congested route this was the time spent behind a platoon. This allowed a trade-off to be made, i.e. the free flow route allowed desired speed, no platoons and no oncoming traffic but it introduced a time penalty.

Each variable was represented by different values or levels. The SP variables used and their levels are shown in *Table 1* below, for example Route A In Vehicle Time was shown as either 13, 14 or 15 minutes. In estimating a choice model of this type it is important that the independent variables are not correlated with each other, otherwise this so called 'multicollinearity' can cause statistical estimation problems. A so called 'orthogonal' design was therefore used (this ensures that there were no correlations between the different independent variables and levels).

In order to produce an orthogonal design covering all these variables and levels 27 scenarios were needed. This is clearly too many for a respondent to cope with so we split the design into three sub designs A,B and C each containing 9 Scenarios. Consequently there were six versions of the questionnaire – either time pressured or non time pressured group and there were three versions A, B and C of each. The values presented to time pressured or non time pressured respondents were the same but we did explore if there were differences in the models between these groups in Appendix A.



Table 1 – Stated Preference Variables and Levels Used

<i>Variables</i>	<i>Values (Levels)</i>
Route A In Vehicle Time (IVT) - minutes	13,14,15
Route B IVT – minutes	8, 10, 12
Route A On Coming Traffic	No
Route B On Coming Traffic	Yes or No
Route A Platoon Ahead	No
Route B No. Of cars in platoon ahead	2,4,6
Route B No. Of HGVs in platoon ahead	0,1,3
Route A speed (mph)	60
Route B Speed (mph)	35, 40 or 50

The layout of the SP survey is shown in Figure 1. The graphics which were used to generate a visual impression of the different options were provided by TRL from the video simulations. A full written description of the scenario was also given.

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Figure 1 - Example Stated Preference Scenario

Option	Route A	Route B
A4		
Ahead	Nothing	6 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	15	8
I Choose (circle A or B)	A	B

Each respondent was provided with a self-complete questionnaire, see Appendix B, which included an introduction, an example and nine different SP scenarios. To explain the SP exercise, the explanation provided in *Figure 2* was used. There were two versions depending on whether the respondent was subject to time pressures or not.

Respondents were asked to say which alternative route they would choose given the scenarios presented. No explicit mention was made of overtaking. Respondents were told to make a choice on the basis of the information shown. So in the above example if they choose Option A their journey time would be 15 minutes and their speed would be 60 mph. If they chose Option B their journey time would be 8 minutes they would travel at 50 mph and would be following a platoon of traffic of 6 cars and 3 lorries and there would be oncoming traffic for this length of time.

Figure 2 – Stated Preference Introduction

Introduction

Please think of a recent journey you have made by car of over 20 minutes that is made mostly on a single carriageway. Similar to the experiments you have just completed, you **are / are not** subject to time pressures.

We would like you to think of this journey again and imagine a situation where for part of your journey you are presented with a choice between two routes.

These routes are described in terms of the following:

- Whether or not there is a queue of traffic ahead and, if there is, how that traffic queue is made up in terms of the number of cars and HGVs
- Whether there is oncoming traffic or not
- The speed you can travel at, which is either your desired speed or a speed lower than this
- The journey time you spend travelling on this route for which the above conditions apply.

Route A is traffic free so you are able to travel at your desired speed but it is a longer distance than Route B which is why the journey time is longer. On route B you have to travel at a slower speed because of the traffic.

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3 Fieldwork

Given the complexity of the exercise a pilot survey was carried out with 12 members of AECOM's Glasgow office, who had not been involved in the design of the SP Survey, on Thursday 31st October 2013.

This pilot survey worked well. Firstly respondents could understand what they were being asked to do and the choice context was understandable.

An important measure of the quality of a SP survey is the degree to which respondents change their choice between the alternatives presented through the SP exercise. If they choose different alternatives at least once as the exercise progresses they are called 'traders'. Respondents who choose the same option throughout are called 'non traders'. In the Pilot survey all but two respondents 'traded' which suggested that the exercise was well designed with good trade-offs, , although this data was not actually modelled statistically.

This provided a significant degree of confidence that the survey design and approach would work well.

The main survey took place on the following dates:

Table 2 – SP Survey Dates

<i>Perth</i>	<i>Inverness</i>
Tuesday 5th November	Wednesday 13th November
Wednesday 6th November	Thursday 14th November
Thursday 7th November	Friday 15th November
Saturday 9th November	Saturday 16th November

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4 Survey Results

A total of 98 respondents in Perth and 85 respondents in Inverness completed the SP survey, making a total sample of **183** respondents. Of these, 99 were time pressured and 84 were not time pressured.

The concept of trading in the SP survey was discussed in Section 4. Of the 183 respondents, there were 54 non traders, representing 30% of the total sample. Of these 54 non traders, 47 chose Route A (the free flow route) and 7 chose Route B (the congested route). Clearly it is good to minimise the level of non trading, but from AECOM's experience of carrying out over 90 SP studies, this level of non trading is considered acceptable given the complexity of what respondents were being asked to do.

Table 3 below shows which option was chosen in the SP survey and this has been broken down by whether they were time pressured or not. This shows that Route A (the free flow route with the longer journey time) was chosen 69% of the time, while Route B (the congested route) was chosen 31% of the time.

These percentages did not vary significantly by whether the respondent was time pressured or not, which was a surprise as it was expected that people who were time pressured would choose the route with the shorter journey time.

