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TECHNICAL REPORT

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Isles of Scilly

Travel Demand Study

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The research described in this report was prepared for the Cornwall County Council.

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Preface

In August 2004, a Major Scheme Bid Submission for capital funding support for improved transport links between the Isles of Scilly and the mainland was submitted to the UK Department for Transport. Feedback on the bid highlighted the need for a robust Cost Benefit Analysis (CBA) and specifically for the need of an appropriately calibrated and validated mode choice and demand model for travel to the Isles. As a result, in July 2005 Cornwall County Council commissioned RAND Europe together with Accent Marketing and Research and the Institute of Transport Studies (ITS) Leeds to develop the mode choice and travel demand model. The objectives of the study were set out clearly in the brief, i.e.:

> '… to design a mode choice model from Stated and Revealed Preference Surveys of visitors to, and residents of, the Isles of Scilly. The aim of the mode choice model is to demonstrate the value-for-money (or otherwise) for a replacement ferry between the Isles and Penzance.'

This report summarises the findings from that study, setting out the study design, the data collection, the model development and the findings from scenario tests that were conducted as part of the CBA. A number of interesting aspects of the modelling are discussed including the joint usage of stated preference and revealed preference data for model development, the modelling of trip frequency effects, the impacts of capacity restraint on demand forecasting and resulting consumer surplus calculations and the calculation of consumer surplus using the travel demand curve, taking into account both journey time and cost as well as comfort and quality changes.

The report should be of interest to government officials evaluating transport infrastructure projects and those designing and specifying transport demand models to forecast travel demand. Parts of the report are highly technical in nature.

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Executive Summary

The Isles of Scilly are located 28 miles off the south west coast of England. The Isles comprise five inhabited islands, with a combined population of about 2000, and many smaller uninhabited islands and rocky islets. The main industry on the Isles is tourism, which is highly dependent upon the transport links to and from the mainland.

At present there are three commercial services operating between the Isles and the mainland: a sea ferry, a helicopter service and fixed-wing aircraft services. However, the boat used for the ferry service is now nearing the end of its operational life and if nothing is done, the sea ferry will be taken out of service after 2014. In response, Cornwall County Council, on behalf of the Penzance to Isles of Scilly Route Partnership, are preparing a Major Bid Submission for capital funding support for improved transport links to the UK Department for Transport. As part of this bid, a robust Cost Benefit Assessment was required to quantify whether a replacement ferry between the Isles and Penzance is justified. As part of this assessment a travel demand model was required to examine travellers' responses and quantify their benefits from different ferry service options, including the option of abandoning the ferry service. The study is unique as a multi-modal study in addressing links to an isolated island community, with modal choice between sea vessels, fixed wing aircraft and helicopter.

The Data: Both observed and hypothetical choice data were required
Both stated preference (SP) and revealed preference (RP) data were collected to develop the transport models. The strength of SP data is in deriving the *relative* importance of the different aspects of service (price, crossing time, comfort, etc.). However, to derive elasticities and forecasts it is necessary also to estimate the absolute scale of response and in this respect RP data is required. Current best practice is to combine SP data with RP data wherever possible and this methodology was undertaken in the present study. In a joint analysis, the main information concerning the relative importance of price and service comes from the SP data, while information concerning the overall likelihood that a traveller will choose a particular mode is derived from the RP data. Joint analysis exploits the specific strengths of the two data types, using each to reduce the weakness of the other.

A programme of SP and RP surveys were therefore undertaken during the summer operating season in 2005. The surveys were conducted with non-resident visitors and residents of the Isles.

The Design of the SP Survey
Respondents participated in three experiments in the stated preference survey:

- a *within-mode experiment* in which respondents were asked to choose between two hypothetical ferry alternatives for travel;

- a *between-mode experiment* in which hypothetical ferry, airplane and helicopter alternatives were compared;

- a *between-mode experiment* in which hypothetical airplane and helicopter services only were available (no ferry was available).

The choice cards for each experiment were specifically generated for each respondent so that the attributes in each experiment were realistic for respondents. This was particularly important for presentation of fares, which reflected the fare for the group of persons who were travelling together to the Isles.

The within-product experiment was designed to provide valuations for differing ferry attributes, e.g. ferry journey time, frequency of travel and schedule, quality of boat, harbour-side characteristics and Penzance and St. Mary's and price. An example within-mode choice is presented below.

Choice 5

If only a ferry service was available when you travelled to the Isles of Scilly, which of the following would you have preferred?

Ferry A	Ferry B
Journey time is 2 hours 40 minutes	**Journey time is 2 hours**
Penzance - St. Mary's 08:00 St. Mary's - Penzance 17:30	Penzance - St. Mary's 07:00 St. Mary's - Penzance 10:30 Penzance - St. Mary's 14:00 St. Mary's - Penzance 17:30
Existing boat, passengers may be prone to seasickness in rough conditions	Modern boat, passengers less prone to seasickness
New passenger terminal building and covered walkway to the vessel at Penzance	No passenger terminal building and exposed quayside area at Penzance
New shelter canopy at St Mary's	New shelter canopy at St Mary's
The return ferry fare for your journey is £148.75	The return ferry fare for your journey is £127.50

Prefer Ferry A   Neither   Prefer Ferry B
☐   ☐   ☐

Figure S.1:   Example of within-mode choice

The between-mode choices presented hypothetical options for each of the 3 modes of travel to the Isles. Access information for each of the alternatives was provided by the respondent (and was not varied in the experiment). In this experiment respondents always had the option available not to make the journey.

Choice 10   7
If the following alternatives had been available when you travelled to the Isles of Scilly,
how would you have travelled?

Ferry **(Penzance)**	**Helicopter** **(Penzance)**	**Airplane** **(Bristol airport)**
3 hours 20 minutes travel by car to the quay	3 hours 20 minutes travel by car to the heliport	1 hour travel by car to the airport
Journey time is 3 hours	Journey time is 20 minutes	Journey time is 1 h 10 min
Penzance - St. Mary's 09:15 St. Mary's - Penzance 16:30	There are frequent flights all day	There are 1 or 2 flights on a weekday, and 3 on Saturdays
Existing boat, passengers may be prone to seasickness in rough conditions		
No passenger terminal building and exposed quayside area at Penzance		
The return ferry fare for your journey is £76.50	The return helicopter fare for your journey is £134.00	The return air fare for your journey is £208.00

Choose Ferry   **Choose Helicopter**   **Choose Airplane**   **Wouldn't make trip**

Figure S.2:   Example of between-mode choice

In the third experiment, no ferry services were available in the between-mode choice experiment.

At the completion of the stated preference choice exercise, questions were asked about the respondent's current trip frequency to and from the Isles. These questions were followed by stated intention questions asking how the respondent's frequency of travel would vary under certain scenarios, specifically with an improved ferry service and with no ferry service. This information was used to estimate the trip frequency models.

Data Collection
Before the data collection commenced, sample size targets were set to ensure that traveller responses could be quantified for three traveller segments to and from the Isles: day-trip visitors, staying visitors and business travellers/residents/visiting friends and relatives (VFR). Staying visitors account for the majority of travel to the Isles of Scilly (62%) and for 37% of all ferry passengers. Day-trip visitors account for about 30% of all travel to the Isles, but for the majority of ferry travel (58%). Travel by residents, VFR and business travellers account for the minority, i.e. 8%, of travel to the Isles of Scillies, and about 5% of all ferry travellers[1] (see Figure S.3).

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[1]   All figures presented here reflect percentages in 2003 (Hyder, 2004).
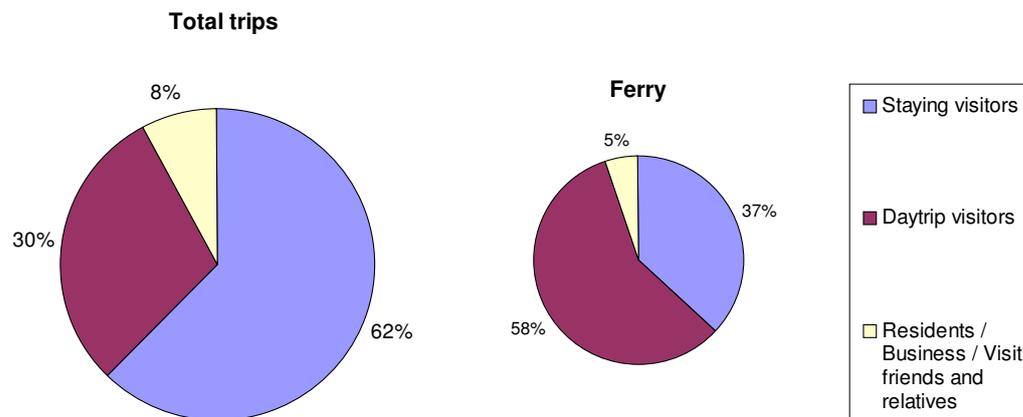
Figure S.3   Segmentation of total trips and ferry trips

1891 face-to-face RP surveys were carried out with non-resident travellers to the Isles of Scilly distributed across day-trip and staying visitors, this was about 25% more surveys than was specified as the target in the set-up of this project (see Table S.1 for a comparison of the targets and recruited sample sizes for each survey segment). 401 SP surveys were conducted, meeting pre-specified targets for each mode and journey purpose category.

Residents were posted RP surveys in October 2005, after the main summer period. In total 251 RP questionnaires were returned by the Island residents, who reported details for 232 personal and 90 business journeys to the mainland in the 12 months previous to the survey. Again, this met the target of information for 300 journeys which had been set at the commencement of the research. 57 SP interviews were then undertaken with those residents who had returned RP interviews, these interviews were undertaken in the second half of November. With the inclusion of the 12 SP interviews undertaken with the non-resident business travellers, we obtained a total of 69 interviews in the residents/business segment, just short of the target of 75.

A number of detailed tests were undertaken to examine the quality of the RP and SP datasets. It was concluded that the quality of the RP and SP datasets was high.

	Target RP			**Number of respondents RP**		
	Ferry	*Helicopter*	*Airplane*	*Ferry*	*Helicopter*	*Airplane*
Non-residents stay	300	300	300	334	506	377
Non-residents day trip	300	300		331	248	
Non-residents business/VFR/other	300			95		
Residents				322		

	Target SP			**Number of respondents RP**		
	Ferry	*Helicopter*	*Airplane*	*Ferry*	*Helicopter*	*Airplane*
Non-residents stay	75	75	75	77	92	79
Non-residents day trip	75	75		77	76	
Non-residents business/VFR/other	75			(included in non-resident numbers)		
Residents				57		

Table S.1:   Target and final number of respondents for the RP and SP surveys

The Structure of the Model

In order to meet the DfT requirements, the model needed to represent two passenger responses as a result of changes in ferry services to the Isles: changes in modal shift and changes in total travel demand.

Our experience in modelling holiday markets indicated that it would be more accurate to think of these latter responses in terms of *frequency* of travel, i.e. those persons who have never travelled to the Isles may choose to make this journey and those who currently travel to the Isles who may travel more or less frequently depending on the travel characteristics to the Isles.

It is noteworthy that we have restricted our analysis to existing travellers to the Isles of Scilly and residents of the Isles of Scilly, because it was judged that it would be too costly, both in terms of time and money, to identify persons who currently did not travel but would consider making future trips to the Isles of Scilly. The model, therefore, explicitly does not consider trips that could be made by persons who currently do not travel to the Isles of Scilly who might make journeys with improved transport services.

The total annual trips by traveller segment for future years were produced as a separate exercise using trend analysis and other techniques[2]. These provide the basic inputs into the final calibrated model. It is then the task of the model to predict:

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[2] "Isles of Scilly Link Major Scheme Bid, Part Two: Options for the Future" by Hyder Consulting, report no. RT/DV01104/25B/023.

- the change in total forecast year demand by traveller segment as a result of changes in modal and personal attributes; and

- how the demand would be apportioned between available modes.

The information on reported journey frequency and the stated intentions data were used to estimate disaggregate models of changes in trip frequency as a result of changes in ferry service levels.

The Mode Choice Model Results

Disaggregate discrete mode choice and trip frequency models were developed for the traveller segments: day-trip visitors, staying visitors and Island residents, VFR and business travellers.

The RP and SP data have been used jointly to estimate the time, cost and frequency coefficients, taking explicit account of error variation between the data sets[3]. As part of the model estimation procedure we have explicitly tested for correlation between alternatives, through nested model structures, and for 'inertia', i.e. preference for the currently used mode.

A secondary estimation procedure has been employed to re-estimate appropriate mode-specific constants, using RP information only, as is recommended in the upcoming WebTAG advice on development of demand forecasting models for major public transport schemes (developed for DfT by RAND Europe).

In the models for the three traveller segments, the resulting model parameters were highly significant.

The best models, from a behavioural perspective, are those models which incorporate (household) income-specific cost sensitivity, resulting in income-specific values of time for access time (for the visitor models only) and ferry time. The day-trip model also incorporates separate values of time for business travellers. The resulting values of time are presented below.

	Day-Trip Visitors	Staying Visitors	Residents
Business Ferry Time	£24.07		
Personal Ferry Time			
£0-£60,000 per year	£11.82	£5.01	£9.85
£60,0000+ per year	£16.09	£22.22	£12.60
Unknown/not stated income	£14.71	£13.31	£11.41

Table S.2: **Ferry Values of Time (£/hr, 2005 prices). Note that the values for business and personal ferry time are combined for staying visitors and residents.**

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[3]   Bradley, M. A. and Daly, A. J. (1991) Estimation of Logit Choice Models using Mixed Stated Preference and Revealed Preference Information, presented to *6th. International Conference on Travel Behaviour*, Québec.

For non-business travel, the values of ferry time have been well estimated and we do not have any reason to disbelieve the resulting valuations. We have therefore recommended that the non-business values be incorporated in the appraisal procedure without adjustment. For business travel, we recommend adjustments to the model values of time to reflect WebTAG-recommended values. The user has the option of applying these amended values in the forecasting tool and we recommend that they do.

The resulting valuations for the quality improvements, both for the new ferry and for the harbour improvements at Penzance and St. Mary's, also appear to be reasonable. The following table compares the average willingness-to-pay to save 30 minutes of ferry travel time to the average valuations for the quality improvements investigated in the study, namely the introduction of the new ferry and for harbour improvements (both at Penzance and at St. Mary's together)

	Day-Trip Visitors	Staying Visitors	Residents
Faster ferry (30 min. less time)	£7	£5	£5
New ferry (less prone to seasickness)	£10	£13	£7
Harbour improvements	£6	£5	£10

Table S.3: **Average Willingness-to-Pay for Ferry Time Savings and Quality Improvements by traveller segment (per one-way trip)**

Trip Frequency Model Results

For visitors, separate trip frequency models were estimated for day trip and staying visitors. For residents, separate models were estimated for leisure and business travel. It is noteworthy that the trip frequency term is not significant (at the 95% confidence level) in any of the models. It is our experience that it is difficult to identify significant relationships between trip frequency and level-of-service changes at a disaggregate level. The resulting trip frequency models do, however, generally reproduce the reported changes in trip making reported by the SP survey respondents, as shown below. As the table shows, both the visitors and the residents tend to predict much higher increases in trip making for the situation with improved ferry services than decreases as a result of the removal of ferry services. The models do not reflect this asymmetry, rather they reflect the average response. Additionally, for visitors we see that the day trip visitors are more sensitive to ferry accessibility changes and for residents we see that personal trips are more sensitive to ferry accessibility changes: both which we would expect.

	Improved Ferry Services		No Ferry Services	
	Model	SI Data	Model	SI Data
Day Trip Visitors	55% increase		19% decrease	
Staying Visitors	25% increase		9% decrease	
Overall Visitors	34% increase	30% increase	12% decrease	20% decrease
Residents – Personal	29% increase	20% increase	13% decrease	30% decrease
Residents - Business	16% increase	15% increase	8% decrease	20% decrease

Table S.4:   Trip Frequency Model Results: Model Results and Reported Figures

Cost-Benefit Analysis (CBA) Requirements

In order to achieve the main objective of the study the model must provide the necessary information for a CBA of the options in full conformance with the principles and practices set out in WebTAG[4], principally estimates of the traveller benefits and operator revenue.

The proposed changes to the ferry service are expected to alter the demand for the ferry and the competing air and helicopter services. WebTAG guidance suggests the use of the Rule of Half[5] for calculation of traveller benefits in such situations. However, the Rule of Half breaks down if a new mode is introduced or an existing mode becomes redundant. The Do Minimum scenario reflects the latter situation, as the existing ferry is removed from service in 2009 (for freight) and 2014 (for passengers). In this situation an estimate of the consumer surplus requires additional analysis using the travel demand model as an estimate of the demand curve. Specifically, in this study, the consumer surplus for a travelling group is calculated, in utility terms, using the exact integral of the demand function. This is converted into units of money using the model cost coefficients for the relevant demand segment.

The standard components of generalised cost from which user benefits are calculated usually include:

- changes in crossing time,

- changes in fares (if any); and

Additionally, for this study the user benefit calculations include a calculation for benefits associated with different timetables and quality benefits, both in terms of the boat and harbour-side improvements.

Placing an economic value on these characteristics represents an enhancement to a standard transport appraisal.

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[4]   WebTAG is the UK Department for Transport's website for guidance on the conduct of transport studies, including advice on the modelling and appraisal appropriate for transport schemes.

[5]   The "rule-of-half" states that the benefits of each new passenger are equal to half the benefits of an existing passenger (the first new passenger has the full benefits, the last new passenger has no benefits; on average each new passenger has half the benefits).

Forecast Results

Future forecasts were produced using a sample enumeration procedure, where the demand model is applied for each travelling group in the (weighted) RP survey sample. This procedure allowed representation of the socio-economic variation in the sample, particularly in terms of group size (and characteristics) and household income.

In order to produce future forecasts, for each forecast year, the user is required to specify the ferry service characteristics, e.g. type of ferry, ferry journey time, ferry timetable, harbour-side quality and fares, and fare adjustments factors for the helicopter and airplane, if relevant. Other model inputs include information on future year volumes of travellers by segment are also input to the model (Hyder, 2004), information on ferry capacity, forecast changes in values of time, discount rates, etc..

The travel demand model then predicts for each observed travel group the probability of choosing a specific mode, given the characteristics of the ferry and other modes. Adjustments to the total number of trips are also calculated, depending on the overall travel accessibility, i.e. the mode choice model logsum, for the scenario. The following outputs are produced for each specified year: demand by mode and model segment, revenue by mode and model segment and consumer surplus by model segment (see Table S.4). The total consumer surplus for a 30 year projection periods are also output.

In certain forecasting scenarios the demand for ferry travel predicted by the models may exceed the ferry capacity. In these cases, the demand forecasts are adjusted by introducing a 'shadow price': a negative utility term for ferry that reduces overall demand to the exact capacity of the boat. The same shadow price term is applied to each model segment; it is not calibrated against any other utility term. The appropriate shadow price to match ferry demand to capacity is determined iteratively.

Tests have been conducted to examine the resulting ferry fare elasticities obtained from the model. These are presented below. Note that the ferry fare elasticity for day trip visitors is inelastic (i.e. elasiticity is between 0 and -1), implying that the revenues could be increased by increasing the day trip fare.

Model segment	Elasticity
Day Trip	-0.7
Day Trip (for VFR purpose)	-1.1
Day Trip (for business purpose)	-0.8
Stay Trip	-2.0
Stay Trip (for VFR purpose)	-1.9
Stay Trip (for business purpose)	-2.2
Residents (for leisure purpose)	-2.0
Residents (for business purpose)	-2.0
Total	-1.3

Table S.4:   Ferry Fare Elasticities

It is difficult to compare these fare elasticities with elasticities reported in other studies, since none of these other studies are directly comparable with the Isles of Scilly situation. Perhaps the most comparable are ferry passenger elasticities provided by the Scottish Office Industry Department[6] study on fare price elasticities, which ranged from -0.8 to –1.5 for specific Scottish ferry routes. For Eurotunnel[7] an own-elasticity to tariff for shuttle car use of -1.6 to -1.8 was found; while for the 'French Straits' the own-elasticity was -2.4. For Union Railways[8] an own-elasticity to fare for Eurostar train services of -0.5 was found. Certainly the elasticity figures found from this study are consistent with these figures, with higher elasticities for those traveller segments, i.e. staying visitors and residents, who may consider a wider-range of travel alternatives to the Isles.

Scenarios

The model has been used to evaluate a few scenarios to demonstrate its use in a cost-benefit analysis.

'Do Minimum'   with no ferry services after 2014

'Do Something 1/2'   new modern ferry on which travellers may be less prone to seasickness, travel speed 15 knots (same as now), minor harbour improvements at Penzance and St. Mary's

'Do Something 3/4'   new modern ferry on which travellers may be less prone to seasickness, travel speed 20 knots (30 mins time savings), minor harbour improvements at Penzance and St. Mary's

The results for each scenario test are presented below.

In the 'Do Minimum' scenario, the ferry is taken out of service in 2014. As a result, it will become more difficult to travel to and from the Isles of Scilly (less service alternatives), making travel to the Islands less attractive. This results in an 8% decrease in trips in 2015, compared to 2014. The demand for day trips declines most substantially (–14.7%), largely because of the high ferry market share in 2014 (53.8%). The demand for trips by staying visitors and by residents drops relatively less (stay -5.3%, resident –9.6%).

The remaining demand is distributed over the airplane and helicopter. Both modes gain market share: the market share of the airplane will go up from 24.4% to 31.9% and the market share of the helicopter will go up from 49.1 to 68.1%.

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[6] SOID (1992) *Fare Price Elasticities on the Caledonia MacBrayne Ferry Network*, Scottish Office Industry Department Research Paper

[7] HCG 312-2 (1993), p. 26

[8] HCG 345-2 (1994), p. 27-28
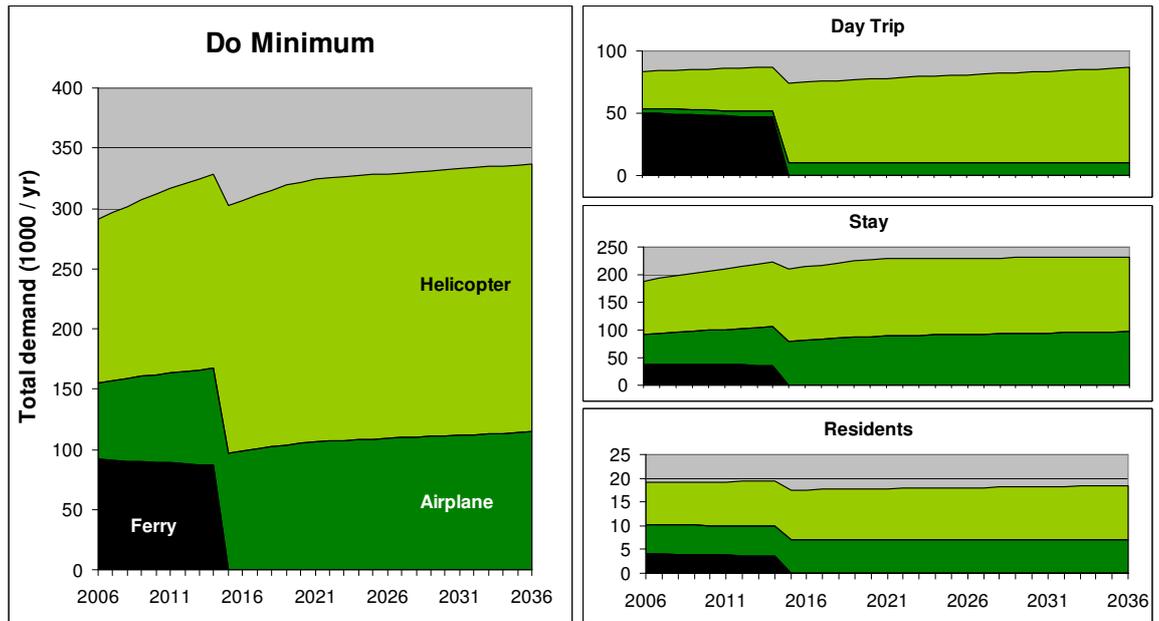
Figure S.4:   Model results for 'Do Minimum' scenario

In the Do Something 1/2 scenario, the model predicts a 7.4% increase in demand, as a result of the improved ferry services. This increase is largely due to increases in day-trip visitors (+18.0%), since the stay market cannot grow more rapidly (+2.5%) because of hotel bed restrictions. The number of resident trips grows by extra 11.1%. With this growth in travel demand and with these improvements the model predicts that the ferry will reach its capacity immediately (currently set at 158,400 passengers per year). The resulting airplane market share drops from 22.6% in 2008 to 16.7% in 2009. The helicopter share will also drop from 47.4% (2008) to 34.4% (2009).
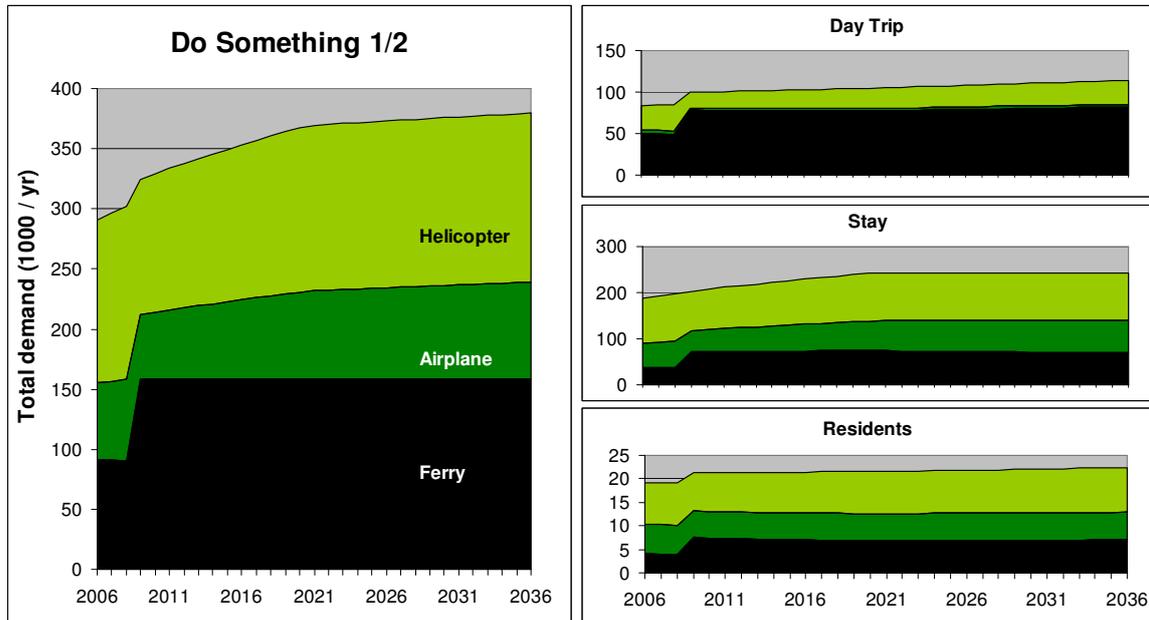
Figure S.5:   Model results for 'Do Something 1/2' scenario

In the Do Something 3/4 scenario, the 30 minute time savings in ferry travel time makes the new ferry even more attractive, which leads to further growth of demand. However, since the ferry is already operating at maximum capacity, this does not increase the ferry market share.
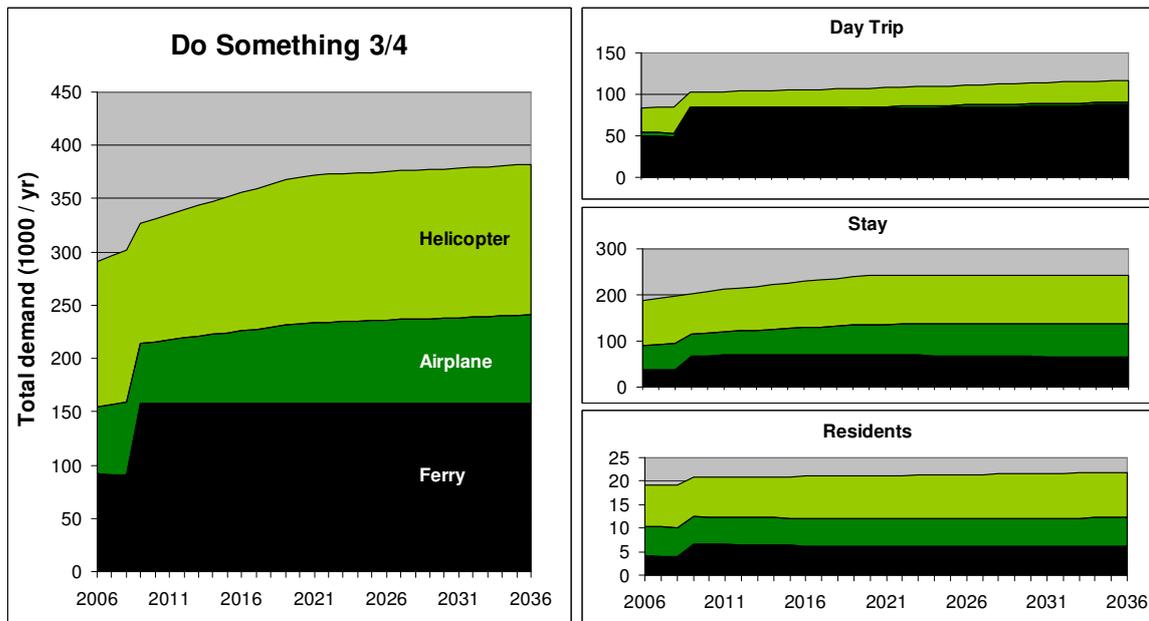
Figure S.7:   Model results for 'Do Something 3/4' scenario

The findings reported above are those predicted from the model that has been estimated from the RP and SP data. There are several reasons why the scenarios presented above might be too optimistic:

- people may have been too optimistic about new options;

- the findings may be subject to 'package effects', specifically that people have a willingness-to-pay threshold for a package of items, which is not measured when looking at the value of individual components of the package).

A 50% reduction of the effect of the new boat and of the harbour improvements approximately reflects the lower bound of the estimated parameters, considering the 95% confidence interval.

The model results, assuming 50% of the values for the new boat and harbourside improvements are presented below. From these results, it can be seen that demand does not grow as much as in the previous scenario. However, the ferry is still predicted to operate at maximum capacity in 2009; although due to the decreasing attractiveness of the ferry over time, the ferry demand is below capacity from 2026.
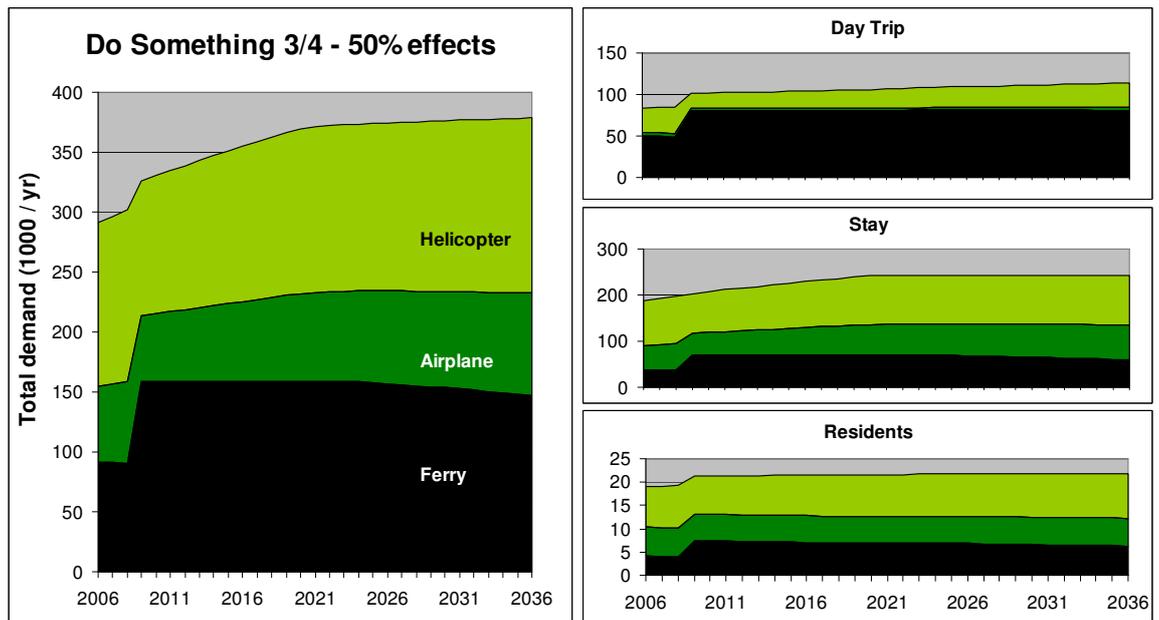
Figure S.8:   Model results for 'Do Something 3/4' scenario with 50% effects

Background

1.1 Study Objective

The objective of this study is set out clearly in the brief, i.e.:

> *'… to design a mode choice model from Stated and Revealed Preference Surveys of visitors to, and residents of, the Isles of Scilly. The aim of the mode choice model is to demonstrate the value-for-money (or otherwise) for a replacement ferry between the Isles and Penzance.'*

Currently, access to the Isles from the mainland is provided by three modes: a sea ferry, a helicopter service and a fixed-wing aircraft service.

The modelling undertaken for this study will be used to support a Major Scheme Bid Submission for capital funding support for improved transport links to the UK Department for Transport. Specifically, the models developed for this study supported the Cost Benefit Analysis (CBA) for the Bid Submission.

It was a requirement that the models developed in this study were capable of predicting traveller responses at least for the following transport options:

- Do Minimum: the Scillonian III passenger vessel will continue operating as at present until the end of 2014 – there will be no service thereafter. The freight vessel will reach the end of its economic life at the end of 2009, and will be replaced by a privately funded vessel with the same operational characteristics as the existing vessel.

- Separate vessels, second-hand freight vessel commissioned in 2010, and new passenger vessel commissioned in 2015. Passenger vessel speed 20 knots (corresponding to a 120 minute trip) and capacity of 400 people. Low scale investment at Penzance and St. Mary's harbours.

- Single combined passenger and freight vessel commissioned in 2010. Vessel speed 20 knots (corresponding to a 120 minute trip) and capacity 400 people. Low scale investment at Penzance and St. Mary's harbours.

The brief emphasised that these options were by no means definitive and that the Study results could suggest better options, particularly in relation to those that improve the ferry sailing frequency, scheduling and comfort.

1.2   Study Scope

The aim of this study was to predict traveller responses to changes in transport services, specifically ferry services, between the UK mainland and the Isles of Scilly.

Changes in ferry (or other mode) services to the Isles, whether it be through improved frequency or reliability, reduced journey times or changes in fares will influence the modal share for the different travel alternatives. These changes may also influence whether or not people choose to travel to the Isles, and/or how frequently they choose to do so.

Our experience in modelling holiday markets indicated that it would be more accurate to think of these latter responses in terms of *frequency* of travel, i.e. those persons who have never travelled to the Isles may choose to make this journey and those who currently travel to the Isles who may travel more or less frequently depending on the travel characteristics to the Isles. We recommended this approach in contrast to an approach which would attempt to model the choice of travelling to the Isles of Scillies, compared to all other destinations, on the basis that it is impossible to measure the attractiveness of all other possible destinations relative to the attractiveness of the Isles of Scilly.

Furthermore, we restricted our analysis to existing travellers to the Isles of Scilly and residents of the Isles of Scilly, because it was judged that it would be too costly both in terms of time and cost, to identify persons who currently did not travel but would consider making future trips to the Isles of Scilly. The model, therefore, explicitly does not consider trips that could be made by persons who currently do not travel to the Isles of Scilly who might make journeys with improved transport services.

Additionally, the study was only concerned with person trip demand – freight demand was outside the scope of the study. The model reflects the average person trip demand responses over a year. It is noteworthy that aggregate mode share data for each model segment is available by month for 2002 and therefore seasonally variation in mode choice could be built into the model forecasting system. This, however, has not been incorporated in the current system because of the limited time available for model development. The total annual trips by traveller segment for future years were produced as a separate exercise using trend analysis and other techniques[9]. These provide the basic inputs into the final calibrated model. It is then the task of the model to predict:

- the change in total forecast year demand by traveller segment as a result of changes in modal and personal attributes; and

- how the demand will be apportioned between available modes.

[9] "Isles of Scilly Link Major Scheme Bid, Part Two: Options for the Future" by Hyder Consulting, report no. RT/DV01104/25B/023.

1.3   Forecasting Model Requirements

1.3.1   The Mode Choice Model

The main objective of the study was to 'define a mode choice model from Stated and Revealed preference Surveys of visitors to, and residents of, the isles of Scilly'. It was required that the model be able to address such issues as:

- How many of the existing ferry passengers will cease to travel to the Isles if the ferry service were unavailable?

- How many should shift to one of the other modes?

- What are the fare elasticities?

- What are the identifiable traveller segments?

- What are the values of time for the traveller segments?

We concur with the view that both stated preference (SP) and revealed preference (RP) data are required to develop reliable forecasting models to predict travellers' responses to changes in travel services. The strength of SP data is in deriving the *relative* importance of the different aspects of service (price, crossing time, comfort, etc.). However, to derive elasticities and forecasts it is necessary also to estimate the absolute scale of response and in this respect SP data is less appropriate. The best current practice is to combine SP data with RP data wherever possible and this methodology was undertaken in the present study. In a joint analysis, the main information concerning the relative importance of price and service comes from the SP data, while information concerning the overall likelihood that a traveller will choose a particular mode is derived from the RP data. Joint analysis exploits the specific strengths of the two data types, using each to reduce the weakness of the other.

A programme of SP and RP surveys were therefore collected, across the available modes for each traveller segment. These data were used to estimate discrete choice travel demand models representing the choice of model for travel to and from the Isles of Scilly.

The demand forecasting system therefore predicts changes in mode share taking into account the service characteristics of the various travel alternatives, including the 'do minimum' situation where the existing ferry services would cease, and characteristics of the travellers, for differing traveller segments.

1.3.2   The Trip Frequency Model

We measured the 'frequency' impacts for all travellers by asking 'stated intentions' data on likely numbers of trips that they would make in hypothetical scenarios with differing travel conditions. These data were collected as part of the SP interviews. We then estimated models to identify the impact of changes in travel conditions on the frequency of trip making.

1.4   Cost-Benefit Analysis (CBA) Requirements

In order to achieve the main objective of the study, i.e. to design a mode choice model from Stated and Revealed Preference Surveys of visitors to, and residents of, the Isles of

Scilly to demonstrate the value-for-money (or otherwise) for a replacement ferry between the Isles and Penzance, the study must provide the necessary information for a CBA of the options in full conformance with the principles and practices set out in WebTAG[10].

As set out in the WebTAG guidance, user benefits for work and non-work travellers are calculated separately.

The proposed changes to the ferry service are expected to alter the demand for the ferry and the competing air and helicopter services. WebTAG guidance suggests the use of the Rule of Half[11] on each mode in such situations. However, the Rule of Half breaks down if a new mode is introduced or an existing mode becomes redundant. The Do Minimum scenario reflects the latter situation, as the existing ferry is removed from service in 2009 (for freight) and 2014 (for passengers). In this situation an estimate of the consumer surplus requires additional analysis using the demand forecasting model as an estimate of the demand curve. Our methodology reflects this technical issue.

The standard components of generalised cost from which user benefits will be calculated will be:

- changes in crossing time,

- changes in fares (if any); and

- changes in out of pocket costs (e.g. overnight accommodation).

Additionally, the user benefit calculation will include a calculation for benefits associated with increased frequency, reduction of round trip journey time and quality benefits. These latter estimates of benefit will require a significant amount of analysis including economic (welfare) valuations of:

- reductions in "dead" or "lost" time and/or increases in useable time at destination for day trippers;

- improved frequency of low frequency services (e.g. 1 service a day to 3 services a day); and

- improvements to the quality of the ferry and/or harbour services.

Placing an economic value on these characteristics represents an enhancement to a normal transport appraisal. Specifically, for this study, the demand model developed from this study is used directly to derive such values.

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[10]   WebTAG is the UK Department for Transport's website for guidance on the conduct of transport studies, including advice on the modelling and appraisal appropriate for transport schemes.

[11]   The 'rule-of-half' states that the benefits of each new passenger are equal to one-half of the benefits of an existing passenger (the first new passenger has the full benefits, the last new passenger has no benefits and therefore on average each new passenger has half of the benefits).

1.5   Traveller Segments

The study brief identifies three possible traveller segments: business and residents, non-resident day-trip travellers, non-resident staying travellers. Table 1 shows the number of annual return trips by mode for 2003 (the percentages reflect the mode share for each segment). The brief notes that the total trips by mode are considered to be very reliable: the traveller segment splits are, however, estimates, based on survey samples.