However, this was generally not the case, indicating that choosing a route free from a traffic platoon with a higher speed was important to time pressured respondents even though this involved a longer journey time.

Table 3 - Choice of Route by Whether Time Pressured

	<i>Choice</i>		<i>Respondents(N)</i>
	<i>Route A Free Flow</i>	<i>Route B Congested</i>	
<i>Time Pressured</i>	69%	31%	99
<i>Not Time Pressured</i>	71%	29%	84
<i>Overall</i>	69%	31%	183

The proportion choosing each route did not vary by whether the survey location was Perth or Inverness.

Table 4 shows whether people traded in the SP exercise and whether they were time pressured or not.

Overall, 70% of the respondents traded in the SP survey. Of the remaining 30%, 26% chose only the free flow route and 4% chose only the congested route. There was little difference by whether people were time pressured or not, as shown in *Table 4* below.

Table 4 - Trading Behaviour by Time Pressure

	<i>Time Pressured</i>	<i>Not Time Pressured</i>	<i>All</i>
<i>Trader</i>	68%	74%	70%
<i>Non Trader (All A)</i>	27%	24%	26%
<i>Non Trader (All B)</i>	5%	2%	4%
<i>Respondents (N)</i>	99	84	183

This table shows that 70% 'traded' in the SP survey which was slightly higher for non time pressured people 74% compared with 68% for time pressured respondents. Of the 30% who did not trade most chose the free flow route (Route A).

The time pressure variable did not produce the results that were expected. It may be that respondents had difficulty understanding this concept or it is possible that respondents may not have kept their time pressure/non time pressure 'mind set' throughout the survey.

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5 Application of the Model

5.1 The Model

The SP modelling exercise, which is described in more detail in the Appendix, used the statistical analysis package Biogeme (Bierlaire,2003) to estimate a standard binary logit model from which the model parameters associated with the utility functions described below and goodness of fit statistics were derived. These are direct outputs from the Biogeme model estimation software.

Economists use a term utility to define goodness or wellbeing and we are interested to see how important different variables are in making up this utility. The modelling process estimated a utility function for each route (A and B) based on the variables shown to respondents in the SP exercise. A utility function describes how important different variables are in determining utility and hence choice, since it is assumed that the alternative with the highest utility (lowest disutility) will be chosen.

The utility functions estimated for each route are presented below. These are linear additive in nature. It may be that a more complex relationship could be more appropriate, but exploring non linear models was outside the scope of this study. The model estimation software provides parameter estimates which provides the 'best fit' to the choices made in the survey.

The utility functions are:

$$U_a = b1 * TIME_a$$

$$U_{b1} = ASC + b1 * TIME_b + b2 * (TIME_b * SPEEDDIFF) + b3 * (TIME_b * CARS) + b4 * (TIME_b * HGVS) + b5 * (TIME_b * ONCOMTRAF)$$

where:

TIME_a: journey time on Route A;

TIME_b: journey time on Route B;

SPEEDDIFF: difference between the desired free flow speed presented on route A (60mph) and the speed shown on route B;

CARS: number of cars in the platoon ahead on Route B;

HGVS: number of HGVs in the platoon ahead on Route B;

ONCOMTRAF: described whether there was oncoming traffic or not on Route B;

ASC: route specific constant which measures the impact of other variables not included in the model; and

b1, b2, b3, b4 and b5: parameters to be estimated.

The parameters b1 – b5 measure the impact of a unit change in the variable in question on utility.

Looking at the utility functions above:

A journey time variable (*TIME*) has been estimated using the model, which gives the based time multiplier, the parameter b1 measures how much utility changes when the time on Route A or Route B changes by one unit (one minute). Although the time variable has a number of discrete values it has been estimated as a continuous variable

The other parameters were estimated using interaction variables. Parameters b2 to b5 measure the impact of a unit change of the non time variable on the time variable, for example b4 measures how much the time parameter changes if there is a unit change in the number of HGVs. This way it is possible to see how the time variable changes in relation to these other variables. A fuller explanation of the modelling is provided in appendix A of this report. The overall preferred model is shown below in Table 5

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Table 5 - Model 1: Overall Preferred Model (Non Traders Included)

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
(b2) <i>TIME * SPEEDDIFF</i>	-0.00760	9.85
(b4) <i>TIME * HGVS</i>	-0.00900	2.77
(b5) <i>TIME * ONCOMTRAF</i>	-0.02480	2.78
(b1) <i>TIME</i>	-0.18900	7.84
Number of observations:	1616	
Number of individuals:	180	
Rho-square:	0.187	
Adjusted rho-square:	0.183	

In estimating this model, parameters were also estimated for:

- *TIME*CARS* (b3) which measured the impact of the number of cars in the platoon on the value of time; and
 - A route constant ASC which measures the impact of influences not specified in the model.
- However, their T Ratio was less than 1.96 so they were dropped from the model.

In this overall preferred model all the T Ratios are much greater than 1.96 giving confidence that the parameter values are reliable. The rho squared statistic is also high (0.187) so the model can be viewed as being robust.

This model suggests that route choice (and hence drivers' frustration) and their Value of Time is influenced by:

- Not being able to drive at desired speed;
- Whether there is oncoming traffic; and
- The number of HGVs in the platoon ahead (the number of cars in the platoon does not seem to be important).

5.2 Definition of Time Multipliers

In applying these results there is an issue of whether there is a degree of double counting of benefits and this depends on what benefits are included in the base value of time that the results of this work are applied to. This issue has been further explored in AECOM (2014) Driver Frustration – Technical Note 14.