Table 1:   Annual Return Trips by Mode and Traveller Segment for 2003 (Brief)

Traveller Segment	Fixed-Wing[1]	Helicopter[2]	Ferry	Total
Business & Residents	1,488	3,850	2,394	7,732
	(19.2%)	(49.8%)	(31.0%)	(100%)
Day Trip	372	7,821	27,770	35,963
	(1.0%)	(21.7%)	(77.2%)	(100%)
Staying Visitors	10,542	31,575	17,715	59,832
	(17.6%)	(52.8%)	(29.6%)	(100%)
Total	12,402	43,246	47,879	103,527

[1]   Including trips from Land's End only
[2]   Excluding trips to Tresco

The smallest segment is the 'business and residents' segment: this segment is likely to be important, however, in terms of how important the travel links are between the Islands and the mainland. Very little information is available on how many business trips are made by non-residents and whether it would be possible to split these two segments, i.e. business travellers and residents. Normally, we would consider these two segments separately on the basis that residents may not make the same mode choices for leisure and business trips, and that they are unlikely to have the same valuations, e.g. value of time, for trips for different purposes. As noted earlier, the economic appraisal would also normally deal with these trips differently.

For this study, we set quotas for residents/business travellers together, on the basis that it was not clear whether we would be able to fill non-resident business quotas. However, we asked residents about both business and leisure travel in the RP survey - in the SP survey residents were only asked about travel for one specific purpose, on the basis that the SP survey was already very long.

Mode choice will also vary substantially by season of travel, primarily in this case because the ferry does not run in the winter season. However, given study timescale constraints, it was only feasible to conduct interviews in the summer period, and therefore all model coefficients reflect the travel in this period.

Mode choice may also be influenced by party size, including number of children, and this was investigated explicitly in the modelling. Quotas were not, however, set by party size.

Study Design: Data Collection

For this project, three types of surveys were undertaken:

- Revealed preference (RP) surveys, i.e. surveys undertaken with visitors and residents collecting information about *actual transport choices* made, such as what mode of travel they used to travel between the mainland and the Isles, for what purpose they were travelling, information about their trip origin and destination, etc.;

- Stated preference (SP) surveys, i.e. surveys that ask about *hypothetical choices* that they might make, if the options for travel were different, for example if there was a faster ferry, if the price of travel for any of the modes changed, or in some cases if no ferry services existed;

- Stated intentions (SI) surveys, i.e. surveys that ask about how the respondent's frequency of travel may change given hypothetical changes in the ferry service levels.

All surveys were conducted with non-resident visitors travelling to the Isles and residents of the Isles.

The surveys were conducted in two stages. Firstly, RP surveys were conducted with a sample of visitors and residents; next SP interviews were undertaken with persons who indicated that they would be willing to participate in a second-stage (SP) interview. The SI questions were asked at the end of the SP interviews.

More details on the survey methodology can be found in Appendix C.

2.1 Revealed preference survey

Non-resident visitors were interviewed during their trip to or from the Isles. Respondent's were asked to report on the circumstances of their trip to the Isles during the interview, including:

- the origin and destination terminals of the journey (information on the home location and final destination were also collected);

- currently used mode of travel, i.e. ferry, helicopter or fixed-wing aircraft;

- (detailed) purpose of travel;

- the residence status of the passenger (Isles resident, other UK resident, other resident);

- party size, including whether there are children in the party;

- journey details, such as access/egress times to terminal;

- journey access information for the modes that were not used;

- fare/ticket type;

- trip/holiday duration, i.e. the time that the respondent is away from home;

- frequency of travel to/from the Isles.

The RP survey also collected background details of the travelling party, including:

- age;

- sex;

- employment status;

- household income;

- whether they own a house in the Scilly Isles.

Island residents received a RP questionnaire by mail. They were asked to describe the details of their most recent trip made for business purposes (for self-employed people a business trip was defined as a trip for which they were able to claim tax rebates for the fares for their journey) and non-business purposes.

2.2   Stated preference survey

Respondents who participated in the stated preference survey partook in three experiments:

- a *within-mode experiment* in which respondents were asked to choose between two hypothetical ferry alternatives for travel;

- a *between-mode experiment* in which hypothetical ferry, airplane and helicopter alternatives were compared; in addition a 'wouldn't make a trip' alternative was available;

- a *between-mode experiment* in which hypothetical airplane and helicopter services only were available (no ferry is available) – again a 'wouldn't make a trip' option was available.

The choice cards for each experiment were specifically generated for each respondent so that the attributes in each experiment were realistic for that respondent.   This was particularly important for presentation of fares, which reflected the fare for the group of persons who were travelling together to the Isles.

At the completion of the stated preference choice exercise, stated intention questions were asked to inquire about the respondent's current journey frequency to and from the Isles

and how this may vary under certain scenarios, specifically with an improved ferry service and with no ferry service.

2.2.1 Questions 1 – 9: Within-mode experiment

Because future scenarios incorporate possible reductions in ferry journey time and increased ferry sailing frequency, all respondents were asked to participate in a within-mode experiment comparing two hypothetical ferry alternatives. The ferry alternatives were described by six variables: sailing frequency, journey time, journey ambience (i.e. characteristics of the ferry), quayside facilities in Penzance and at St. Mary's and cost.

Figure 1 shows an example choice situation from the within mode experiment.

Choice 5

If only a ferry service was available when you travelled to the Isles of Scilly,
which of the following would you have preferred?

Ferry A	**Ferry B**
Journey time is 2 hours 40 minutes	**Journey time is 2 hours**
Penzance - St. Mary's 08:00 **St. Mary's - Penzance 17:30**	**Penzance - St. Mary's 07:00** **St. Mary's - Penzance 10:30** **Penzance - St. Mary's 14:00** **St. Mary's - Penzance 17:30**
Existing boat, passengers may be prone to seasickness in rough conditions	**Modern boat, passengers less prone to seasickness**
New passenger terminal building and covered walkway to the vessel at Penzance	**No passenger terminal building and exposed quayside area at Penzance**
New shelter canopy at St Mary's	New shelter canopy at St Mary's
The return ferry fare for your journey is £148.75	**The return ferry fare for your journey is £127.50**

Prefer Ferry A	**Neither**	**Prefer Ferry B**
☐	☐	☐

Figure 1   Example within mode choice

The fares for each ferry alternative were calculated on the basis of percentage adjustments to a 'base' fare, i.e. the fare actually paid for respondents who travelled by ferry or an estimated fare based on group size and ticket type for respondents who travelled by fixed-wing aircraft or helicopter or for those who didn't know their fare.

The levels in the within-mode experiment are summarised in Table 2. It is noteworthy that a large number of fare levels were investigated (8 levels) in order to examine a wide-range of valuations for ferry travel time savings.

Nine choice situations were presented to each respondent in the within mode experiment. One of these nine was a dominant question, i.e. where all the attributes of one option were

better than the other (see Figure 2). This question has been used to identify some respondents who did not appear to answer the questions in a sensible manner. The dominant question responses were not used in the model analysis, leaving eight choice situations per person for analysis.

Choice 7

If only a ferry service was available when you travelled to the Isles of Scilly,
which of the following would you have preferred?

Ferry A	**Ferry B**
Journey time is 2 hours 20 minutes	**Journey time is 2 hours**
Penzance - St. Mary's 09:15 St. Mary's - Penzance 16:30	Penzance - St. Mary's 09:15 St. Mary's - Penzance 16:30
Existing boat, passengers may be prone to seasickness in rough conditions	Existing boat, passengers may be prone to seasickness in rough conditions
No passenger terminal building and exposed quayside area at Penzance	No passenger terminal building and exposed quayside area at Penzance
Limited shelter at St Mary's	Limited shelter at St Mary's
The return ferry fare for your journey is £127.50	**The return ferry fare for your journey is £106.25**

Prefer Ferry A	**Neither**	**Prefer Ferry B**
☐	☐	☐

Figure 2   Example dominant choice

Variables	Levels
Ferry journey time	1. 3 hours
	2. 2 hours 40 mins
	3. 2 hours 20 mins
	4. 2 hours
Ferry sailing schedule	1. There is 1 sailing per day
	Penzance - St. Mary's 09:15 St. Mary's - Penzance 16:30
	2 There is 1 sailing per day
	Penzance - St. Mary's 08:00 St. Mary's - Penzance 17:30
	3. There are 2 sailings per day

	Penzance - St. Mary's 08:00
	      St. Mary's - Penzance 11:15
	      Penzance - St. Mary's 14:30
	      St. Mary's - Penzance 17:30

	4. There are 2 sailings per day

	Penzance - St. Mary's 07:00
	      St. Mary's - Penzance 10:30
	      Penzance - St. Mary's 14:00
	      St. Mary's - Penzance 17:30

Ferry ambience	1. Existing boat, passengers may be prone to seasickness in rough conditions
	2. Modern boat, passengers less prone to seasickness
Penzance quayside facilities	1. No passenger terminal building and exposed quayside area at Penzance
	2. New passenger terminal building and a covered walkway to the vessel at Penzance
St. Mary's quayside facilities	1. Limited shelter at St Mary's
	2. New shelter canopy at St Mary's
Fare	1. 175% of base fare
	2. 165% of base fare
	3. 150% of base fare
	4. 140% of base fare
	5. 125% of base fare
	6. 115% of base fare
	7. 100% of base fare
	8. 90% of base fare

Table 2:   Within-mode experiment – variables and levels

2.2.2   **Questions 10 – 17: Between-mode experiment (with ferry)**

Respondents then participated in a between-mode experiment containing hypothetical choices between the three modes available to travel to the Isles of Scilly. Respondents were

presented with 8 choice scenarios where a number of variables varied between the alternatives, as shown in Table 3.

The access time for each mode was also presented in the choice exercise (as reported for each mode by the respondent), but this was not varied in the experiment. Helicopter and airplane journey times were also presented, but these were not varied.

Ferry	Helicopter	Airplane
Access Time to Ferry Quay *(as specified by respondent in RP survey, not variable)*	Access Time to Heliport *(as specified by respondent in RP survey, not variable)*	Access Time to chosen Airport *(as specified by respondent in RP survey, not variable)*
Ferry journey time *(levels: see Within experiment)*	Helicopter journey time "Journey time is 20 minutes" *(fixed level, not variable)*	Airplane journey time *(fixed level, depending on chosen airport in RP: Land's End: "There are frequent flights all day" Newquay: "There are 3 flights on most weekdays, and 4 on Saturdays" Exeter: "There are 1 or 2 flights on a weekday, and 3 on Saturdays" Bristol: "There are 1 or 2 flights on a weekday, and 3 on Saturdays" Southampton: "There is 1 flight a day from Monday to Wednesday, and on Friday")*
Ferry sailing schedule *(levels: see Within experiment)*	Helicopter schedule: "There are frequent flights all day" *(fixed level, not variable)*	Airplane schedule: *(fixed level, depending on chosen airport in RP: Land's End: 15 minutes Newquay: 30 minutes Exeter: 1 hour Bristol: 1 h 10 min Southampton: 1h 30 min*
Ferry ambience *(levels: see Within experiment)*		
Quayside facilities at Penzance *(levels: see Within experiment)*		
Fare 1. 175% of base fare 2. 165% of base fare 3. 150% of base fare 4. 140% of base fare 5. 125% of base fare 6. 115% of base fare 7. 100% of base fare 8. 90% of base fare	Fare 1. 140% of base fare 2. 115% of base fare 3. 100% of base fare 4. 80% of base fare	Fare 1. 140% of base fare 2. 115% of base fare 3. 100% of base fare 4. 80% of base fare

Table 3:   Between-mode experiment variables

Figure 3 shows an example choice card from the between-mode experiment. It is noted that the order of the presentation of the modes was varied between respondents, in order to reduce the possibility of a response bias, e.g. that respondents would always prefer the left-side alternative. It is emphasised that the access information for each mode was reported by the respondent.

Choice 10   7

If the following alternatives had been available when you travelled to the Isles of Scilly, how would you have travelled?

Ferry **(Penzance)**	**Helicopter** **(Penzance)**	**Airplane** **(Bristol airport)**
3 hours 20 minutes travel by car to the quay	3 hours 20 minutes travel by car to the heliport	1 hour travel by car to the airport
Journey time is 3 hours	Journey time is 20 minutes	Journey time is 1 h 10 min
Penzance - St. Mary's 09:15 St. Mary's - Penzance 16:30	There are frequent flights all day	There are 1 or 2 flights on a weekday, and 3 on Saturdays
Existing boat, passengers may be prone to seasickness in rough conditions		
No passenger terminal building and exposed quayside area at Penzance		
The return ferry fare for your journey is £76.50	The return helicopter fare for your journey is £134.00	The return air fare for your journey is £208.00

Choose Ferry	**Choose Helicopter**	**Choose Airplane**	**Wouldn't make trip**
☐	☐	☐	☐

Figure 3:   Example between-mode choice situation

As in the within-mode experiment, the fares for each alternative reflected the fare for the travelling group and were calculated by percentage adjustments made to a 'base' fare for each mode, i.e. the fare actually paid for respondents who travelled by that mode, or an estimated fare based on group size and ticket type for unchosen modes (or for the chosen mode if the respondent did not know the fare for their observed journey). In the choices, these fares were multiplied by percentage increases and decreases, in order to understand the importance of cost in choice of mode. Therefore, in some choices the helicopter option would be more expensive than airplane and in others the airplane option was more expensive than helicopter.

2.2.3   Questions 18 – 21: Between-mode experiment (no ferry available)

Respondents were then asked to consider a hypothetical situation where there was no longer a ferry service available for travel to the Isles. They were then presented with 4 more choices where there was no ferry service. Figure 4 shows an example choice card for the between-mode choice experiment without any available ferry service.

Choice 18   7

If the following alternatives had been available when you travelled to the Isles of Scilly,
how would you have travelled?

Ferry **(Penzance)**	**Helicopter** **(Penzance)**	**Airplane** **(Bristol airport)**
	3 hours 20 minutes travel by car to the heliport	1 hour travel by car to the airport
	Journey time is 20 minutes	Journey time is 1 h 10 min
Not available	There are frequent flights all day	There are 1 or 2 flights on a weekday, and 3 on Saturdays
	The return helicopter fare for your journey is £107.20	The return air fare for your journey is £260.00

Choose Helicopter	**Choose Airplane**	**Wouldn't make trip**
☐	☐	☐

Figure 4:   Example between-mode choice situation – no ferry

2.3   Stated intentions questions

At the completion of the stated preference experiments, respondents were asked a number of questions about their frequency of travel to (or from) the Scilly Isles, over the last 12 months, for both business and leisure purposes. They were asked to state how many trips they would make in the next 12 months, again for both business and leisure purposes, in the following scenarios:

- given the current service characteristics (status quo);

- in case where the ferry services to the Islands was improved, specifically that:

    o   a new modern ferry was introduced which could undertake the journey in 2 hours, rather than in 2 hours and 40 minutes, as is the case for the current trip

    o   on the new ferry passengers would be less prone to seasickness

    o   the new ferry would be able to make 2 round trips per day to the Islands; this would mean that people making a day trip to the Isles would get about 6 hours on the Islands.

    o   there would be improvements at the quayside in Penzance and St. Mary's, namely a new passenger terminal building and covered walkway to the vessel at Penzance, and a new shelter canopy at St. Mary's;

- in case the ferry service was stopped.

These 'stated intentions' questions were used to quantify trip frequency responses to changes in (ferry) travel service characteristics.

Respondents were also asked questions about how their travel may change if there was a regular Sunday ferry services, if the ferry services ran for all twelve months of the year and if there were Sunday services for helicopter and airplane services. The findings from the surveys are reported in Appendix B.

CHAPTER 3 Sample Sizes

3.1 RP survey for non-residents

The interviews for the RP survey for non-resident visitors to the Islands were undertaken in August and September, coinciding with the largest visitor volumes to the Isles. In total, 1891 RP interviews with non-resident visitors were undertaken. Table 4 shows the proposed targets and number of interviews obtained for each non-resident traveller segment. Note that the targets for the business trips were combined with the targets for the residents (see next section).

		Mode of transport used/using to travel to the Isles from the mainland			Total
		Ferry	Helicopter	Airplane	
segment	Business - day trip	5	33	8	46
	Business - long stay	8	33	7	48
	Non-business - day trip	331	248	30	609
	Non-business - long stay	334	506	347	1187
	Unknown	1	0	0	1
Total		679	820	392	1891
Target	Non-business - day trip	*300*	*300*	*300*	
	Non-business - long stay	*300*	*300*		
Total		*600*	*600*	*300*	*1500*

Table 4   Targets and number of interviews in the RP survey for non-residents

As can be seen from the table, about 25% more interviews were completed compared to the target. We exceeded the targets for all segments, except for non-business day-trip travellers by helicopter, where we obtained slightly fewer interviews than anticipated. This has not caused any problems in the analysis.

3.2   Resident RP surveys

Questionnaires for residents were sent out in October 2005, after the main summer period, and were returned in the weeks thereafter. In total 251 RP resident questionnaires were completed. Each respondent was asked whether they had made business or leisure trips in the last 12 months:

- nine respondents did not make any trips to the mainland in the last 12 months;

- eight respondents provided information about a business trip only;

- one hundred-fifty respondents provided information about a personal trip only; of these, two persons made their trip with a private airplane or private boat (these are out-of-scope for this study);

- the remaining eighty-four provided information about both a personal and a business trip; the business trips of two respondents were made by private airplane or private boat (out of scope), so this information was not used in the subsequent modelling; their information about their personal trips remained useful for the analysis.

We had proposed a target of 300 interviews for all business and resident trips. This target was easily met by the residents alone, see Table 5. We note that we have not included the non-resident business interviews in the table.

		Mode of transport used/using to travel to the mainland from the Isles				Total
		Ferry	Helicopter	Airplane	Unknown	
segment	Business – residents	12	51	26	1	90
	Personal – residents	50	131	51		232
Total		62	182	77	1	322
Target						*300*

Table 5   Targets and number of interviews in the RP survey for residents

So, in total we collected information about 90 resident-business and 232 resident-personal trips (total 322 residents trips).

3.3   Non-resident SP surveys

Those respondents that indicated that they were willing to participate in a follow-up SP interview were then posted the SP showcards. A few days later they were telephoned by an Accent interviewer to undertake the SP survey. These interviews were undertaken in September and October.

In total, 401 interviews were undertaken, which is 7% more than what was targeted (see Table 6). Note that this table includes 12 respondents that made their trip for business

purposes (strictly speaking: the business respondents should be counted with the resident SP respondents, since these survey segments have a common target).

		Mode of transport used/using to travel to the Isles from the mainland			Total
		Ferry	Helicopter	Airplane	
segment	Day trip	77	76	10	163
	Long stay	77	92	69	238
Total		154	168	79	401
Target	Non-business – day trip	*75*	*75*	*75*	
	Non-business – long stay	*75*	*75*		
Total		*150*	*150*	*75*	*375*

Table 6   Targets and number of interviews in the SP survey for non-residents

3.4   Resident SP surveys

Resident SP interviews were undertaken in the second half of November. The willingness to participate in these follow-up interviews was not as high as anticipated: only 57 SP interviews were undertaken with island residents[12]. The low participation rates may have been a result of the lengthy RP questionnaire. When the 12 non-residents who travelled for business purposes are included (for which a common target existed with the resident SP interviews), we have completed 69 interviews in this survey segment, just short of the 75 that we proposed to do.

		Mode of transport used/using to travel to the Isles from the mainland			Total
		Ferry	Helicopter	Airplane	
segment	Business	4	7	5	17
	Personal	13	22	5	40
Total		17	30	10	57
					75

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[12] Four more interviews were completed after the analysis had been completed and were not included in the sample.

Data Quality

4.1 RP survey for non-residents (exclusions)

To inspect the quality of the 1891 RP questionnaires, we have checked the survey responses for consistency.

4.1.1 Location of recruitment

The first check was on the location of recruitment. This was recorded together with the mode of travelling and the direction of travel (towards or returning from the Isles). The combined responses are displayed in Table 7.

		Travel mode during recruitment			Total
		Ferry	Helicopter	Airplane	
Outbound to Isles	On-board Scillonian – to St Marys	377	0	0	377
	On-board Scillonian – to Penzance	1	2	0	3
	At St Marys airport	2	1	2	5
	At Penzance Heliport	4	738	8	750
	At Land's End Airport	1	4	200	205
Total		385	745	210	1340
Return from Isles	On-board Scillonian – to St Marys	5	0	0	5
	On-board Scillonian – to Penzance	292	1	1	294
	At St Marys airport	4	71	164	239
	At Penzance Heliport	0	5	4	9
	At Land's End Airport	0	0	4	4
Total		301	77	173	551

Table 7 **Location and mode during recruitment**

We have excluded 37 respondents (2.0%) for which there was inconsistency in the mode choice and recruitment location information, i.e.:

- 3 respondents were recruited "on-board the Scillonian – to Penzance", but were reportedly travelling "outbound to Isles"; furthermore, two of them used a "helicopter" for their outbound trip.

- 2 respondents were recruited "at St Marys airport" while travelling "outbound to Isles" using a "ferry".

- 12 respondents were recruited "at Penzance heliport" while travelling "outbound to Isles" using a "ferry" (4) or a "fixed wing aircraft" (8).

- 5 respondents were recruited "at Land's End airport" while travelling "outbound to Isles" using a "ferry" (1) or a "helicopter" (4).

- 5 respondents were recruited "on-board the Scillonian – to St Marys" on their "return from Isles".

- 2 respondents were recruited "on-board the Scillonian – to Penzance" on their "return from Isles" using a "helicopter" (1) or a "fixed wing aircraft (1).

- 4 respondents were recruited "at St Marys airport" on their "return from Isles" using a "ferry".

- 4 respondents were recruited "at Penzance heliport" on their "return from Isles" using a "fixed wing aircraft".

4.1.2 Completeness of answers
We have excluded 1 respondent who travelled to the Isles by fixed wing aircraft, because he did not state from which airport he travelled.

4.1.3 Group size
We have excluded 2 respondents who specified numbers of people in their travelling group in each age band that did not add up to their reported total number of people in their group (difference was 5 and 24 persons).

4.1.4 Access times and costs
One respondent seems to have confused his outbound and return trip. He has specified an outbound trip but his answers on the access for the return part of his trip (i.e. access on the Isles to the departure location of his return).

One respondent seems to have confused travel times to Cornwall with travel time to the ferry (within Cornwall on the day of departure to the Isles). Two more respondents have given travel times to Cornwall that appear to be inconsistent with their home locations.

These four respondents have been excluded.

Two respondents did not know how long it took them to travel to go to the airport/quay. Nine respondent did not state this journey time. Since this is essential information for the modelling, these 11 respondents have been excluded.

4.1.5 Travel to Cornwall
Seven respondents that were staying overnight in Cornwall as part of their journey to the Isles did not state their travel mode of their journey between their home and where they

were staying in Cornwall. Six of them did specify the travel time and travel cost of this part of their journey. Since this information is used in the modelling (rather than the travel mode), there is no reason to exclude these respondents. However, one respondent did not know their travel cost for this part of his/her journey. This respondent has been excluded.

Two respondents did not know how long it took them to travel between their home and where they were staying in Cornwall. One respondent did not state this journey time. All three have been excluded.

4.1.6 Nights spent on the Isles

Six respondents did not specify how many nights they spent on the Isles, however, one indicated that he/she made a day trip. The remaining five have been excluded.

4.1.7 Access times for alternative modes

Respondents were asked to estimate how long they thought it would take them to get to their alternative departure location (i.e. the airport, heliport and/or quay in case they have *not* chosen the corresponding mode).

- thirty-two respondents did not know or did not state their alternative access time to the heliport;

- (in addition) one respondent did not state their likely mode of travel for his alternative access journey to the ferry quay;

- (in addition) thirty-six respondents did not know or did not state their alternative access time to the ferry quay;

- (in addition) twenty-nine respondents did not state their preferred departure airport for an alternative journey by aircraft;

- (in addition) fifty-five respondents did not know or did not state their alternative access time to the airport.

In total 153 respondents (8.0%) were excluded from further analysis because of incomplete information about the access times and mode of travel (and departure airports) for the unchosen modes.

4.1.8 Ticket type

One respondent travelling by airplane specified that his ticket type was a "mid week offer". However, this type of ticket is only available to helicopter travellers. This respondent has been excluded.

4.1.9 Conclusion

In general, the quality of the RP data for non-resident visitors to the Isles seems to be high. Since we obtained a larger sample size than originally planned, we have been quite rigorous in removing respondents from the sample because of incomplete or inconsistent responses. In total, 218 respondents (11.5%) have been excluded from the sample, leaving 1673 respondents for further analysis. This is still more than the original target of 1500 respondents.

4.2   RP survey for residents (exclusions)

To inspect the quality of the information for the 322 trips described by the residents in their RP questionnaires, we have checked the responses for completeness of the answers:

- one respondent did not provide information about his mode of transport;

- one respondent who travelled to the mainland by fixed wing aircraft, did not state from which airport he travelled to;

- three respondents did not provide information about the size of the group in which they travelled;

- two respondents did not state whether the fare they paid was for a single or for a return ticket;

- five respondents did not provide enough information for our fare calculator procedure to be able to work properly.

These 12 respondents (3.7%) have been excluded from further analysis.

4.3   SP survey for non-residents (exclusions)

A number of questions were included in the SP survey to check whether respondents were able to make the choices presented to them in the SP choice exercises.

4.3.1   Respondent ability to make SP choices

After the within-mode experiment and, again, after the between-mode experiments, respondents were asked whether they were able to make the comparisons in the presented choices. 21 respondents indicated that they were not able to make the choices in the within-mode experiment and 7 indicated that they were not able to make the choices in the between-mode experiments.

Respondents who indicated that they were unable to make the choices were probed why they were not able to make choices. In many cases in the within-mode experiment, the respondents indicated that he would never consider going by ferry, for instance because of seasickness. Those respondents always chose the 'neither' alternative. In principle, these are valid choices and there is no reason to exclude these respondents.

Some respondents complained that the prices were too high in many choice options and that they chose the 'neither' alternative instead. Again, these are valid choices, so these respondents have not be excluded.

From the answers of thirteen respondents, we judged that they had problems understanding the experiments. These respondents have been excluded from the analysis.

4.3.2   Non-intuitive answer to the dominant question

As discussed in Section 2.2.1, a dominant question was included in the within-mode experiment, where Ferry B was clearly better than Ferry A (shorter sailing time and cheaper). Eleven respondents indicated that they preferred Ferry A to Ferry B (including one respondent that was excluded for reasons mentioned above). It is not clear whether

these respondents understood the choices or simply were not paying enough attention to the choices. They have, however, been excluded from further analysis.

4.3.3 Conclusion

In total 23 respondents (6%) from the SP survey sample were excluded from further analysis. This percentage is similar with the exclusion percentages in other SP studies. 378 respondents are left in the non-residents sample for analysis.

4.4 SP survey for residents (exclusions)

The same procedure was followed to check the quality of the SP survey for residents (57 interviews).

4.4.1 Respondent ability to make choices

Two respondents indicated that they were not able to make the choices in the within-mode experiment: these respondents have been excluded from the analysis of this experiment. Only one of these respondents indicated that he/she was not able to make the choices in the between-mode experiment. The other respondent has therefore been included again in the analysis of the between-mode experiment.

4.4.2 Non-intuitive answer to the dominant question

One respondent indicated that he/she preferred Ferry A to Ferry B. This respondent has been excluded from further analysis.

4.4.3 Conclusion

In total, two respondents (3.5%) were excluded from further analysis, leaving 55 respondents in the sample for analysis.

4.5 SP survey for non-residents (trading)

We have inspected the results from the between-mode experiment to examine whether respondents traded between the choice alternatives. Trading is required in order to investigate how cost and service levels influence mode choice in the corridor.

The following Venn-diagrams shows how the 378 non-resident SP respondents traded between ferry, helicopter, airplane and the 'wouldn't make trip' option in the first eight choices and how they traded between helicopter, airplane and the 'wouldn't make trip' option in the last four choices where ferry was not available. The tables are presented separately for travellers of each observed mode. Two numbers are presented for each choice alternative: the total number of persons who chose the alternative and the number who chose that alternative and also chose the 'wouldn't make a trip' alternative in some choices.

Ferry   **Helicopter**

49   **13**   **4**
18   *3*   *2*

                          20
                           1

         11   **9**
          5   *0*

                    8
                     1

                                    Chose these options only
                                    Also chose 'wouldn't make trip'

Airplane

144 Ferry Users: Ferry Available

Ferry   **Helicopter**

    -   **-**   **21**
    -   *-*   *13*

                          -
                           -

'Wouldn't make
trip' only : 38   **-**   **37**
                             -   *4*

                    23
                     8
                                    Chose these options only
                                    Also chose 'wouldn't make trip'

Airplane

144 Ferry Users: Ferry Unavailable

Ferry   **Helicopter**

13
4

0   **69**
0   *8*

6
2

0   **43**
0   *7*

7
1

**Chose these
options only**
*Also chose
'wouldn't make trip'*

Airplane

160 Helicopter Users: Ferry Available

Ferry   **Helicopter**

-
-

-   **81**
-   *12*

-
-

**'Wouldn't make
trip' only : 1**

-   **58**
-   *2*

5
1

**Chose these
options only**
*Also chose
'wouldn't make trip'*

Airplane

160 Helicopter Users: Ferry unavailable

Ferry   **Helicopter**

0
1

1
0

1
0

6
2

2
0

29
3

21
8

Chose these options only
Also chose 'wouldn't make trip'

Airplane

74 Airplane Users: Ferry Available

Ferry   **Helicopter**

-
-

-
-

0
0

-
-

-
-

37
3

'Wouldn't make trip' only : 1

27
6

Chose these options only
Also chose 'wouldn't make trip'

Airplane

74 Airplane Users: Ferry Unavailable

In most cases, we see a preference for the mode actually used (except for airplane users where we see more persons who trade between the airplane and helicopter services than those who generally prefer the air services), but with a good level of trading between the alternatives, with ferry users equally likely to trade with either helicopter or airplane, and frequently with both. Helicopter and airplane users tend to trade between these two modes more frequently than they choose ferry.

When the ferry was made unavailable, a large proportion of ferry users (around 25%) indicated that they would not make the trip, with the remainder of choices being split evenly between helicopter and airplane.

4.6   SP survey for residents (trading)

We have undertaken the same analysis for the residents and the results are shown in the following Venn diagrams. Again, we observe a preference for the mode actually used. The level of trading between the alternatives is similar to the non-residents, although because of the smaller number of respondents in this survey segment, the number of trading respondents is quite low.

When the ferry was made unavailable, only about 10% of ferry users indicated that they would not make the trip any longer.

Ferry   **Helicopter**

9
3

1
1

0
0

1
1

1
0

1
1

0
0

**Chose these
options only**
*Also chose
'wouldn't make trip'*

Airplane

19 Ferry Users: Ferry Available

Ferry   **Helicopter**

-
-

-
-

0
2

-
-

-
-

11
2

**'Wouldn't make
trip' only : 2**

0
2

**Chose these
options only**
*Also chose
'wouldn't make trip'*

Airplane

19 Ferry Users: Ferry Unavailable

Ferry

Helicopter

1
0

4
1

9
0

3
0

0
0

8
0

'Wouldn't make trip' only   1

1
0

Chose these options only
Also chose 'wouldn't make trip'

Airplane

28 Helicopter Users: Ferry Available

Ferry

Helicopter

-
-

-
-

13
1

-
-

-
-

11
2

'Wouldn't make trip' only : 0

1
0

Chose these options only
Also chose 'wouldn't make trip'

Airplane

28 Helicopter Users: Ferry unavailable

Ferry

Helicopter

0
0

0
0

0
0

1
0

1
0

2
0

4
0

Chose these options only
Also chose
'wouldn't make trip'

Airplane

8 Airplane Users: Ferry Available

Ferry

Helicopter

-
-

-
-

0
0

-
-

-
-

3
0

'Wouldn't make trip' only : 1

5
0

Chose these options only
Also chose
'wouldn't make trip'

Airplane

8 Airplane Users: Ferry Unavailable

The Mode Choice Model: Analysis of the SP/RP Data

Disaggregate discrete mode choice models were developed for the three traveller segments: day-trip visitors, staying visitors and Island residents from the RP and SP data. The unit for these models is the travelling group, i.e. those persons who have made the journey to and from the Isles of Scilly together.

5.1 Estimating Joint Models from RP and SP Data

The essence of joint SP/RP modelling is the estimation of model coefficients for terms which are common between the datasets (e.g. travel cost), taking account of differences in model scale between the SP and RP datasets. It is also possible to estimate coefficients for terms which are specific to only one set of data (e.g. value of a new ferry, harbour-side improvements, etc.), which will also be relevant in this study.

Mathematically, we set up utility equations for the RP choice alternatives, which in this case will be the set of current set of available transport modes[13]:

$$u^{RP} = \beta . x^{RP} + \alpha . w + \varepsilon$$

where:

x^{RP}, w are vectors of the measured variables influencing the RP decision;

β, α are vectors of unknown parameters (to be estimated);

ε represents the sum of the unmeasured utility components of utility influencing the RP decision.

and similarly we set up utility equations for the SP choice alternatives,

$$u^{SP} = \beta . x^{SP} + \gamma . z + \nu$$

where:

x^{SP}, z are vectors of the measured variables influencing the SP decision;

β, γ are vectors of unknown parameters (to be estimated);

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[13] Bradley, M. A. and Daly, A. J. (1991) Estimation of Logit Choice Models using Mixed Stated Preference and Revealed Preference Information, presented to *6th. International Conference on Travel Behaviour*, Québec.

ν   represents the sum of the unmeasured utility components of utility influencing the SP decision.

The parameters (β) attached to variables (x) that appear in both the SP and RP utility functions are jointly estimated from both datasets.

The terms w and z are terms that can only be estimated from the RP or SP datasets, respectively. Terms which we cannot observe in the RP modelling, e.g. the value of the new ferry, the value of harbour-side improvements, etc. will be derived from the SP data only. It is important to note that generally the alternative-specific constants should be different between different data sources.

In estimating these models we need to make some assumptions about the distributional properties of the unmeasured components of utility in each data set. In the simplest case we assume that both of these components are distributed independently (across both individuals and alternatives and independently of each other) with the limiting-value distribution (Gumbel), *but with unequal variance*. This allows us to use a specification from the logit family of models and we can estimate the coefficients on the utilities jointly if we allow for the differences in the variance of the unmeasured components on each of the two sets of data; this is achieved by also estimating a scale parameter θ, with $\theta^2 = \text{var}(\varepsilon) / \text{var}(\nu)$.

The modelling approach we therefore use incorporates a base estimation step, in which both RP and SP data are used, with separate scaling factors applied to each SP data set and with alternative-specific constants estimated separately for the different data types.

As part of the model estimation procedure we have explicitly tested for correlation between alternatives, through nested model structures, and for 'inertia', i.e. preference for the currently used mode. For a full account of the model estimation procedure, see the separate memorandum on the model estimation.

For making model predictions, however, we use the RP data alone, with its observed scale and with alternative-specific constants that are estimated to take account of the true market shares of the alternatives in the current market place, as is recommended in the upcoming WebTAG advice on development of demand forecasting models for major public transport schemes (developed for DfT by RAND Europe)[14]. The coefficients which describe the behaviour of the model, however, are developed both from the RP and the SP data.

5.2 **Variables in the Mode Choice Models**

The explanatory variables in the mode choice models and the data that contribute to the estimation of these parameters are summarised in Table 8.

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[14]   WebTAG is the UK Department for Transport's website for guidance on the conduct of transport studies, including advice on the modelling and appraisal appropriate for transport schemes (see www.webtag.org.uk).

Table 8:   Mode Choice Explanatory Variables

Variable Label	Variable Definition	RP	SP Within-mode	SP Between-mode
Cost	One-way travel costs, measured in pounds (excluding access and egress costs)	✓	✓	✓
Ftime	One-way ferry journey time, in hours	✓	✓	✓
AccTime	One-way access-time from the location where the respondents started their current journey to mainland port or airport (max 8 hours)	✓		✓*
Boat	Constant reflecting option of a new, modern boat, measured relative to the existing ferry		✓	✓
Penzance	Constant reflecting harbour-side improvements at Penzance, measured relative to no improvements		✓	✓
StMary	Constant reflecting harbour-side improvements in St. Mary's, measured relative to no improvements		✓	
Sailings	Sailing frequency and departure time options		✓	✓

*   It is noted that the access time for each alternative was presented on the SP choice cards but that these were not varied for each respondent (of course access time does vary across respondents).

The 'sailings' term reflects the relative attractiveness of four possible sailing/departure time options investigated in the SP survey, two options with one sailing per day and two options with two sailings per day, as shown below.

Whenever a respondent chose an option with 2 sailings per day, he was asked which sailing he would have used for both his outward and for his return trip. This information was used directly in the modelling, in that separate ferry alternatives were specified for each outward and return option available in the specific choice exercise, with appropriate constants estimated for each alternative (labelled 'E' for early departures and 'L' for later departures). All sailing constants are measured relative to level 1, i.e. one sailing, leaving Penzance at 09:15 and returning at 16:30.

Table 9:   Sailings Variable Definition

Sailings attribute level	Number of sailings per day	Out	Back	Out	Back
1	1	9:15			16:30
2	1	8:00			17:30
3	2	8:00	11:15	14:30	17:30
4	2	7:00	10:30	14:00	17:30

Sailing levels as used on the choice cards for the ferry description

		Out	Back	Out	Back
1		9:15			16:30
2		8:00			17:30
3_EE		8:00	11:15		
3_EL		8:00			17:30
3_LE			11:15	14:30	
3_LL				14:30	17:30
4_EE		7:00	10:30		
4_EL		7:00			17:30
4_LE			10:30	14:00	
4_LL				14:00	17:30

Sailing levels as used during the modelling

As recommended, separate mode specific constants have been estimated for each data source, e.g. the RP data and the SP between-product data. Separate airport-specific constants have also been estimated (these are measured relative to the use of Land's End airport as the preferred airport): there is also a (positive) constant for the helicopter alternative, for people who were travelling directly to Tresco is incorporated in the models. A 'neither' constant has also been estimated for the 'neither' option in the SP within-product exercise and separate 'No trip' constants have been estimated in the SP between-mode model, for cases where the ferry exists and where it does not exist.

The models were developed incrementally in order to reduce the chance of input errors, i.e. first within-mode choice models were developed, then SP between-mode choice models were developed, then RP models were developed, then joint SP within-mode and between-mode choice models were developed and finally all data sets were pooled.

A number of model specification tests were undertaken on the joint SP models, i.e. the models containing both the within-mode and between-mode choices, specifically:

- tests to identify the optimal specification of cost; the best models incorporate a term representing the cost per person in the group (specifications based on cost per group, cost per adult and non-linear cost valuations have been tested);

- tests to examine whether there was any evidence from the SP responses of non-linearity in the value of ferry travel time; the evidence is that the valuation of ferry time is linear.

In the estimation procedure we also tested for 'inertia', i.e. a preference for the currently used mode, in the between-product models. These constants were found to be positive

and highly significant. In general, the model coefficients had the correct sign and were highly significant, i.e.:

- the price of travel was found to be important in all traveller segments and had a negative impact on choice of mode, i.e. i.e. all travellers preferred alternatives with lower costs, all else being equal; in all segments, travellers from households with income less than £60,000 were observed to exhibit higher price sensitivity than those from households with income greater than £60,000; in the day trip segment, business travellers were observed to have lower price sensitivity that those travelling for non-business purposes;

- ferry time is valued negatively, i.e. travellers prefer shorter ferry journey times, this term is also highly significant; significant variations in the value of ferry time were observed by income group in the long-stay visitor segment, i.e. those with higher incomes had significantly more negative valuations of ferry time;

- access time was found to be valued negatively and significantly in the day trip and long-stay visitor segments; no significant access time coefficient could be identified for the resident travellers;

- a new modern ferry had a positive and significant valuation for all traveller segments;

- improvements at St. Mary's harbour were not valued significantly for any of the traveller segments;

- on the other hand, improvements at Penzance were valued positively and significantly by visitors to the Isles of Scilly; they were not valued significantly by Island residents;

- for the day-trip segment there was a preference for 2 sailings per day, this is likely due to the fact that these options allowed for more time on the Islands (earlier outward departure and later return trip); for the long-stay visitor segment the number of sailing and departure time alternatives were not valued significantly, relative to choice of mode.

A number of socio-economic impacts were also identified, i.e.:

- negative terms on the helicopter alternative, if someone in the travelling group was fearful of flying in helicopters;

- negative terms on the airplane alternative, if someone in the travelling group was fearful of flying on an airplane;

- negative terms on the ferry, if someone in the travelling group was prone to seasickness.

Sailing constants which were not significantly different from one another were aggregated during the model estimation procedure.

5.2.1 Scaling and Structural Parameters
The basic model structure incorporates separate scaling for the different SP datasets:

- ScaleWithn: which reflects the relative scale of the within-mode choices, relative to the RP model;

- ScaleBetw: which reflects the relative scale of the SP between-mode choices, relative to the RP model.

In all segments we find that the within-mode responses have significantly more unexplained variance than the RP data (ScaleWithn < 1). The SP between-mode responses are more variable: they have significantly less unexplained variance than the RP data (ScaleBetw > 1) for the day-trip segment, significantly more unexplained variance than the RP data (ScaleBetw < 1) for the long-stay segment. The SP between-mode scale was not significantly different from the RP scale for the resident segment.