The interpretation of the *overall model* contained in *Table 5* is that the time variable (*TIME*) is the base time which represents travelling at the unconstrained and desired speed (assumed to be 60mph). This has a time multiplier equal to 1.

To account for the other variables considered in the model, this base time multiplier is adjusted to take into account the factors as detailed below:

- **Speed:**

$$\text{Speed Time Multiplier} = 1 + (0.0402 * (60 - \text{actual speed}))$$

The speed multiplier⁵ of travelling at for example 50mph (10mph below the desired speed) is:

$$1 + (0.0402 * (60-50)) = \mathbf{1.40}$$

⁵ 0.0402 in the formula comes from the ratio between *TIME*SPEEDDIFF* / *TIME* in table 5, i.e. -0.0076/-0.189

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So the perception of time of travelling at 10mph below the desired speed is **40% higher** than travelling behind no platoon with no oncoming traffic at the desired speed

- **HGVs:**

$$\text{HGV Time Multiplier} = 1 + (0.0476 * \text{Number of HGVs})$$

As an example, the HGV time multiplier⁶ for 3 HGVs in a platoon ahead is:

$$1 + (0.0476 * 3) = 1.1428$$

This means the perception of time travelling behind a platoon containing 3 HGVs is **14% higher** than travelling behind no platoon with no oncoming traffic at the desired speed

- **Oncoming Traffic:**

$$\text{On Coming Traffic Multiplier} = 1.1312$$

This variable can only take two possible values: presence or absence of oncoming traffic. The perception of time if there is oncoming traffic is **13% higher**⁷ than travelling behind no platoon with no oncoming traffic at the desired speed. If there is no oncoming traffic, the multiplier is 1.

Using these three multipliers, it is possible to derive the impact of any combination of Speeds, HGVs and whether there is oncoming traffic or not.

5.3 Example Application

Table 6, below, summarises the separate time multipliers for different speeds, HGVs and whether or not there is oncoming traffic.

EXAMPLE

In order to calculate the time multiplier for travelling at 1mph below the desired speed:

$$\text{Time Parameter} = -0.189 \text{ (Base)} - (1 * 0.0076) = -0.1966$$

$$\text{Multiplier} = -0.1966 / -0.189 = 1.0402$$

Similarly the time multiplier for travelling at 10mph below the desired speed:

$$\text{Time Parameter} = -0.189 \text{ (Base)} - (10 * 0.0076) = -0.265$$

$$\text{Multiplier} = -0.265 / -0.189 = 1.4021$$

⁶ 0.0476 in the formula comes from the ratio between TIME*HGVS / TIME in table 5, i.e. -0.009/-0.189

⁷ This value arises from the ration between TIME*ONCOMTRAF / TIME in table 5, i.e. -0.0248/-0.189

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Table 6 Time Multipliers for Different Speeds HGVs and On Coming Traffic

Base time		-0.189	Multiplier=1.0	
		<i>Parameter</i>	<i>Time Parameter</i>	<i>Multiplier</i>
Below Speed	60mph			
	1	-0.0076	-0.1966	1.0402
	10	-0.076	-0.265	1.4021
	20	-0.152	-0.341	1.8042
	30	-0.228	-0.417	2.2063
	40	-0.304	-0.493	2.6085
HGVs				
	0	0	-0.189	1.0000
	1	-0.009	-0.198	1.0476
	2	-0.018	-0.207	1.0952
	3	-0.027	-0.216	1.1429
	4	-0.036	-0.225	1.1905
	5	-0.045	-0.234	1.2381
Oncoming Traffic				
	Yes	-0.0248	-0.2138	1.1312

Table 7 below shows the time multipliers for different combinations of the variables. These are based on the values presented in the TRL driver simulator exercise so a comparison between the frustration scores derived from the different experimental and SP approaches can be made. The values used are:

- Speed (mph) 60(just as base) 56 and 40;
- On Coming Traffic – Yes/No; and
- Number of HGVs in platoon – 0 1 5.

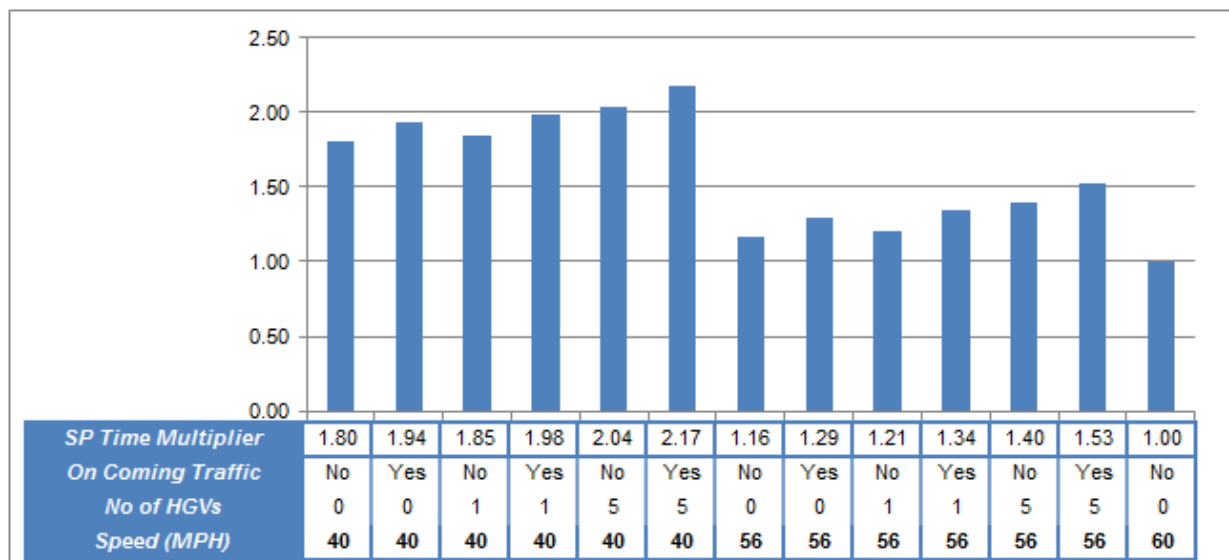
Table 7 Time Multipliers for Different Combinations of Different Levels of Speed, HGVs and On Coming Traffic

<i>Speed (MPH)</i>	<i>On Coming Traffic</i>	<i>No of HGVs</i>	<i>Time Multiplier</i>
60	No	0	1.0000
56	No	0	1.1608
56	No	1	1.2085
56	No	5	1.3989
56	Yes	0	1.2921
56	Yes	1	1.3397
56	Yes	5	1.5302
40	No	0	1.8042
40	No	1	1.8519
40	No	5	2.0423
40	Yes	0	1.9354
40	Yes	1	1.9831
40	Yes	5	2.1735

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The time multipliers in this table are shown graphically below in Figure 3.

Figure 3 Time Multipliers



5.4 Comparison of Results from SP and Experimental Survey

The overall study has involved two methods for exploring driver frustration. Firstly an experimental study where respondents were shown different clips and they were asked to say how frustrated they felt. This is described in Helman and Kinnear (2014), and secondly a SP survey where respondents were asked to trade-off different driving conditions and say which route they would choose.

The experimental study provides a direct estimate of people’s frustration, where as the SP study provides relative values of time for different driving conditions, which is taken as a proxy for frustration level.

Table 8 shows the relative frustration scores or indices from both methods for a number of different combinations of speed (56mph and 40mph) whether or not there is on-coming traffic and number of HGVs in the platoon. These are the key significant variables from the preferred SP model.

Table 8 Comparison of SP and Experimental Frustration Scores

Speed (MPH)	On Coming Traffic	No of HGVs	SP Frustration Index(Time Multiplier)	SP Frustration Index(Time Multiplier (Rebased))	TRL Frustration Index
60	No	0	1.0000		
56	No	0	1.1608	1.000	1.000
56	No	1	1.2085	1.041	1.082
56	No	5	1.3989	1.205	1.436
56	Yes	0	1.2921	1.113	1.125
56	Yes	1	1.3397	1.154	1.213
56	Yes	5	1.5302	1.318	1.375
40	No	0	1.8042	1.554	2.794
40	No	1	1.8519	1.595	2.734
40	No	5	2.0423	1.759	3.136
40	Yes	0	1.9354	1.667	2.873
40	Yes	1	1.9831	1.708	2.843
40	Yes	5	2.1735	1.872	3.096

These indices are shown graphically below in Figure 4.

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Figure 4 Comparison of SP and Experimental Indices



This shows a very good correspondence between the two indices. This is confirmed by the person correlation coefficient which is 0.975. This is very high and is significant at the 0.01 level (2-tailed).

The Experimental frustration index is generally higher than the SP Frustration Index, particularly when the speed is lower at 40mph, but there might be scaling issues at play so it is difficult to compare the absolute values produced by the two approaches but the high correlation between them is encouraging particularly as the methodologies used to derive these indices were totally different.

In terms of application of these results it was always envisaged that the results from the Stated Preference research would be used rather than the results from the experimental work because Stated Preference is regarded as a more robust methodology however the high correlation between the results from the two different approaches is reassuring. AECOM (2014) Driver Frustration – Technical Note 14 contains more information on how these results have been applied.

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6 Other Evidence

In order to provide a context for the time multipliers derived from this SP work, a short literature review was undertaken to determine if there was any other evidence available in this area.

A more extensive evidence review has been carried out subsequently and this is contained in AECOM (2014) Driver Frustration – Technical Note 14.

An important document in this context was a study of congestion multipliers carried out by Wardman and Ibanez in 2012 (*Wardman & Ibanez (2012)*). Focussing on work carried out in the UK by SDG and by AECOM and ITS on M6 Toll and also in the USA, the authors conclude by recommending the time multipliers shown in *Table 9* for use in the UK.

Table 9 - Recommended UK Congestion Multipliers (Wardman and Ibanez (2012))

Free Flow	1.00
Busy	1.15
Light Congested	1.20
Heavy Congested	1.30
Stop Start	1.50
Gridlock	1.80

There is a degree of interpretation involved needed to compare the values in Table 10 with the results produced in this study. For example, if "*Heavy Congested*" can be interpreted as a drop to 40mph (i.e. 20mph below 60mph), then the results of the *overall model* would give a time multiplier of 1.80 compared with the 1.30 value in the table above. It is worth noting, however, that the above table is heavily influenced by the M6 Toll study and there may be differences in peoples' perceptions of congestion and frustration on motorways compared with a single carriageway so these values may not be directly comparable. Other evidence produced by *Abrantes and Wardman (2011)* and unpublished work by Wardman suggests a higher value of congested time in relation to free flow time of around 1.55. This value, though, would still be lower than the 1.80 obtained from the *overall preferred model*.