A number of different nested model structures were also tested (for details see the separate memorandum on the model estimation). Firstly, a structure nesting the air modes, i.e. helicopter and airplane was tested. Separate nesting coefficients were tested on the SP between-mode responses and the RP responses. There is some evidence from the SP responses of correlation between the helicopter and airplane alternatives, for the visitor segments (ThetaAirB is significantly less than 1 for these segments). This structure was not, however, replicated in the RP model (ThetaAirRP) and was not identified when joint nesting coefficients were estimated. The final visitor models therefore incorporate the air nesting for the SP between-mode responses.

We also tested a structure with nesting across the between-mode travel alternatives, relative to the alternative of not making a trip (theta). Significant parameters were identified for the visitor segments, which have been retained in the final model.

5.3   Mode Choice Model Results

For each logit model run, two sets of results are presented:

1.   Model summary statistics;

2.   Model coefficients and their associated approximate t-ratios.[15]

The model summary statistics which are presented are defined in Table 10.

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[15]   This ratio is an asymptotic approximation to the standard statistical Student's t-ratio.

Table 10:   Model Summary Statistics

Statistic	Definition
File	This defines the name of the model run.
Observations	The number of observations included in the model estimation.
Final log (L)	This indicates the value of the log-likelihood at convergence. The log-likelihood is defined as the sum of the log of the probabilities of the chosen alternatives, and is the function that is maximised in model estimation. The value of log-likelihood for a single model has no obvious meaning. However comparing the log-likelihood of two models with different specifications allows the statistical significance of new model coefficients to be assessed properly.
D.O.F.	Degrees of freedom, i.e. the number of coefficients estimated in this model. Note that if a coefficient is constrained to a fixed value (indicated by (*)) then it is not counted as a degree of freedom.

Next, the coefficient values are presented, together with their t-ratio (coefficient value divided by the standard deviation). Coefficients are significant at a 95% confidence level if the t-ratio is greater than 1.96.

In interpreting the coefficient values the following points should be considered.

- **A positive coefficient** means that the variable level or constant has a positive impact of utility and so reflects a higher probability of choosing the alternatives to which it is applied, i.e. the new boat increases the probability that the ferry alternative will be chosen.

- **A negative coefficient** means that the variable level or constant has a negative impact on utility and so reflects a lower probability of choosing the alternative to which it is applied, i.e. increasing costs will decrease the probability that an alternative will be chosen, all else being equal.

- **Most coefficients are multiplied by continuous variables** and therefore reflect the disutility per unit of the variable, e.g. the ferry time coefficient reflects the relative utility of ferry per hour of travel.

- **Some coefficients are applied to categorical variables**, which reflects the total utility increase or decrease for the variable, e.g. we observe an increase in the utility of the ferry alternative with the harbour-side improvements.

In this study we compared a number of different model specifications. These specifications been judged on the basis of the following criteria:

- A measure of the overall 'fit' of the model. All models have been estimated using the maximum likelihood (ML) method. In ML estimation there is no measure like R^2 in least squares regression which gives the proportion of variation in the dependent variable explained by the regressor variables (and even for least squares there is an ongoing debate whether this is a good measure). In ML estimate the

value of the log-likelihood function is maximised. The resulting log-likelihood (LL) value (the maximum value obtained) can be used for statistical tests. Because of the logarithmic transformation of the choice probabilities, this value will be negative. The closer to zero the LL value gets, the better the model fits the data. Adding coefficients will always increase the LL value, but the increase may not be significant.

The most important use of the LL value is to compare different model specifications. This can be done in a formal statistical test if two model specifications have been estimated on the same data and one specification is nested in the other (by restricting coefficients one specification can be derived from the other). In these cases, the **Likelihood ratio test** can be undertaken, in which the negative of twice the difference of the LL values is compared to a χ^2 value from published tables. The value in the table depends on the confidence interval chosen (usually 95%) and the number of restrictions needed to go from one model to the other (degrees of freedom). For example, with the 95% confidence interval and one restriction the critical value in the χ^2 table is 3.84. Therefore, if the difference in LL values between two models where one has one extra coefficient (degree of freedom) is 1.92, the specification of the model with the extra coefficient is considered to give a significant improvement in model fit.

— The t-value of the coefficient: a coefficient should have a t-value greater than 1.96 to be significantly different from zero (at 95% confident). For evaluation we shall use the 95% confidence interval throughout this report.

— Sign and size of the estimated coefficients.

The mode choice model results for the three traveller segments, i.e. day-trip visitors, long-stay visitors and Island residents are presented in Table 11. [16]

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[16] Note that the t-ratios presented in this table reflect naïve estimates, in that no correction has been made for repeated measurements from the same respondent. This results in an overestimation of the t-ratios.

Table 11:   Mode Choice Model Results

		Daytrip		Stay		Residents	
General model information							
Number of observed choices used for modelling		3578		5654		1402	
Log likelihood of final model		−2962.2		−6114.5		−1326.8	
Degrees of freedom in model estimation		44		49		29	
Estimates based on observed choices from RP, SP-between and SP-within							
Cost coefficient on single way fare p.p.		*Estimate*	*t-ratio*	*Estimate*	*t-ratio*	*Estimate*	*t-ratio*
Trip for any purpose, income < £60,000/yr	CostPP12			−0.076	(−7.4)	−0.0673	(−11.6)
Trip for any purpose, income > £60,000/yr	CostPP3			−0.0549	(−5.8)	−0.0526	(−7.8)
Trip for any purpose, income unknown	CostPP4			−0.0741	(−7.5)	−0.0581	(−9.8)
Personal trip, income < £60,000/yr	CostPP12	−0.11	(−5.7)				
Personal trip, income > £60,000/yr	CostPP3	−0.0808	(−5.0)				
Personal trip, income unknown	CostPP4	−0.0884	(−5.1)				
Business trip, any income	CostPPB	−0.054	(−4.7)				
Time coefficient for single way trip							
Ferry time, any income	FTime	−1.3	(−4.2)			−0.663	(−2.4)
Ferry time, income < £60,000/yr	FTime12			−0.381	(−2.3)		
Ferry time, income > £60,000/yr	FTime3			−1.22	(−5.4)		
Ferry time, unknown income	FTime4			−0.986	(−4.6)		
Access to departure port (max. 8 hrs)	AccTime	−0.816	(−5.6)	−0.273	(−6.7)		
Quality improvement coefficients (relative to current situation)							
New boat (less prone to seasickness)	Boat	0.965	(4.2)	0.956	(5.7)	0.446	(2.1)
Improved Penzance quayside facilities	Penzance	0.567	(3.2)	0.363	(3.3)	0.166	(0.8)
Improved St. Mary's quayside facilities	StMary	0	(*)	0	(*)	0.474	(1.4)
Sailing schedule coefficients (relative to schedule 1)							
Schedule 2, 3 or 4	Sail_2_4	0.386	(2.1)				
Extra constant for EE (schedule 3/4 only)	Sail__EE	−8.42	(−4.7)				
Extra constant for LL (schedule 3/4 only)	Sail__LL	−7	(−4.9)				
Schedule 2	Sail_2			−0.274	(−1.9)		
Schedule 3 (EE) or 4 (EE)	Sail_34_EE			−2.34	(−6.1)	−2.88	(−4.9)
Schedule 3 (EL) or 4 (EL)	Sail_34_EL			−1.04	(−5.1)	−3.29	(−5.3)
Schedule 3 (LE) or 4 (LE)	Sail_34_LE			−1.27	(−5.4)		
Schedule 3 (LL) or 4 (LL)	Sail_34_LL			−2.68	(−6.2)	−9.05	(−3.4)
Schedule 2, 3 (LE) or 4 (LE)	Sail234_LE					−0.385	(−1.5)
Other							
On heli alt. if origin/destination is Tresco	trescoH					0.54	(1.6)
On heli alt. if any in group fears flying heli	fearheH					−0.347	(−1.6)
On plane alt. if any fears flying on a plane	fearplP					−0.417	(−1.6)

		Daytrip		Stay		Residents	
Estimates based on observed choices from RP only							
Other		*Estimate*	*t-ratio*	*Estimate*	*t-ratio*	*Estimate*	*t-ratio*
On plane altern. if pref. airport is Newquay	RP_Newquay	−1.34	(−2.2)	−0.496	(−2.5)		
On plane altern. if pref. airport is Exeter	RP_Exeter	2.87	(2.2)	2.46	(5.4)		
On plane altern. if pref. airport is Bristol	RP_Bristol			3.18	(4.9)		
On plane altern. if pref. airport is Southam.	RP_Southam			1.7	(1.7)		
On heli alt. if origin/destination is Tresco	RP_TrescoH	1.72	(7.0)	2.28	(8.9)		
On ferry alt. if any is prone to seasickness	RP_seasicF	−0.545	(−2.6)	−0.513	(−3.4)	−0.435	(−1.2)
On plane alt. if any fears flying on a plane	RP_fearplP	−0.299	(−0.6)	−0.4	(−1.7)		
On heli alt. if any in group fears flying heli	RP_fearheH	−0.805	(−2.6)	−0.398	(−1.9)		
Alternative specific constant for plane	RP_PlaneC	0.0977	(0.2)	1.59	(8.0)	1.34	(6.3)
Alternative specific constant for helicopter	RP_HeliC	1.96	(4.1)	1.75	(7.0)	2.4	(11.4)
Estimates based on observed choices from SP-between only							
Other		*Estimate*	*t-ratio*	*Estimate*	*t-ratio*	*Estimate*	*t-ratio*
On plane altern. if pref. airport is Newquay	B_Newquay	−0.548	(−3.0)	0.0524	(0.2)		
On plane altern. if pref. airport is Exeter	B_Exeter	4.58	(4.6)	1.00	(3.1)		
On plane altern. if pref. airport is Bristol	B_Bristol	3.91	(4.0)	2.59	(5.6)	0.735	(0.9)
On plane altern. if pref. airport is Southam.	B_Southam	6.17	(5.2)	4.29	(6.3)	2.66	(4.4)
On ferry alt. if any is prone to seasickness	B_seasickF	−0.125	(−0.4)	−0.257	(−0.9)		
On heli alt. if any in group fears flying heli	B_fearhelH	−0.224	(−0.9)	−1.23	(−3.5)		
On plane alt. if any fears flying on a plane	B_fearplaP	−0.347	(−1.6)	−1.67	(−4.4)		
On NoTrip alt. if any fears flying heli	B_fearheNT			0.336	(0.7)		
On NoTrip alt. if any fears flying on a plane	B_fearplNT	3.86	(1.3)				
Alternative specific constant for helicopter	B_HeliC	−10.3	(−1.4)	2.79	(3.8)	−0.714	(−0.9)
Alternative specific constant for plane	B_PlaneC	−10.1	(−1.4)	2.67	(3.6)	−0.831	(−1.1)
Inertia constant for using ferry	B_Inert_F	−7.96	(−1.1)	2.83	(3.9)	0.539	(1.7)
Inertia constant for using helicopter	B_Inert_H	1.14	(4.4)	2.6	(6.5)	1.11	(4.6)
Inertia constant for using plane	B_Inert_P	0.442	(1.7)	1.98	(5.5)	1.7	(5.1)
Ineratia constant for using heli or plane	B_Inert_Fl	12.2	(1.7)	1.98	(3.6)		
Alternative specific constant for NoTrip	B_NoTripC	−32.8	(−1.7)	−5.14	(−4.3)	−5.3	(−6.5)
Extra ASC for no trip if no ferry is available	B_NoTripNF	13.1	(1.4)	1.34	(2.0)	0.169	(0.5)
Estimates based on observed choices from SP-within only							
Other		*Estimate*	*t-ratio*	*Estimate*	*t-ratio*	*Estimate*	*t-ratio*
On neither altern. if any prone to seasickn.	W_seasickN	0.703	(2.0)	0.642	(3.4)		
On neither altern. if any fears flying heli	W_fearhelN	0.87	(1.5)	0.18	(0.6)		
On neither altern. if any fears flying plane	W_fearplaN	−0.222	(−0.4)	−0.678	(−2.1)		
On neither altern. if destination is Tresco	W_TrescoN	1.49	(3.2)	−0.157	(−0.5)	1.19	(1.6)
Alternative specific constant for Neither	W_Neith	−8.39	(−5.2)	−5.42	(−6.5)	−5.36	(−5.0)

Scale factors							
Within experiment	ScaleWithn	0.523	(5.3)	0.703	(6.7)	0.435	(6.7)
Between experiment	ScaleBetw	1.26	(5.1)	0.719	(6.9)	1.00	(*)
Heli/Plane vs Ferry in between experiment	thetaAirB	0.566	(8.5)	0.801	(9.7)	1.00	(*)
No Trip vs Trip	theta	0.15	(1.7)	0.677	(6.5)	1.00	(*)
Heli/Plane vs Ferry in RP experiment	thetaAirRP	1.00	(*)	1.00	(*)	1.00	(*)
Schedule 1 vs 2 vs 3 vs 4	thetaFer	1.00	(*)	1.00	(*)	1.00	(*)

Calibration constants based on comparison with observed market shares							
Alternative Specific Constants							
Ferry, any trip purpose		0		0		0	
Airplane, holiday purpose	RP_PlaneC	−0.401		1.84		2.12	
Airplane, business or visit friends/relatives	RP_PlaneC	1.86		1.64			
Helicopter, holiday purpose	RP_HeliC	1.42		2.26		1.61	
Helicopter, business or visit friends/relativ.	RP_HeliC	2.25		2.17			

5.4 Model Validation: Examination of Values of time and Values of Quality

The best models, from a behavioural perspective, are those models which incorporate (household) income-specific cost sensitivity, resulting in income-specific values of time for access time (for the visitor models only) and ferry time (note that about 10% of the respondents have an income above £60,000 per year). The day-trip model also incorporates separate values of time for business travellers. The resulting values of time are presented below.

Table 12:   **Ferry Values of Time (£/hr, 2005 prices). Note that the values for business and personal ferry time are combined for staying visitors and residents.**

	Day-Trip Visitors	Staying Visitors	Residents
Business Ferry Time	£24.07		
Personal Ferry Time			
£0-£60,000 per year	£11.82	£5.01	£9.85
£60,0000+ per year	£16.09	£22.22	£12.60
Unknown/not stated income	£14.71	£13.31	£11.41

For non-business travel, the values of ferry time have been well estimated and we do not have any reason to disbelieve the resulting valuations. We have therefore recommended that the non-business values be incorporated in the appraisal procedure without adjustment. For business travel, we recommend adjustments to the model values to reproduce WebTAG-recommended values. The user has the option of applying these amended values in the forecasting tool and we recommend that they do.

The resulting valuations for the quality improvements, both for the new ferry and for the harbour improvements at Penzance and St. Mary's, also appear to be reasonable. The

following table compares the average willingness-to-pay to save 30 minutes of ferry travel time to the average valuations for the quality improvements investigated in the study, namely the introduction of the new ferry and for harbour improvements (both at Penzance and at St. Mary's together)

Table 13:   Average Willingness-to-Pay for Ferry Time Savings and Quality Improvements by Traveller Segment (per one-way trip)

	Day-Trip Visitors	Staying Visitors	Residents
Faster ferry (30 min. less time)	£7	£5	£5
New ferry (less prone to seasickness)	£10	£13	£7
Harbour improvements	£6	£5	£10

5.5   Model Calibration

Because the RP sample is a random sample of travellers, specifically a random sample of travellers travelling in the summer period, a further model calibration step is required in order to apply the models presented in Table 11 to ensure that the models replicate the observed modal shares. Observed mode share information was available for 2003 for each traveller segment, as shown in Table 16.

Table 14:   Mode Shares for Calibration

	Day-Trip Visitors		Staying Visitors		Residents/VFR/Bus		Total	
Ferry	55,539	68%	35,430	21%	4,788	22%	40,218	21%
Plane	3,331	4%	42,392	25%	5,493	25%	47,885	25%
Helicopter	23,150	28%	93,370	55%	11,384	53%	104,754	54%
Total	82,020	100%	171,192	100%	21,665	100%	192,857	100%

For model application, a weight was applied to each RP record such that the total number of observations in each of the three traveller segments was reproduced in the RP sample. The weighting procedure was complicated by the fact that we observed business travellers and personal travellers visiting friends and relatives in the visitor segments, when the aggregate figures incorporate these with residents only. In order to identify each relevant group in the sample and link these with the aggregate information provided for each traveller segment, it was necessary to define eight model segments:

- Day trip visitors – leisure
- Day trip visitors – visiting friends/relatives (VFR)
- Day trip visitors – business
- Staying visitors – leisure

- Staying visitors – VFR

- Staying visitors – business

- Residents – non-business

- Residents – business

In order to calculate weights for these segments it is necessary to split the "residents, business and VFR" aggregate figures into four sub-segments:

- Non-residents - VFR

- Non-residents - business

- Residents - business

- Residents - non-business

This split was based on the observation that residents in the sample each made an average of 4.40 return personal trips and 1.96 return business trips in the previous year. These figures are based on 'in scope' residents only – i.e. those who had made at least one trip to the mainland. It has been estimated that there are 1,500 in scope residents: this figure implies that 12% of "residents, business and VFR" trips are made by non-residents.

Weights for non-residents VFR and business are applied equally to the day trip and staying visitor segments. For clarity, Table 2 shows the eight model segments and identifies the associated weights.

Model segment	Weighting segment
Day trip visitors – leisure	Day trip - leisure
Day trip visitors – VFR	Non-residents - VFR
Day trip visitors – business	Non-residents - business
Staying visitors – leisure	Staying visitors - leisure
Staying visitors – VFR	Non-residents - VFR
Staying visitors – business	Non-residents - business
Residents – non-business	Residents - business
Residents – business	Residents - non-business

The model was then rerun, using the weighted records, to re-estimate the RP alternative mode-specific constants such that the observed mode shares for each model segment are met. All other coefficients were constrained to be equal to the values identified in the mode choice model analysis.

The Trip Frequency Model

The Stated Intentions data collected at the end of the SP surveys (see Section 2.3) were used to estimate disaggregate models of changes in trip frequency as a result of changes in ferry service levels.

In the SP survey respondents were asked to report how many return trips that they made between the Isles of Scilly and the mainland during the last year, for both business and leisure purposes (we did not ask separately about day trip and longer visits) and how many trips that they intended to make in the next year.

Respondents were then asked to estimate how many extra trips that they would make given two hypothetical scenarios:

Scenario 1:   Improved Ferry Services

I would now like you to image a case where the ferry services to the Islands was improved, specifically that a new modern ferry was introduced which could undertake the journey in 2 hours, rather than in 2 hours and 40 minutes, as is the case for the current trip. On the new ferry passengers would be less prone to seasickness.

The new ferry would be able to make 2 round trips per day to the Islands. That is, it might (depending on the tides):

– *leave Penzance between 07:00 and 08:00;*

– *return to Penzance between 10:00 and 11:00;*

– *depart again for St. Mary's at between 13:00 and 14:00; and,*

– *return to Penzance at the end of the day between 16:00 and 17:00.*

This would mean that people making a day trip to the Isles would get about 6 hours on the Islands.

Additionally, there would be improvements at the quayside in Penzance and St. Mary's, namely a new passenger terminal building and covered walkway to the vessel at Penzance, and a new shelter canopy at St. Mary's.

With these improvements and if the cost of making the journey by ferry was the same as now, would you make any more trips to the Isles by ferry than you have planned in the next 12 months?

Scenario 2:   No Ferry Services

If the ferry service was stopped, would you make fewer trips to the Isles than you had planned for in the next 12 months?

From these data, a model for the function *f* can be developed such that:

$$\text{Triprate}_{i,s} = f(\text{accessibility}_{i,s}, \text{socioeconomics}_i)$$

where for each individual i:

triprate$_{i,s}$ =   reported trips for s = 0 (base), s = 1 (Scenario 1), s = 2 (Scenario 2), for travel by residents and non-residents;

accessibility$_{i,s}$ =   accessibility from the mode choice model (logsum), for SP respondents for s = 0, 1 and 2[17];

socioeconomic$_i$ =   socioeconomic variables, including income, as appropriate.

Disaggregate Analysis

The structure of the trip frequency model is of the form:

$$\log(T_{i,s}) = \alpha + \theta * \text{logsum}_{is} + \gamma * \text{socioeconomics}_i$$

Where:

T_{is} =   number of trips

α =   constant

θ =   sensitivity of trip rate to changes in accessibility (logsum)

γ =   sensitivity of trip rate to socioeconomics

The changes in accessibility, i.e. the logsums, are provided from the mode choice model, for each group (i), for each of the scenarios tested (S).