These differences in time multipliers may be explained by the innovative approach that has been used in this study. The SP developed in this report, which has used best practice has explicitly looked at the impact of suppressed speed, platoon length and type and oncoming traffic driver frustration and hence time multipliers. This has been innovative and it is possible that these valuations are picking up wider effects of frustration that are not normally picked up from studies purely looking at valuations of stop start or other types of congestion in relation to free flow time.

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7 References

AECOM (2014) Driver Frustration – Technical Note 14

Abrantes and Wardman (2011) Meta-analysis of UK values of travel time: An Update Transportation Research Part A 45 pp1-17

Bierlaire, M. (2003) BIOGEME: A Free Package for the Estimation of Discrete Choice Models. *Proceedings of the 3rd Swiss Transportation Research Conference*, Ascona, Switzerland.

Grayson Kinnear Helman (2012) A Review of the Effects of Frustration on Driving Behaviour and the Propensity to Overtake (Draft Project Report RPN 2135) (Unpublished)

Helman and Kinnear (2014) Factors Associated with Driving Frustration and Overtaking Intentions, Draft Project Report by TRL for Transport Scotland (unpublished).

Wardman and Ibanez (2012) The Congestion Multiplier: Variations in Motorists valuations of travel time with traffic conditions, Transportation Research Part A 46 pp213-225

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Appendix A – Detailed SP Modelling

A1 Introduction

This Appendix explains the SP Modelling process in more detail.

The SP modelling exercise used the statistical analysis package Biogeme (Bierlaire,2003) to estimate a standard binary logit model from which the model parameters associated with the utility functions described below and goodness of fit statistics were derived. These are direct outputs from the Biogeme model estimation software.

The modelling process estimated a utility function for each route (A and B) based on the variables shown to respondents in the SP exercise. A utility function describes how important different variables are in determining utility and hence choice, since it is assumed that the alternative with the highest utility (lowest disutility) will be chosen.

The utility functions estimated for each route are presented below. These are linear additive in nature. It may be that a more complex relationship could be more appropriate, but exploring non linear models was outside the scope of this study.

The model estimation software provides parameter estimates which provides the 'best fit' to the choices made in the survey.

There were two versions of the utility functions for Route B. The first U_{b1} estimated separate parameters for the number of cars and HGVs in the platoon ahead

$$U_a = b1 * TIME_a$$

$$U_{b1} = ASC + b1 * TIME_b + b2 * (TIME_b * SPEEDDIFF) + b3 * (TIME_b * CARS) + b4 * (TIME_b * HGVS) + b5 * (TIME_b * ONCOMTRAF)$$

The second, U_{b2} below only estimated a parameter for the number of vehicles in the platoon irrespective of whether they are cars or HGVs. This is specific for Model shown in Table 9.

$$U_a = b1 * TIME_a$$

$$U_{b2} = ASC + b1 * TIME_b + b2 * (TIME_b * SPEEDDIFF) + b6 * (TIME_b * QUEUE) + b5 * (TIME_b * ONCOMTRAF)$$

where:

TIME_a: journey time on Route A;

TIME_b: journey time on Route B;

SPEEDDIFF: difference between the desired free flow speed presented on route A (60mph) and the speed shown on route B;

CARS: number of cars in the platoon ahead on Route B;

HGVS: number of HGVs in the platoon ahead on Route B;

QUEUE: number of vehicles (cars and HGVs) in the platoon ahead on Route B;

ONCOMTRAF: described whether there was oncoming traffic or not on Route B;

ASC: route specific constant which measures the impact of other variables not included in the model; and

b1, b2, b3, b4 and b5: parameters to be estimated.

The parameters b1 – b5 measure the impact of a unit change in the variable in question on utility.

Looking at the utility functions above:

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A journey time variable (*TIME*) has been estimated using the model, which gives the based time multiplier, the parameter b_1 measures how much utility changes when the time on Route A or Route B changes by one unit (one minute).

The other parameters were estimated using the model for interaction variables. Parameters b_2 to b_5 measure the impact of a unit change of the non time variable on the time variable. This way it is possible to see how the time variable changes in relation to these other variables.

For example, looking at utility function U_b , the parameter b_4 in the term $[b_4 * (TIME_b * HGVS)]$ measures how much the *TIME* parameter ($TIME_b$) changes if the number of HGVs (*HGVS*) changes by one unit. It was important to specify the modelling in this way in order to facilitate the impact of the different variables to be estimated on the value of time which we are taking as a proxy for frustration level.

How good a model is can be assessed by looking at three sets of key indicators which come directly from Biogeme, the statistical estimation package:

- Sign of parameters
- T Ratios of Parameters
- Rho Squared

These are described below.

The sign of the parameters (whether +ve or -ve) indicate whether they are 'goods' or 'bads'. Spending time travelling is perceived to be 'bad' consequently the parameters associated with spending time in the different conditions have a negative sign, which is the expected sign.

Associated with each parameter is a T Ratio, which is the ratio of the standard error and the parameter estimate. The standard error indicates the accuracy with which the coefficient is estimated. The T ratio indicates whether a variable is statistically different from zero. In order to be 95% confident that the parameter is not zero, the absolute value of the T Ratio must be **1.96** or higher. The T ratios in the models detailed in the subsequent sections of this Chapter have been adjusted to take into account the "panel effect" – i.e. the fact that each respondent had 9 choices so each observation is not independent. This is standard practice in SP modelling.