By making sure that the trip rate is small, e.g. by expressing the trip rate as trips per week:

$$T_{i,s} = (\text{existing trips}_i + \text{new trips}_{i,s}) / 52$$

then the trip rate is approximately equal to the trip probability and a logit model can be used (Daly, 1997)[18], i.e.:

$$V_{i,s} = \alpha + \theta * \text{logsum}_{is} + \gamma * \text{socioeconomics}_i$$

---

[17]   It is noted that the model examined changes in numbers of trips as a function of the change in accessibility, i.e. change in logsum, for the different scenarios.

[18]   The LOGIT function can be specified as:

$$\log(T_{i,s}/(1-T_{i,s})) = \alpha + \theta * \text{logsum}_{i,s} + \gamma * \text{socioeconomics}_i$$

where $(1-T_{i,s})$ tends to 1 as $T_{i,s}$ is very small, which leads to a formulation that is near to the aggregate model specification.

The objective of the model is to obtain the sensitivity of trip rate to changes in accessibility (θ) and socioeconomics (γ). The constant (α) and socioeconomics term (γ) are useful in reducing the bias with which θ is estimated.

The model results are summarised for non-resident travellers are set out in Table 15 below. Separate models are presented for day trip and staying visitors.

Table 15:   Trip Frequency Model Results for Non-Resident Travellers

```
                        Non-Residents            Day Trippers          Staying Visitors
File              SI_NR_Leis_V10.F12    SI_NR_Leis_V10_day.F12  SI_NR_Leis_V10_stay.F12
Observations                    1047                       423                      624
Final log (L)                 -107.4                     -33.5                    -73.1
D.O.F.                             2                         2                        2

tripconst          -3.87  (-17.1)         -4.27   (-9.5)            -3.71  (-13.4)
theta              0.133   (0.6)          0.193   (0.7)            0.392   (0.6)
```

It is noteworthy that neither of the resulting elasticity terms is significantly different from zero at the 95% confidence level. This may be a result of the relatively small number of observations in the sample in combination with the large variation in responses across the sample. It is consistent with other modelling using disaggregate trip frequency data of which we are aware.

The following table compares the resulting predicted change in the aggregate number of trips for the sample of travellers, with those reported in the SI survey.

Table 16:   Comparison of Predicted and Reported Changes in Trips

	S1: Improved Ferry Services		S2: No Ferry Services	
	Model	SI Data	Model	SI Data
Day Trip Visitors	55% increase		19% decrease	
Staying Visitors	25% increase		9% decrease	
Overall Visitors	34% increase	30% increase	12% decrease	20% decrease

In general, visitors predicted much higher increases in trip making for the situation with improved ferry services than decreases as a result of the removal of ferry services. It is not clear how reliable are these responses. As such, the model does not reflect this asymmetry, rather it reflects the average response. Additionally, we see that the day trip visitors are more sensitive to ferry accessibility changes, which we would expect.

The model results for residents are summarised are summarised in Table 17 below. Separate models are presented for leisure and business travel. Again, none of the accessibility terms is significant at the 95% confidence level.

Table 17:   Trip Frequency Model Results for Island Residents

```
                        Residents              Leisure                Business
File             SI_Res_All_V3.F12      SI_Res_Leis_V3.F12     SI_Res_Bus_V3.F12
Title           Resident SI Models      Resident SI Models     Resident SI Models
Observations                   156                      78                     78
Final log (L)                -39.1                   -27.7                   -8.7
D.O.F.                           2                       2                      2

tripconst        -2.64   (-7.9)          -2.09   (-5.6)          -3.74   (-4.8)
theta            0.494   (0.5)           0.568   (0.5)           0.332   (0.1)
```

Table 18 compares the resulting predicted change in the aggregate number of trips for the residents with those reported in the SI survey.

Table 18:   Comparison of Predicted and Reported Changes in Trips for Island Residents

	S1: Improved Ferry Services		S2: No Ferry Services	
	Model	SI Data	Model	SI Data
Personal Travel	29% increase	20% increase	13% decrease	30% decrease
Business Travel	16% increase	15% increase	8% decrease	20% decrease

Large trip frequency changes are observed for personal travel than for business travel, as is expected. Again, the model does not reflect the asymmetry in SI responses.

It is noteworthy that there were no significant socio-economic effects identified in the models.

CHAPTER 7   **Forecasting Tool**

A forecasting tool was developed using a sample enumeration technique to produce future year demand forecasts by applying the estimated mode choice and trip frequency models to the survey samples. The tool takes the form of an Excel workbook with macros.

7.1   Sample Enumeration

In sample enumeration, the RP survey sample used to estimate a demand model is also treated as a representative sample of the travel population for the purpose of forecasting. The response of each group in the sample to changes in the attributes of the travel modes is predicted using the mode-choice model: specifically, the probability of choosing each mode is calculated. These probabilities are then weighted and summed over the whole sample to produce forecasts of demand, and in this case revenue and consumer surplus.

Because the Isles of Scilly models also predict changes in travel frequency in response to changes in the attributes of the travel modes, the demand attached to each group in the sample will change in response to these attributes to simulate the effect of increased or reduced travel frequency.

The calculation of weights for each model segment, and implementation of frequency response is detailed in Section 7.5 below.

Figure 5 shows diagrammatically the inputs required and outputs produced by the forecasting tool.

User Inputs

Scenario years:
- Year
- Ferry type
- Ferry journey time
- Ferry timetable
- Harbour side improvements
- Fare increases by mode

Static Inputs

Survey samples (8 segments)
Fare estimates
Demand forecasts at fixed service
   levels
Model coefficients
- Mode choice
- Frequency response
Ferry capacities
VoT changes and discount rates (DfT
   guidance)
Consumer surplus adjustment factors
Residents, business and VFR segment
   split

Forecasting Tool

Outputs
(forecasts)

Scenario years:
- Demand by mode
- Revenue by mode
- Consumer surplus by segment
- Demand and revenue by mode and segment

30 year and 60 year projections:
- Consumer surplus by segment

Figure 5:   Forecasting tool inputs and outputs

7.2   **User Inputs**

The Forecasting Tool takes as input a table of run years and scenario variables (see Figure 6). These define a Do Minimum or Do Something scenario. The scenario variables are:

- Ferry Type: No Ferry[19], Existing Ferry or New Ferry;

- Ferry Time: Journey time in hours and minutes;

- Ferry Timetable: The four timetable options are displayed to the right of the table;

- Harbour Improvements and Penzance and/or St. Mary's;

- Fare Increases: Percentage fare increases in real terms for each mode.

The values of these variables for each run year completely define a scenario, from the point of view of demand, revenue and consumer surplus forecasts.
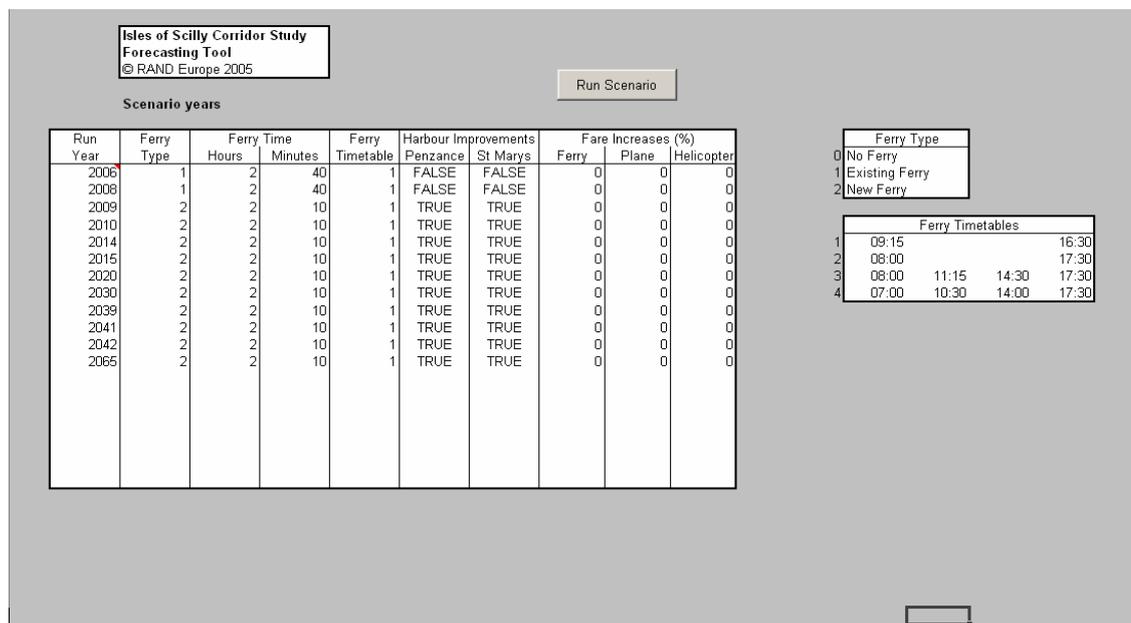
Figure 6:   Input sheet

7.3   Outputs

The main table in the output sheet shows overall demand and revenue for each mode, consumer surplus for each model segment, and then demand and revenue by mode for each segment (see Figure 7 and Figure 8). These values are output for each of the run years in the input sheet.

Consumer surplus shown in the main table is based on the utility functions, including cost and time coefficients, used in forecasting for each segment. It is expressed in 2002 prices, but at run year values, i.e. it is not discounted. Revenue is also expressed in 2002 prices and run year values.

---

[19] If No Ferry is specified, then the remaining ferry variables will have no effect on the results.

F17   =   3987.79243262527

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q |

Isles of Scilly Corridor Study
Forecasting Tool
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Forecast Outputs

Interpolated and Discounted Consumer Surplus

30 Year	26,743,662	12,983	61,556	22,841,070	174,514	91,061	1,497,116	744,074
Adjusted	26,743,662	12,983	54,785	22,841,070	174,514	182,122	1,497,116	1,413,740
60 Year	43,374,040	19,551	94,930	34,881,969	266,947	139,731	2,394,088	1,216,777
Adjusted	43,374,040	19,551	84,487	34,881,969	266,947	279,463	2,394,088	2,311,877

Demand an

	Demand by Mode			Revenue by Mode (£000)			Consumer Surplus (£)									
Run Year	Ferry	Plane	Helicopter	Ferry	Plane	Helicopter	Day Trip	Day Trip VFR	Day Business	Stay	Stay VFR	Stay Business	Residents Personal	Residents Business	Ferry Demand
2006	91466	63654	135945	2286	3928	7278	0	0	0	0	0	0	0	0	50098
2008	90329	68184	143312	2264	4276	7677	0	0	0	0	0	0	0	0	49163
2009	158400	55435	112622	4033	3518	6126	1641955	891	4258	1417936	11919	6344	98451	48185	82982
2010	158400	57506	115808	4038	3679	6301	1663918	893	4252	1448681	11933	6330	98728	48380	82762
2014	158400	64082	125062	4043	4216	6806	1754038	903	4264	1541399	12064	6329	100892	49663	82595
2015	158400	65767	127333	4044	4355	6930	1776563	906	4269	1564694	12096	6333	101454	50004	82554
2020	158400	74487	138428	4049	5088	7534	1892941	918	4312	1684046	12278	6372	104643	51962	82369
2030	158400	79458	140103	3988	5659	7587	2145376	957	4565	1737257	13004	6720	115974	58355	85491
2039	158400	84185	141445	3934	6204	7622	2409745	995	4859	1794443	13724	7121	127562	65364	88207
2041	158400	84925	141016	3933	6303	7595	2450394	1002	4930	1813104	13886	7218	130389	67103	88272
2042	158400	85291	140801	3933	6352	7582	2470858	1006	4966	1822468	13967	7268	131802	67984	88302
2065	158400	92544	136166	3924	7327	7295	2956565	1087	5881	2043080	15784	8512	163032	89465	88697

Figure 7:   Output sheet

Y4   =

| P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD | AE | AF |

744,074
1,413,740
1,216,777
2,311,877

Demand and revenue (£) by mode and sector

	Day Trip						Day Trip VFR						Day Trip Business			
Residents Business	Ferry Demand	Plane Demand	Helicopter Demand	Ferry Revenue	Plane Revenue	Helicopter Revenue	Ferry Demand	Plane Demand	Helicopter Demand	Ferry Revenue	Plane Revenue	Helicopter Revenue	Ferry Demand	Plane Demand	Helicopter Demand	Ferry Revenue
0	50098	3712	29459	804226	132109	1184033	27	12	21	450	414	927	77	128	220	1348
0	49163	3891	31047	789496	138825	1250226	26	12	23	428	425	977	73	131	223	1279
48185	82982	1847	17276	1340998	65907	684679	51	7	12	853	238	539	202	97	164	3566
48380	82762	1896	17766	1337658	67738	705041	51	7	13	842	243	557	198	98	165	3505
49663	82595	2062	19472	1335832	74018	775962	49	7	14	810	259	619	188	104	170	3336
50004	82554	2103	19896	1335389	75593	793580	48	7	15	802	263	634	186	105	171	3298
51962	82369	2308	22021	1333500	83578	881987	46	8	16	765	282	707	176	112	176	3128
58355	85491	2542	24769	1386567	93607	996775	44	8	18	740	302	791	174	118	179	3090
65364	88207	2772	27419	1433013	104181	1107544	43	9	20	716	326	866	172	124	181	3071
67103	88272	2779	27592	1434642	104985	1115264	43	9	20	712	329	876	173	124	181	3082
67984	88302	2783	27676	1435422	105396	1119018	43	9	20	710	331	880	173	124	180	3088
89465	88697	2868	29183	1447598	116169	1186766	40	9	22	674	396	955	180	127	174	3241

Figure 8:   Output sheet (continued)

The "Interpolated and Discounted Consumer Surplus" table above the main table shows consumer surplus for each segment discounted to 2002 values[20] and interpolated over 30-year and 60-year time frames beginning with the first run year in the table. For years intermediate between the run years (the years in the input and output tables) consumer surplus is calculated by interpolating between the run years on either side before discounting. If consumer surplus is needed for years after the final run year, the interpolation result will just be the final run year value.

The "Adjusted" consumer surplus figures in this table are corrected for differences between the values of time implied by the forecasting model, and DfT recommended values of time (see Appendix A for details). It is recommended that these values be used for appraisal.

7.4   Using the tool

Use of the Forecasting Tool is straightforward. The user enters scenario variables for the desired run years in the table on the input sheet, and selects the "Run Scenario" button. Progress will be shown in the status bar, and results will appear in the output sheet.

The user should be careful to enter run years in consecutive rows of the table. If more run years are required than the number of rows in the table, the user may continue below.

In any set of scenarios that will be compared, it is recommended that the same run years be used. This will prevent any bias occurring in the consumer surplus results because of interpolation between different sets of run years.

7.5   Internal operation of the tool

7.5.1   Traveller segmentation

The total annual trips by traveller segment for future years were produced as a separate exercise using trend analysis and other techniques[21]. Table 19 shows the forecasts for the number of one-way trips segmented by traveller type.

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[20] Using an annual discount rate of 3.5% until 2032; thereafter 3% until 2077 and 2.5% for any years after that.

[21] "Isles of Scilly Link Major Scheme Bid, Part Two: Options for the Future" by Hyder Consulting, report no. RT/CV01104/25B/023.

Table 19:   Hyder future demand forecasts

Year	Day Trip	Staying Visitors	Residents, business and VFR[22]	Total
2003	82020	171181	21725	274926
2010	84934	205714	21937	312585
2020	89278	240809	22244	352331
2030	93843	240809	22554	357206
2039	98152	240809	22838	361799

The forecasts for staying visitors are capped at 240809. This represents the expectation that accommodation capacity on the islands will be unable to exceed this limit. To avoid inconsistency, the frequency response for staying visitors is switched off in the model runs when the ferry service improves.

Demand models have been applied for the eight segments discussed in Section 5.5. In many cases it was not possible to estimate separate models for each of these segments and therefore the models are the same .

7.5.2 Demand forecasting and capacity restrictions

The estimation of mode choice and frequency response models is described elsewhere in this report. In demand forecasting a composite model of demand is used. For each group in the survey sample, the representative demand for mode i is given by:

$$D(i) = \exp(\theta \Delta V^*) \cdot \frac{\exp(V_i)}{\sum_j \exp(V_j)}$$

where V_j is the utility of mode j and ΔV^* is the difference in the accessibility logsum between the forecasting scenario, and a 'base' scenario in which the attributes of all modes are unchanged. The logsum is given by:

$$V^* = \log \sum_j \exp(V_j)$$

In a base scenario the sum of the demand for each of the three modes is one – so the demand function represents the choice probability.

In certain forecasting scenarios the demand for ferry travel predicted by the models will exceed capacity. In these cases, the demand forecasts are corrected by introducing a 'shadow price': a negative utility term for ferry that reduces overall demand to the exact capacity of the boat. The same shadow price term is applied to each segment; it is not calibrated against any other utility term. This means that, as far as possible, the reduction in demand will be drawn equally from each segment.

The appropriate shadow price to match ferry demand to capacity is determined iteratively.

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[22] Visiting friends and relatives

7.5.3 Consumer surplus calculation

Changes in consumer surplus for a group in the sample are calculated in utility terms using the analytic integral of the demand function. They are converted into units of money using the model cost coefficient (which has units of utils per pound) for the relevant model segment.

Where no shadow price is used, the difference in consumer surplus from the 'base' scenario (as above) is given by:

$$\Delta CS = \frac{\exp(\theta \Delta V *) - 1}{\theta}$$

or, for staying visitors (where frequency response is switched off, i.e. $\theta = 0$):

$$\Delta CS = \Delta V *$$

These consumer surplus functions ensure that in the base scenario, where the attributes of all modes are unchanged, the consumer surplus value is zero.

When a shadow price is used for the ferry, the consumer surplus calculation is complicated. The shadow price reduces the utility of the ferry until the demand reaches capacity; but using this reduced utility in the consumer surplus calculation does not take account of the fact that those passengers who still choose the ferry benefit from the full, unreduced utility.

The correct consumer surplus calculation in this case is:

$$\Delta CS' = \frac{\exp(\theta \Delta V *) - 1}{\theta} + D(ferry) \cdot (-V_{shadow})$$

or, without frequency response,

$$\Delta CS = \Delta V * + D(ferry) \cdot (-V_{shadow})$$

The logsum $V *$ is based on the reduced ferry utility, but the shadow price utility is 'returned' to those travellers who choose the ferry anyway. It has been verified that this consumer surplus function has the necessary properties.

The consumer surplus values calculated by this method are based on the time and cost sensitivities, and hence values of time, found during model estimation. To correct for differences between these values and DfT recommended values of travel time, adjustment factors have been calculated for the three business as described elsewhere in this report and in 'Outputs' above.

CHAPTER 8 **Results**

This chapter presents model results for a number of scenario tests (Section 8.1). We also present findings with regard to the ferry fare elasticity (Section 8.2).

8.1 Scenario runs

8.1.1 Reference scenario (Status quo)

To better understand the impact of the assumptions in the scenarios, we have first created a reference scenario. In this scenario nothing changes with respect to the present situation: a ferry with current specifications is available for all years. We note that this is not a "realistic" scenario, since it is planned to take the current vessel out of service after 2014. Therefore, this scenario is for reference only.

Figure 9 shows the demand by mode in this scenario as predicted by the model. Since the characteristics of the services are unchanged, no extra demand is generated above the base demand (see Table 19). The total day trip visitor market is predicted to grow steadily, whereas the staying visitor market grows until 2020, after which is then remains constant limited by the capacity of sleeping capacity on the Islands. The resident market grows slowly.

When looking at the demand by mode, it is striking that the ferry market share is predicted to decline. This is a result of the assumption of increased values-of-time over time (in real terms, i.e. above and beyond any inflation effects). In the model, this effect is implemented as a decreasing cost coefficient, i.e. cost sensitivity. As a result, people are more willing to switch to the use of helicopter and airplane, since they are more prepared to pay the higher fares for the time savings and other benefits of these modes.
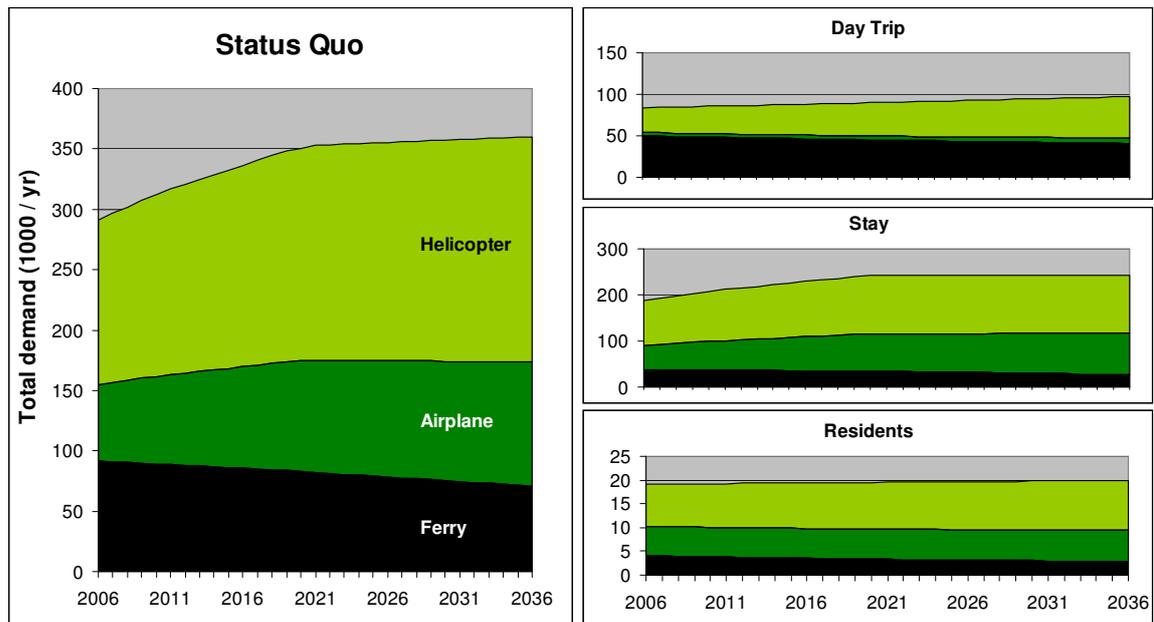
Figure 9   Demand by mode in the Status Quo scenario

8.1.2 Do Minimum scenario (no ferry after 2014)

In the 'Do Minimum' scenario, the ferry is taken out of service in 2014. As a result, travel to and from the Isles of Scilly becomes more difficult (less service alternatives), making travel to the Islands less attractive. This results in a decrease in the number of trips compared to the Status Quo scenario. In the model, the decline in demand is predicted through the trip frequency model.

The total demand in 2015 drops by 8.0% compared to 2014 (Figure 10). The demand for day trips declines most substantially (–14.7%), largely because of the high ferry market share in 2014 (53.8%). The demand for trips by staying visitors and by residents drops relatively less (stay -5.3%, resident –9.6%).

The remaining demand is distributed between airplane and helicopter. Both modes gain market share: the market share of the airplane increases from 24.4% to 31.9% and the market share of the helicopter increases from 49.1 to 68.1%.
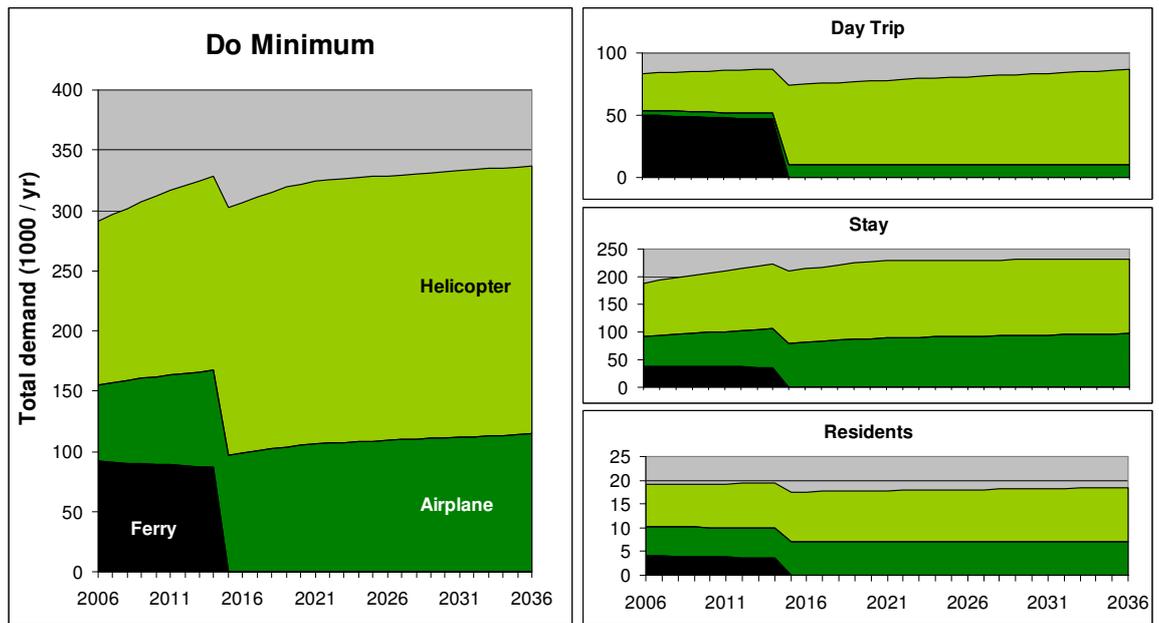
Figure 10   Demand by mode in the Do Minimum scenario

8.1.3 **Do Something 1/2 scenario (new 15-knot ferry from 2009)**

In these scenarios, the ferry in 2009 is replaced by a new ferry which:

- travels at a speed of 15 knots (has about the same travel time as the current ferry);

- is a new modern ferry on which travellers may be less prone to seasickness.

The harbour facilities at Penzance and St. Mary's will also be improved.

Because of the improved ferry services, the model predicts an increase in demand of 7.4%[23] (see Figure 11). This increase is largely due to increases in day-trip visitors (+18.0%), since the stay market cannot grow much further (+2.5%) because of hotel bed restrictions. The number of resident trips grows by an extra 11.1%. With this growth in travel demand and with these ferry and harbour-side improvements the model predicts that the ferry will reach its capacity immediately (assumed to be 158,400 passengers per year). The resulting airplane market share decreases from 22.6% in 2008 to 16.7% in 2009. The helicopter share will also drop from 47.4% (2008) to 34.4% (2009).

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[23] Note that in the status quo scenario demand increases by 5.1%
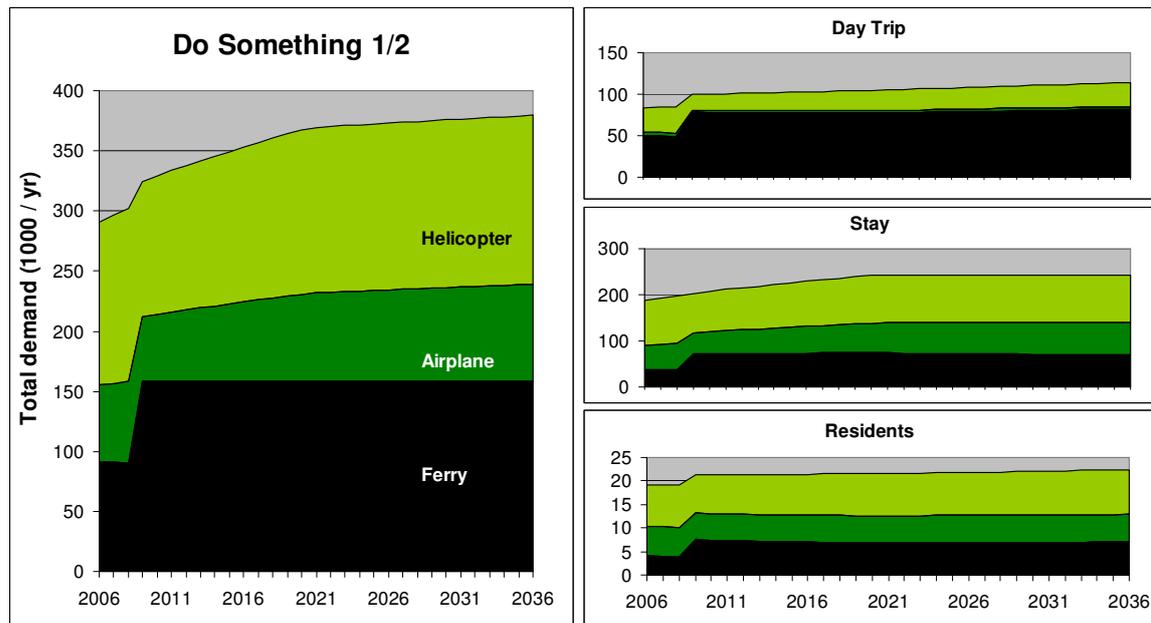
Figure 11   Demand by mode in the Do Something 1/2 scenario

8.1.4   Do Something 3/4 scenario (new 20-knot ferry from 2009)

In these scenarios, the ferry in 2009 is replaced by a new ferry which:

- travels at a speed of 20 knots, i.e. the ferry journey can be completed in 2 hours;

- is a new modern ferry on which travellers may be less prone to seasickness.

The harbour facilities at Penzance and St. Mary's will also be improved.

The increase in speed makes the new ferry even more attractive, since the ferry travel time will be reduced by 30 minutes. This will lead to an extra growth of demand, however, since the ferry is already operating at maximum capacity, this does not increase the ferry market share (see Figure 12).
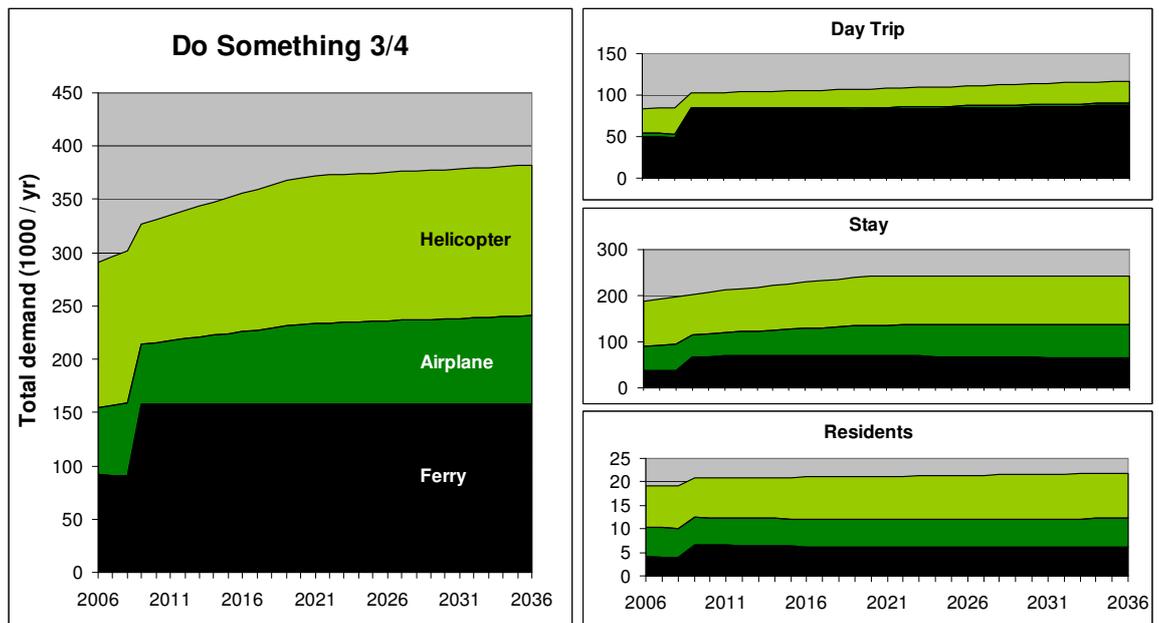
Figure 12   Demand by mode in the Do Something 3/4 scenario

8.1.5 Do Something 3/4 scenario (50% effects)

The findings reported above are those predicted from the model that has been estimated directly from the RP and SP data. There are several reasons why the scenarios presented above might be too optimistic:

- respondents may be too optimistic about new options;

- the findings may be subject to 'package effects', specifically that people have a willingness-to-pay threshold for a package of items, which is not measured when looking at the value of individual components of the package).

A 50% reduction of the effect of the new boat and of the harbour improvements approximately reflects the lower bound of the estimated parameters, considering the 95% confidence interval.

The model results, assuming 50% of the values for the new boat and harbourside improvements are presented in Figure 13. From these results, it can be seen that demand does not grow as much as in the previous scenario. However, the ferry is still predicted to operate at maximum capacity in 2009; although due to the decreasing attractiveness of the ferry over time (see the status quo scenario), the ferry demand is below capacity from 2026.
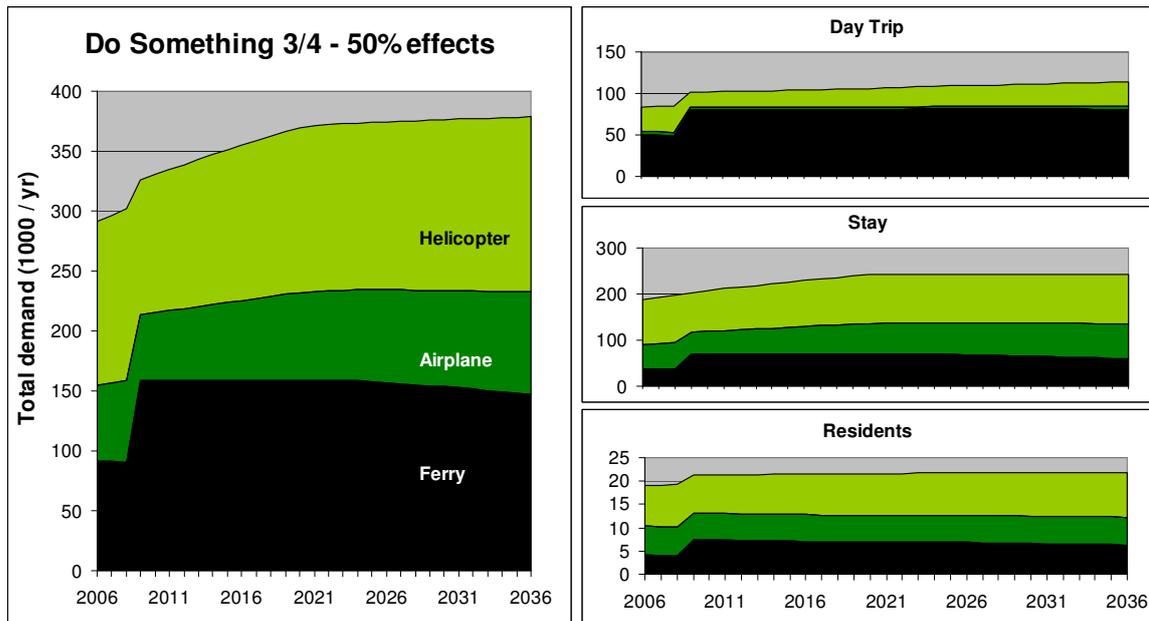
Figure 13   Demand by mode in the Do Something 3/4 scenario with 50% of the new boat and of the harbour effects

8.2   Ferry fare elasticities

Fare elasticities have been measured by examining the relative change in demand predicted by the model when the ferry fares have been increased by 1%. The resulting elasticities are presented in Table 20. Note that the ferry fare elasticity for day trip visitors is greater than –1, implying that the revenues could be increased by increasing the day trip fare.

Table 20   Elasticities per Model Segment

Model Segment	Elasticity
Day Trip	-0.7
Day Trip (for VFR purpose)	-1.1
Day Trip (for business purpose)	-0.8
Stay Trip	-2.0
Stay Trip (for VFR purpose)	-1.9
Stay Trip (for business purpose)	-2.2
Residents (for leisure purpose)	-2.0
Residents (for business purpose)	-2.0
Total	-1.3

It is difficult to compare these elasticities with elasticities reported in other studies, since none of these other studies are directly comparable with the Isles of Scilly situation. Perhaps the most comparable are ferry passenger elasticities provided by the Scottish Office Industry Department[24] study on fare price elasticities, which ranged from -0.8 to –1.5 for specific Scottish ferry routes. For Eurotunnel[25] an own-elasticity to tariff for shuttle car use of -1.6 to -1.8 was found; while for the 'French Straits' the own-elasticity was -2.4. For Union Railways[26] an own-elasticity to fare for Eurostar train services of -0.5 was found. Certainly the elasticity figures found from this study are consistent with these figures, with higher elasticities for those segments, i.e. staying visitors and residents, who may consider a wider-range of travel alternatives to the Isles.

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[24] SOID (1992) *Fare Price Elasticities on the Caledonia MacBrayne Ferry Network*, Scottish Office Industry Department Research Paper

[25] HCG 312-2 (1993), p. 26

[26] HCG 345-2 (1994), p. 27-28

CHAPTER 9   **Conclusion**

We have developed a tool which calculates the travellers' benefits and disbenefits of changes in the transport services between the Isles of Scilly and Penzance. This tool can handle changes in:

- price of the ferry, helicopter and/or airplane tickets

- crossing time of the ferry

- harbour facilities at Penzance and/or at St. Mary's

- quality of the ferry itself

The tool takes into account the effects of the limited capacity of the ferry. In addition, it is also capable to calculate the effects of a decision to discontinue the ferry service.

The model predicts changes in modal shift and in total travel demand as a result of changes in the services. It is based on a mode choice model and a trip frequency model.

The mode choice model was derived from stated and revealed preference surveys of visitors to and residents of the Isles of Scilly. We have found significant coefficient values for most parameters. The values-of-time and the elasticities that were derived from this model are consistent with expected values based on previous studies.

The trip frequency model was derived from stated intention questions in the surveys mentioned above. Current travellers were asked how many trips they are likely to make in the next year if the ferry operated at its current service level, or was improved; or was disbanded. Since the model was based on a limited number of questions, the model coefficients were not very significant. Furthermore, it is important to underline that this model only predicts the number of trips made by current travellers and not by people that are currently not travelling to/from the Isles but might decide to do so if the (ferrry) service is improved.

We have demonstrated the use of the tool for a few simple scenarios. This shows a rather small drop in total passenger demand when the ferry service is discontinued and a rather large modal shift if the ferry service is improved. We therefore advice to take the following into account when interpreting the outcomes of the tool:

- respondents in the surveys may have been too optimistic about new options;

- the findings from the survey may be subject to 'package effects', specifically that people have a willingness-to-pay threshold for a package of items, which is not measured when looking at the value of individual components of the package.

- respondents in the survey might have overstated their reaction for "political" reasons. This might have been true especially for stated intention questions: if people are strongly in favour for a certain option, they might change their answer in a positive direction

- the coefficients in the trip frequency model were not highly significant, indicating that the demand predictions made from this model have a large confidence interval.

The tool will be used by the Penzance to Isles of Scilly Route Partnership as part of a robust Cost-Benefit Assessement (CBA) of a possible replacement of the current ferry that is nearing the end of its operational life. The scenarios used in this CBA will be more detailed than the simple ones that were shown in this report for demonstration purpose only.

The CBA is required by the UK Department for Transport in order to receive possible capital funding for improved transport links. Our tool provides an enhancement to nortmal transport appraisal procedures because:

- it includes travellers' benefits from improved quality of the boat and from the harbour facilities

- it uses exact consumer surplus calculations allowing for heterogenity in travellers preferences and the possibility of a discontinuation of the ferry service

APPENDICES

Appendix A: Value of Time

This appendix presents the non-resident demand model results, separately for day trip and long-stay visitors, and resident model results for four model specifications:

- a model with a single cost and time coefficient and therefore a single value of time (VOT) per traveller segment;

- a model with separate cost coefficients (and therefore separate VOTs) for business and personal travel;

- a model with income-specific cost coefficients (and time coefficients for long-stay travellers) and therefore income-varying VOTs;

- a model with income-specific cost coefficients (and time coefficients for long-stay travellers) and therefore income-varying VOTs for personal travel, with a separate cost coefficient for business travel.

The detailed model coefficients are presented at the end of this note.

Day-Trip Visitors

Day trip visitors account for about 30% of all travel to the Isles of Scillies, and about 60% of all ferry travellers (based on 2003 data).

The resulting values of time for the day-trip visitors are presented in Table 21 below.

The best model fit is obtained when separate business and non-business cost valuations are taken into account and when the non-business cost valuations take account of household income variation. We observe significantly higher values of time for ferry and access time for business users (about 7% of the non-resident RP sample) and for personal travellers with a household income greater than £60,000 per year (about 11% of the non-resident RP sample).