The goodness of fit of the model is given by the Rho Squared statistic, which is analogous with the R squared statistic in a regression model. However, the interpretation of what constitutes a high goodness of fit is less clear with Rho squared (for example the maximum value of Rho squared is influenced by the market shares of each alternative), as the following extract from the ALOGIT V3.8 Manual clarifies:

"It is difficult to give 'rules of thumb' for comparing Rho Squared values between differing models. In some cases, low values (0.05 - 0.10) can be considered to be good, whereas other choice situations can be modelled better, giving Rho Squared values of 0.40 or higher. In general, the simpler the choice that is to be explained, i.e. the smaller the number of alternatives, the higher the Rho Squared that can be expected. Experience is the only reliable guide".

From AECOM's extensive experience of developing this type of model, a Rho square of **0.10 or greater** is generally regarded as acceptable. In the tables that follow an Adjusted Rho Squared statistic is also presented. This takes into account the number of variables in the model allowing models containing different numbers of variables to be compared. Again, this is standard practice in SP modelling.

A2 Models

A large number of models have been estimated, but only the five models are discussed here. Compared with the overall model that was presented earlier in Section 5, which is discussed in Section A2.1, these further models explore the impact of different influences on the estimated model(s).

These models examine the impact of:

- Taking out non traders from the model (Traders Only model (Section A2.2))
- Segmenting the models by whether or not the respondent is travelling on a time sensitive journey or not (Time Sensitive and Non Time Sensitive models (Section A2.3))
- Treating vehicles in the platoon ahead as the same ie not distinguishing between cars and HGV but just treating these as 'vehicles' (Section A2.4).

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These are now discussed.

A2.1 Overall Model

The data set contained a total of 183 respondents. Each respondent was presented with 9 scenarios, thus giving 1,647 SP choices. However, some respondents did not complete all scenarios. Specifically, 31 choices were missing, meaning that 1,616 SP choices were available for modelling. This is equivalent to 180 respondents.

Table A1 below shows the overall model,. This shows the number of observations and goodness of fit statistics plus the variable names, estimated parameter values with associated utility function reference shown in utility functions above, and T Ratios.

Table A1 - Model 1: Overall Preferred Model (Non Traders Included)

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
(b2) <i>TIME * SPEEDDIFF</i>	-0.00760	9.85
(b4) <i>TIME * HGVS</i>	-0.00900	2.77
(b5) <i>TIME * ONCOMTRAF</i>	-0.02480	2.78
(b1) <i>TIME</i>	-0.18900	7.84
Number of observations:	1616	
Number of individuals:	180	
Rho-square:	0.187	
Adjusted rho-square:	0.183	

In estimating this model, parameters were also estimated for:

- *TIME*CARS* (b3) which measured the impact of the number of cars in the platoon on the value of time; and
- A route constant ASC which measures the impact of influences not specified in the model.

However, their T Ratio was less than 1.96 so they were dropped from the model.

In this overall preferred model all the T Ratios are much greater than 1.96 giving confidence that the parameter values are reliable. The rho squared statistic is also high (0.187) so the model can be viewed as being robust.

This model suggests that route choice (and hence drivers' frustration) and their Value of Time is influenced by:

- Not being able to drive at desired speed;
- Whether there is oncoming traffic; and
- The number of HGVs in the platoon ahead (the number of cars in the platoon does not seem to be important).

In isolation it is difficult to assess the impact of these parameters on the time multiplier but an application of this model is contained in Section 6 (Table 10 and Figure2).

A2.2 Traders Only Model

The decision to include or exclude non traders in the models is a pragmatic one. On their own, non traders do not tell us anything about how the different parameters are valued. However, in reality, so long as there is a plausible reason why people should not be trading it is sometimes more defensible to keep them in the model.

As the earlier analysis has shown (see *Section 4*), 30% of the sample were non traders. Most of these (87%, or 26% of the total sample), always chose the route with the fastest speed but longer journey time (*Route A*). The remainder (13%, or 4% of the total sample) always chose the route with the shortest journey time (*Route B*). Both behaviours are explainable, so there would seem no *a priori* reasons to exclude non traders. Consequently the decision whether to exclude non traders or not can be made solely on the basis of how good the models are.

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Table A2 - Traders Only Model

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
<i>TIME * SPEEDDIFF</i>	-0.00873	9.03
<i>TIME * HGVS</i>	-0.00894	1.99
<i>TIME * ONCOMTRAF</i>	-0.0235	1.89
<i>TIME</i>	-0.313	10.31
Number of observations:	1130	
Number of individuals:	127	
Rho-square:	0.181	
Adjusted rho-square:	0.176	

Table A2, above, presents the traders only model. This is shown by the fewer number of observations compared with the Overall model

A2.3 Time Pressure/Non Time Pressure Models

Separate time pressured and non time pressured models are presented in Tables A3 and A4, respectively.

Table A3 - Time Pressured Model

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
<i>TIME * SPEEDDIFF</i>	-0.00806	7.8
<i>TIME</i>	-0.156	4.96
Number of observations:	878	
Number of individuals:	98	
Rho-square:	0.166	
Adjusted rho-square:	0.163	

Table A3 shows the time pressured model. In this model, only the TIME*SPEEDDIFF and variables were significant. The number of cars and HGVs in the platoon and the presence or absence of oncoming traffic were not significant, so were dropped from the model. This suggests that for time pressured drivers speed and time are the key influences and the characteristics of the platoon and whether there is on coming traffic are not important.

Table A4 - Non Time Pressured Model

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
<i>TIME * SPEEDDIFF</i>	-0.0078	7.33
<i>TIME * HGVS</i>	-0.0193	4.1
<i>TIME * ONCOMTRAF</i>	-0.0327	2.2
<i>TIME</i>	-0.224	6.07
Number of observations:	738	
Number of individuals:	82	
Rho-square:	0.215	
Adjusted rho-square:	0.207	

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The non time pressured model is shown in Table A4. The variables included are the same as those in the overall model. Again, the number of cars and the route constant were not significant.

A2.4 All Vehicle rather than Car and HGV Model

Table A5 below shows a model where a parameter for each vehicle in the platoon has been estimated rather than for the number of cars and HGVs separately. It is very similar to the overall model, except that the parameter for TIME * QUEUE is much smaller than the equivalent parameter for TIME * HGV in the overall model. By estimating a single parameter for vehicles we are treating the vehicles in the platoon as the same irrespective of whether they are cars or HGVs. In the overall model the car parameter was found not to be significant and very small in size. So the impact of estimating a single parameter for Cars and HGVs has the effect of diluting the HGV impact.

Table A5 – All Vehicle Model

<i>Name</i>	<i>Value</i>	<i>T Ratio</i>
<i>TIME * SPEEDDIFF</i>	-0.0072	8.85
<i>TIME * VEHICLES</i>	-0.0044	2.24
<i>TIME * ONCOMTRAF</i>	-0.0224	2.5
<i>TIME</i>	-0.193	7.94
Number of observations:	1616	
Number of individuals:	180	
Rho-square:	0.186	
Adjusted rho-square:	0.183	

A3 Discussion

The Traders only model in Table A2 is not as good as the overall model in Table A1 on two grounds:

- The goodness of fit determined by the adjusted rho-square value is lower (0.176 compared to 0.183); and
- The oncoming traffic parameter (ONCOMTRAF) is not significant given its T Ratio is less than 1.96. Therefore, it cannot be stated with confidence that this parameter is not zero and so would have to be dropped from the model.

Since the overall model is more robust than the traders only model, it is recommended that non-traders should be included in the model.

It is expected that respondents making time sensitive journeys would have a higher value of time than those making non time sensitive journeys yet If the two models shown in Tables A3 and A4 are compared, it can be observed that the time parameter (TIME) is larger in the non time pressured model than in the time pressured model. This is counter to expectations. It is not clear why this is but it could be that respondents had difficulty in understanding this concept or it is possible that respondents may not have kept their time pressure/non time pressure ‘mind set’ throughout the survey exercise. This analysis shows that the time pressure/non time pressure contexts did not produce expected results and therefore we do not feel there is merit in producing separate models by whether the respondent is time pressured or not.

It is recommended that the distinction between time sensitive and non time sensitive is not made.

Table A5 shows by estimating a single parameter for all vehicles rather than separate parameters for cars and HGVs we are estimating an average value for both. Given the parameter for cars was not significant this has the effect of diluting the separate HGV effect. Consequently we recommend that a separate parameter is estimated for HGVs and CARS, although this was not significant rather than estimating a single parameter for both.

This model has also a slightly worse goodness of fit than the overall model.

A4 Conclusion

Taking into account the above discussion above, the single **overall model** with non traders included (as shown in Table A1) is our preferred model.

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Appendix B - Questionnaire

Please think of a recent journey you have made by car of **over 20 minutes** that is made mostly on a single carriageway. Similar to the experiments you have just completed, you are **not** subject to time pressures.



We would like you to think of this journey again and imagine a situation where for part of your journey you are presented with a choice between two routes.

These routes are described in terms of the following:

- Whether or not there is a queue of traffic ahead and, if there is, how that traffic queue is made up in terms of the number of cars and HGVs
- Whether there is oncoming traffic or not
- The speed you can travel at, which is either your desired speed or a speed lower than this
- The journey time you spend travelling on this route for which the above conditions apply.

Route A is traffic free so you are able to travel at your desired speed but it is a longer distance than Route B which is why the journey time is longer. On route B you have to travel at a slower speed because of the traffic.

Please consider the example below

Option	Route A	Route B
Example		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B

In the example above you are asked to make a choice between:



ROUTE A where you are travelling on an open road at your desired speed or
ROUTE B where you are travelling in traffic below your desired speed



If you use Route A you are **continuously moving** on an open road **with no traffic** for **14 minutes at your desired speed**. The journey time is longer than keeping on route because it is a longer distance **but you are travelling at your desired speed**.



If you use Route B your journey time is **10 minutes**, you are behind a queue of **2 cars and 3 lorries**, there is **no oncoming traffic** however you are **constrained to 40mph for 10 minutes**.



In the following nine scenarios please indicate by circling A or B for each, whether you would choose Option A or Option B.



Please consider each of the nine scenarios in isolation and do not compare between scenarios. Bear in mind the distances relating to route will vary between scenarios.



Option	Route A	Route B
A1		
Ahead	Nothing	4 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	15	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
A2		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
A3		
Ahead	Nothing	4 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	8
I Choose (circle A or B)	A	B



Option	Route A	Route B
A4		
Ahead	Nothing	6 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	15	8
I Choose (circle A or B)	A	B

Option	Route A	Route B
A5		
Ahead	Nothing	2 Cars 1 Lorry
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	15	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
A6		
Ahead	Nothing	2 Cars 0 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	13	8
I Choose (circle A or B)	A	B

Option	Route A	Route B
A7		
Ahead	Nothing	6 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
A8		
Ahead	Nothing	6 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	13	10
I Choose (circle A or B)	A	B

Option	Route A	Route B
A9		
Ahead	Nothing	4 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	13	12
I Choose (circle A or B)	A	B

Please think of a recent journey you have made by car of **over 20 minutes** that is made mostly on a single carriageway. Similar to the experiments you have just completed, you are **not** subject to time pressures.



We would like you to think of this journey again and imagine a situation where for part of your journey you are presented with a choice between two routes.

These routes are described in terms of the following:

- Whether or not there is a queue of traffic ahead and, if there is, how that traffic queue is made up in terms of the number of cars and HGVs
- Whether there is oncoming traffic or not
- The speed you can travel at, which is either your desired speed or a speed lower than this
- The journey time you spend travelling on this route for which the above conditions apply.

Route A is traffic free so you are able to travel at your desired speed but it is a longer distance than Route B which is why the journey time is longer. On route B you have to travel at a slower speed because of the traffic.

Please consider the example below

Option	Route A	Route B
Example		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B

In the example above you are asked to make a choice between:



ROUTE A where you are travelling on an open road at your desired speed or
ROUTE B where you are travelling in traffic below your desired speed



If you use Route A you are **continuously moving** on an open road **with no traffic** for **14 minutes at your desired speed**. The journey time is longer than keeping on route because it is a longer distance **but you are travelling at your desired speed**.



If you use Route B your journey time is **10 minutes**, you are behind a queue of **2 cars and 3 lorries**, there is **no oncoming traffic** however you are **constrained to 40mph for 10 minutes**.



In the following nine scenarios please indicate by circling A or B for each, whether you would choose Option A or Option B.



Please consider each of the nine scenarios in isolation and do not compare between scenarios. Bear in mind the distances relating to route will vary between scenarios.



Option	Route A	Route B
B1		
Ahead	Nothing	4 Cars 1 Lorry
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	13	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
B2		
Ahead	Nothing	2 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	15	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
B3		
Ahead	Nothing	4 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	15	8
I Choose (circle A or B)	A	B



Option	Route A	Route B
B4		
Ahead	Nothing	2 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	14	8
I Choose (circle A or B)	A	B

Option	Route A	Route B
B5		
Ahead	Nothing	6 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B

Option	Route A	Route B
B6		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	13	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
B7		
Ahead	Nothing	4 Cars 0 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	14	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
B8		
Ahead	Nothing	6 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	15	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
B9		
Ahead	Nothing	6 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	13	8
I Choose (circle A or B)	A	B

Please think of a recent journey you have made by car of **over 20 minutes** that is made mostly on a single carriageway. Similar to the experiments you have just completed, you are **not** subject to time pressures.



We would like you to think of this journey again and imagine a situation where for part of your journey you are presented with a choice between two routes.

These routes are described in terms of the following:

- Whether or not there is a queue of traffic ahead and, if there is, how that traffic queue is made up in terms of the number of cars and HGVs
- Whether there is oncoming traffic or not
- The speed you can travel at, which is either your desired speed or a speed lower than this
- The journey time you spend travelling on this route for which the above conditions apply.

Route A is traffic free so you are able to travel at your desired speed but it is a longer distance than Route B which is why the journey time is longer. On route B you have to travel at a slower speed because of the traffic.

Please consider the example below

Option	Route A	Route B
Example		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B

In the example above you are asked to make a choice between:



ROUTE A where you are travelling on an open road at your desired speed or
ROUTE B where you are travelling in traffic below your desired speed



If you use Route A you are **continuously moving** on an open road **with no traffic** for **14 minutes at your desired speed**. The journey time is longer than keeping on route because it is a longer distance **but you are travelling at your desired speed**.



If you use Route B your journey time is **10 minutes**, you are behind a queue of **2 cars and 3 lorries**, there is **no oncoming traffic** however you are **constrained to 40mph for 10 minutes**.



In the following nine scenarios please indicate by circling A or B for each, whether you would choose Option A or Option B.



Please consider each of the nine scenarios in isolation and do not compare between scenarios. Bear in mind the distances relating to route will vary between scenarios.



Option	Route A	Route B
C1		
Ahead	Nothing	6 Cars 0 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	15	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
C2		
Ahead	Nothing	2 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	15	8
I Choose (circle A or B)	A	B



Option	Route A	Route B
C3		
Ahead	Nothing	2 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	13	10
I Choose (circle A or B)	A	B



Option	Route A	Route B
C4		
Ahead	Nothing	6 Cars 3 Lorries
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	13	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
C5		
Ahead	Nothing	4 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 40 mph
Journey Time (mins)	13	8
I Choose (circle A or B)	A	B

Option	Route A	Route B
C6		
Ahead	Nothing	4 Cars 1 Lorry
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 35 mph
Journey Time (mins)	15	12
I Choose (circle A or B)	A	B

Option	Route A	Route B
C7		
Ahead	Nothing	6 Cars 1 Lorry
Oncoming Traffic	No	No
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	14	8
I Choose (circle A or B)	A	B

Option	Route A	Route B
C8		
Ahead	Nothing	4 Cars 3 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	14	10
I Choose (circle A or B)	A	B

Option	Route A	Route B
C9		
Ahead	Nothing	2 Cars 0 Lorries
Oncoming Traffic	No	Yes
Speed	At desired speed 60mph	Constrained to 50 mph
Journey Time (mins)	14	12
I Choose (circle A or B)	A	B