Table 21:   Day Trip Visitors' Values of Time (£/hour, 2005 values)

	Single VOT	Business/Non-Business	Income-specific terms	Income + Business terms
Ferry Time				
All	£13.03			
Business		£23.49		£24.07
Non-Business		£12.97		
0 – 60,000 GBP/year			£11.77	£11.82
60,000+ GBP/year			£15.98	£16.09
Unknown/not stated income			£15.68	£14.71
Access Time				
All	£13.16			
Business		£13.98		£15.11
Non-Business		£7.72		
0 – 60,000 GBP/year			£10.90	£7.42
60,000+ GBP/year			£14.80	£10.10
Unknown/not stated income			£14.53	£9.23

There are very few sources of ferry journey time valuations to compare with the values obtained in the Isles of Scilly study. If we simply compare the work and non-work valuations with WebTAG recommended valuations, we see that the personal valuations from the Isles of Scilly are higher and the business valuations lower than the recommended values (the business valuations and the average non-business valuations across income categories for the best model are compared to the WebTAG values in Table 22 below). It should be emphasised that there are very few business observations in the non-resident survey samples.

The business value of time has been calculated from responses of business travellers and not from interviews with managers of firms. For the survey, business trips were defined as journeys where at some point the respondent did work for their employer and where their employer paid for the journey. If respondents were self-employed, they were defined as journeys for which they were able to claim tax rebates for the fares for the journey. It is assumed that business users perceive costs in the factor cost unit of account (whilst consumers perceive costs in the market price unit of account) and therefore the resulting business valuations need to be converted to market prices for the appraisal (i.e. multiply by 1.209). This adjustment is made in Table 22 for comparison of the resulting business valuations with WebTAG. With this adjustment, we see that ferry time valuations are 12% higher than the WebTAG recommended values for travel across all modes.

Table 22:   Resulting Valuations of Ferry and Access Time ('Business/Non-Business' model)

	Work		Non-Work	
	2002	**2005**	**2002**	**2005**
WebTAG	£22.11	£25.93	£4.46	£5.16
Ferry Time				
Base Value	£20.52	£24.07	£10.70	£12.37
Business correction (1.209)	£24.81	£29.10		
Jny Time corrected			£5.94	£6.87
Income & jny time corrected				
e=0.36 on income			£5.49	£6.35
e=0.16 on income			£5.73	£6.63
e=0.80 on income			£5.02	£5.81
Access Time				
Base Value	£12.88	£15.11	£6.71	£7.76
Business correction (1.209)	£15.58	£18.27		
Jny time corrected			£4.29	£4.96
Income & jny time corrected				
e=0.36 on income			£3.96	£4.58
e=0.16 on income			£4.14	£4.78
e=0.80 on income			£3.62	£4.19

For non-business travel, one way in which the Isles of Scilly values and the WebTAG values may differ is with regard to journey distance/duration of the journey, where evidence suggests that values of time increase with journey distance. The ITS Leeds' review of the AHCG VOT study identified an elasticity of 0.31 with respect to distance. Using the 2004 NTS data, the average car journey takes 24 minutes and covers 9.4 mi. The ferry journey takes 2 hrs 40 mins. Using the difference in journey times and the distance elasticity, we find that the resulting ferry value of time would be decreased by a factor of 1.80 to be equivalent to the WebTAG values[27]. With this distance/time correction, the average ferry time valuations for non-business journeys are slightly higher than the WebTAG values. In addition to the ferry journey itself, all travellers also make on average access journey of 1 hour 42 mins to the ferry terminal. Using the same approach, this produces a factor of 1.57, which has been applied to the access time valuations. With this adjustment, the access time valuations are in the order of those recommended by WebTAG.

Another way in which the Isles of Scilly values and WebTAG values for non-business travel may differ is with regard to the distribution of household income, where we see that travellers to the Isles of Scilly have a higher average household income than other travellers

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[27] This approach assumes an arc elasticity formulation. An alternative approach would be to take Table 23 in the ITS Leeds report and multiply by the ratio of VOTs reported for the equivalent journey bands. Taking the £30,000-£35,000 income band the VOT for journeys of 5 – 10 mi is 3.84 p/min while for 50 – 100 mi journeys it is 8.03 p/min (all at 1997 prices and values). The ratio is 2.09, which is (not surprisingly) close to the value obtained using the elasticity directly.

in the NTS data (Figure 1). By comparison, the income for the resident sample is only slightly greater than the NTS (Figure 2).
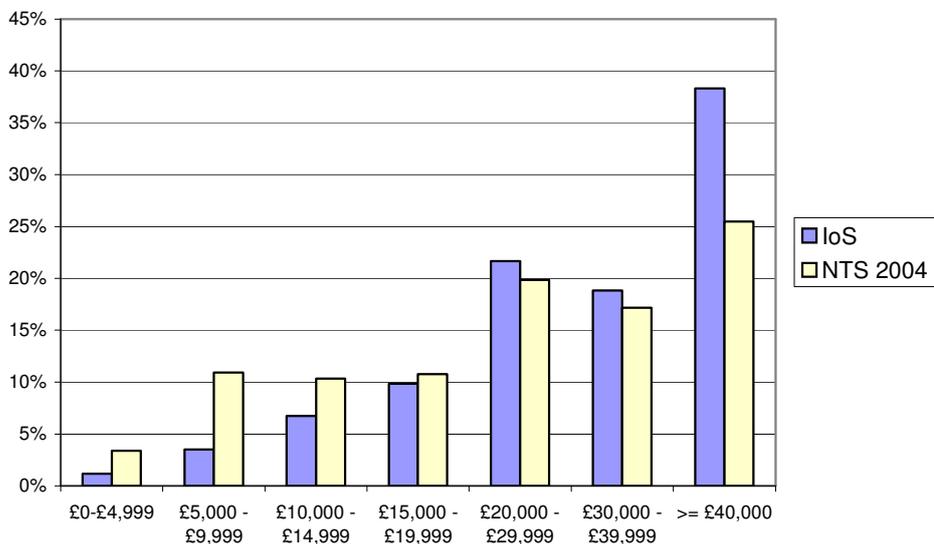
Figure 14:   **Comparison of Household Income for Visitors to the Isles of Scilly and NTS**

Table 23:   **Distribution of Household Income for Isles of Scilly Visitors and Residents and NTS**

	Visitors		Residents	
	IoS	NTS	IoS	NTS
£0-£4,999	1.2%	3.4%	1.6%	3.4%
£5,000-£9,999	3.5%	10.9%	7.1%	10.9%
£10,000-£14,999	6.7%	10.3%	11.0%	10.3%
£15,000-£19,999	9.8%	10.8%	11.0%	10.8%
£20,000-29,999	21.6%	19.9%	22.8%	19.9%
£30,000-£39,999	18.8%	17.2%	25.2%	17.2%
> £40,000	38.3%	25.5%	21.3%	25.5%
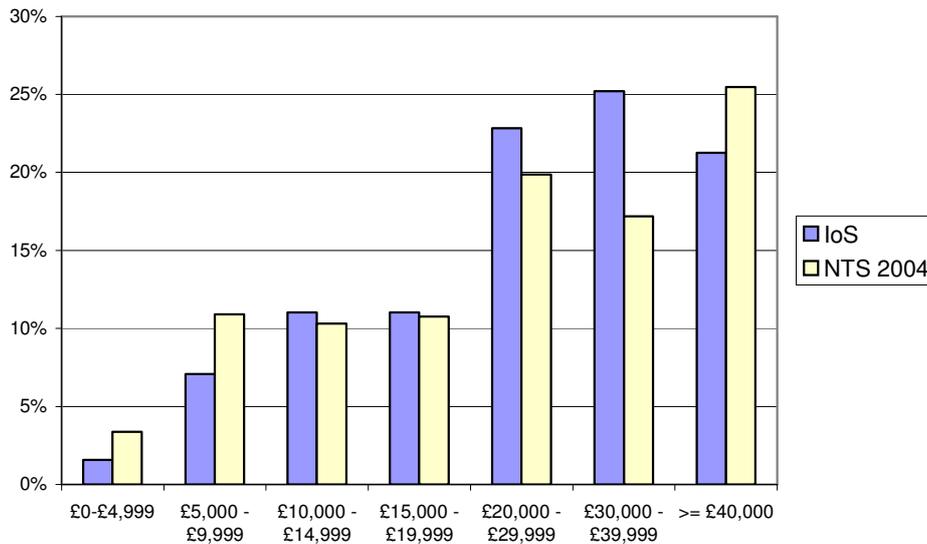
Figure 15:   Comparison of Household Income for Residents of the Isles of Scilly and NTS

The average incomes, using the midpoints of the bands and assuming in the top income category the income is £60,000, are calculated and presented in Table 24.

Table 24:   Average incomes from IoS data and NTS

	Visitors	Residents
IoS	£37,831	£31,161
NTS	£30,336	£30,336
Difference	+24.71%	+2.72%

Current DfT guidance recommends an elasticity of VOT due to income growth of 0.8[28] for non-work journeys, although it is emphasised that this is an inter-temporal elasticity and reflects amongst other things changes in preferences and technological changes over time (and is calibrated from time series data).   The ITS Leeds' review of the AHCG VOT study identified a cross-sectional income elasticity of 0.16.   The AHCG study identified a cross-sectional income elasticity of 0.35 for other travel.   The cross-sectional income elasticity identified directly in the day-trip model is roughly 0.36 (the value of time increases by 36% for an approximate doubling in salary).

In Table 22 the non-working valuations are corrected both for journey time effects and income effects, using three income elasticities (0.36, 0.16 and 0.80). With an income elasticity of 0.16 there is little change on the journey time corrected figures.

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[28] By contrast, the literature suggests the elasticity could be anywhere from 0.16 to 1.0.

Long-Stay Visitors

Long-stay visitors account for the majority, i.e. 62%, of travel to the Isles of Scillies, and about 37% of all ferry travellers (based on 2003 data).

The resulting values of time for the long-stay visitors are summarised in Table 25 below. It is noteworthy that the access time valuations for the long-stay visitors are much lower than what was observed for day-trip visitors, this may be a result of some very long access journey times which have been reported in the survey, e.g. 8 hours or more, compounded with the fact that many of these people were unable to provide reasonable access time estimates for the alternatives that they did not use (the mode choice models are based on respondent's estimates of travel time to the ferry port, heliport and their most convenient airport).

As with the day-trip modelling, we observe significantly higher values of time for ferry time for high-income households, i.e. those with a household income greater than £60,000 per year. These account for approximately 11% of the non-resident RP sample. They also have a higher valuation of access time, but the differential is not as large as is observed for ferry time, which is substantial. *The model with separate income-specific cost variation has the best model fit of all models tested.* Separate ferry/access time valuations were tested for business and non-business travellers, but the resulting values were not intuitive, i.e. the values for business travellers were lower than those for non-business travellers. It is noteworthy that the proportion of business travellers in the long-stay segment is 4%. A model has also been estimated where the values of ferry time and the value of access time has been constrained to be the same for travellers of all incomes. The fit of this model is significantly worse than that which incorporates income variation.

Table 25:   Long-Stay Visitors' Values of Time (£/hour, 2005 values)

	Single VOT	Business/Non-Business	Income-specific terms	Income + Business terms
Ferry Time				
All	£10.49			
Business		£9.27		n/a
Non-Business		£10.59		
0 – 60,000 GBP/year			£5.01	n/a
60,000+ GBP/year			£22.22	n/a
Unknown/not stated income			£13.31	n/a
Access Time				
All	£3.48			
Business		£3.06		n/a
Non-Business		£3.50		
0 – 60,000 GBP/year			£3.59	n/a
60,000+ GBP/year			£4.97	n/a
Unknown/not stated income			£3.68	n/a

Table 26 compares the resulting ferry and access time valuations, for the average VOT valuations obtained from the model with income-specific terms, with the WebTAG recommendations.

Examination of the ferry valuations for business travellers shows that these are low (the model results are 48% of the WebTAG values).

For non-business travel, the average ferry valuation is lower (about 12% lower, on average) than that observed for the day-trip traveller. This may be reasonable given that day trip visitors are more time constrained with regard to the time that they have available on the Islands and they may therefore be willing to pay more to transfer time from the ferry onto the Island. As noted earlier, the access times for long-stay visitors are very low.

Table 26: Resulting Valuations of Ferry and Access Time (Weighted Average VOT from best model)

	Work		Non-Work	
	2002	**2005**	**2002**	**2005**
WebTAG	£22.11	£25.93	£4.46	£5.16
Ferry Time				
Base Value	£8.76	£10.27	£9.32	£10.77
Business correction (1.209)	£10.59	£12.42		
Jny Time corrected			£5.17	£5.98
Income & jny time corrected				
e=0.36 on income			£4.78	£5.53
e=0.16 on income			£4.99	£5.77
e=0.80 on income			£4.37	£5.05
Access Time				
Base Value	£3.33	£3.90	£3.28	£3.79
Business correction (1.209)	£4.02	£4.72		
Jny time corrected			£2.09	£2.42
Income & jny time corrected				
e=0.36 on income			£1.93	£2.24
e=0.16 on income			£2.02	£2.33
e=0.80 on income			£1.77	£2.05

Residents

Travel by residents, VFR and business travellers account for the minority, i.e. 8%, of travel to the Isles of Scillies, and about 5% of all ferry travellers (based on 2003 data).

The resulting values of time for residents are summarised in Table 27 below. It is noteworthy that no access (or in this case) egress time coefficient could be estimated.

Table 27:   Residents' Values of Time (£/hour, 2005 values)

	Single VOT	Business/Non-Business	Income-specific terms	Income + Business terms
Ferry Time				
All	£10.87			
Business		£11.47		£11.46
Non-Business		£10.63		
0 – 60,000 GBP/year			£9.85	£10.49
60,000+ GBP/year			£12.60	£12.49
Unknown/not stated income			£11.41	£10.52

As with the non-resident models, we observe higher values of time for ferry time for high-income households, i.e. those with a household income greater than £60,000 per year. These account for approximately 8% of business travellers and 4% of non-business travellers. ***The model with separate income-specific cost variation has the best model fit of all models tested.*** Separate ferry time valuations were tested for business and non-business travellers, but the estimates were not significantly different from one another. A model has also been tested with separate business and income-specific non-business valuations, but again the model fit is not significantly better than the model with income-specific terms only.

Table 28 compares the resulting ferry and access time valuations, for the average VOT valuations obtained from the model with income-specific terms, with the WebTAG recommendations.

Table 28:   Resulting Valuations of Ferry Time (Weighted Average VOT from best model)

	Work		Non-Work	
	2002	**2005**	**2002**	**2005**
WebTAG	£22.11	£25.93	£4.46	£5.16
Ferry Time				
Base Value	£9.61	£11.27	£9.51	£10.99
Business correction (1.209)	£11.62	£13.63		
Jny Time corrected			£5.28	£6.10
Income & jny time corrected				
e=0.36 on income			£4.88	£5.64
e=0.16 on income			£5.09	£5.89
e=0.80 on income			£4.46	£5.16

The model results are very consistent with those observed for the long-stay travellers.

Again, we observe that the values for business travellers are lower than the values recommended by WebTAG (the model results are 43% of the WebTAG values).

As noted above, the average ferry valuation for non-business travel is very similar to that observed for the long-stay travellers and is higher than that observed for day-trip visitors.

Conclusions

The best models, from a behavioural perspective, are those models which incorporate income-specific cost sensitivity, resulting in income-specific values of time for access time and ferry time. The day-trip model also incorporates separate values of time for business travellers.

For day-trip business visitors, the value of ferry time, once corrected to be in market prices, was 12% higher than the WebTAG recommended values of time (for all modes of travel). We therefore recommended that the consumer surplus for these business travellers be reduced by a factor of 0.89 for the economic appraisal.

For day-trip non-work travellers, we observe that the value of access time is close to WebTAG recommended values when corrections for journey time are applied. For this segment, the WebTAG values are probably most consistent with the access time valuations, since the modes used for access will be comparable to those examined for the WebTAG guidance. It is noteworthy that the results are highly sensitive to the time measure used (be it ferry time, access time or total time). With low income-elasticity assumptions, the income effects are minimal. The value of ferry time is higher than that observed for access time: we hypothesise that this difference can be attributed to the relative comforts of the travel modes, whereby the majority of access journeys are made by car, as a driver or passenger (78% for non-business journeys). The values of ferry time have been well-estimated in the modelling and we do not have any reason to disbelieve the resulting valuations. We therefore recommend that the non-business models are incorporated in the appraisal procedure without adjustment.

For long-stay business visitors, the value of ferry time, once corrected to be in market prices, are 52% lower than the WebTAG recommended values of time (for all modes of travel). We therefore recommended that the consumer surplus for these business travellers be increased by a factor of 2 for the economic appraisal.

For long-stay non-work travellers, the value of ferry time was lower than that observed for day-trip visitors: the values are, however, consistent with the findings for the residents. The difference between the day-trip and long-stay and resident valuations may be that the day-trip visitors are much more time constrained: they may therefore be willing to pay higher amounts for faster journeys, so that they can spend more time on the Islands. As noted earlier in the text, the value for access time for the long-stay visitors was very low. This may be a result of some very long access journey times which have been reported in the survey, e.g. 8 hours or more, compounded with the fact that many of these people were unable to provide reasonable access time estimates for the alternatives that they did not use. Again, on the basis of comparability of the ferry time values for long-day and resident

visitors, we recommend that the long-stay models for non-business travellers be used directly in the appraisal, without adjustment.

For residents making business journeys, the value of ferry time, once corrected to be in market prices, are 57% lower than the WebTAG recommended values of time (for all modes of travel). We therefore recommended that the consumer surplus for these business travellers be increased by a factor of 1.9 for the economic appraisal.

As noted above, the value of ferry time for resident non-work journeys was very similar to that observed for non-resident long-stay travellers. No access (or in this case) egress time coefficient or valuation could be identified. Again, on the basis of comparability of the ferry time values for long-day and resident visitors, we recommend that the resident models for non-business travellers be used directly in the appraisal, without adjustment.

DRAFT NOTE NOT FOR GENERAL CIRCULATION

Table 29:   Day-Trip Visitors Model Results

File	joint033onecost.F12		joint033b_nb.F12		joint033inc.F12		joint033inc_bus.F12	
Observations	3578		3578		3578		3578	
Final log (L)	-2996.2		-2979.2		-2976.0		-2962.2	
D.O.F.	41		42		43		44	
CostPP	-0.0528	(-3.9)	0	(*)	0	(*)	0	(*)
CostPP12					-0.0577	(-4.2)	-0.110	(-5.7)
CostPP3	0	(*)			-0.0425	(-4.1)	-0.0808	(-5.0)
CostPP4					-0.0433	(-3.9)	-0.0884	(-5.1)
CostPPB	0	(*)	-0.0613	(-4.5)			-0.0540	(-4.7)
CostPPN-B	0	(*)	-0.111	(-5.3)				
FTime	-0.688	(-3.4)	-1.44	(-4.1)	-0.679	(-3.6)	-1.30	(-4.2)
FTime1	0	(*)	0	(*)	0	(*)	0	(*)
FTime2	0	(*)	0	(*)	0	(*)	0	(*)
FTime3	0	(*)	0	(*)	0	(*)	0	(*)
FTime4	0	(*)	0	(*)	0	(*)	0	(*)
AccTime	-0.695	(-4.4)	-0.857	(-5.6)	-0.629	(-4.5)	-0.816	(-5.6)
Boat	0.512	(3.4)	1.08	(4.1)	0.498	(3.5)	0.965	(4.2)
StMary	0	(*)	0	(*)	0	(*)	0	(*)
Penzance	0.306	(2.8)	0.651	(3.2)	0.287	(2.8)	0.567	(3.2)
Sail_1	0	(*)	0	(*)	0	(*)	0	(*)
Sail_2_4	0.207	(2.0)	0.435	(2.2)	0.197	(2.0)	0.386	(2.1)
Sail__EE	-4.12	(-3.5)	-9.08	(-4.5)	-4.22	(-3.8)	-8.42	(-4.7)
Sail__LL	-3.47	(-3.6)	-7.59	(-4.7)	-3.53	(-3.9)	-7.00	(-4.9)
RP_PlaneC	-0.769	(-2.1)	0.330	(0.7)	-0.818	(-2.4)	0.0977	(0.2)
RP_HeliC	0.857	(2.3)	2.27	(4.1)	0.811	(2.4)	1.96	(4.1)
RP_Landend	0	(*)	0	(*)	0	(*)	0	(*)
RP_Newquay	-1.47	(-2.4)	-1.32	(-2.1)	-1.44	(-2.3)	-1.34	(-2.2)
RP_Exeter	2.08	(1.6)	3.41	(2.5)	1.89	(1.5)	2.87	(2.2)
RP_Bristol	0	(*)	0	(*)	0	(*)	0	(*)
RP_Southam	0	(*)	0	(*)	0	(*)	0	(*)
RP_TrescoH	1.64	(6.8)	1.77	(7.2)	1.61	(6.7)	1.72	(7.0)
RP_seasicF	-0.483	(-2.4)	-0.542	(-2.6)	-0.494	(-2.5)	-0.545	(-2.6)
RP_fearplP	-0.296	(-0.6)	-0.262	(-0.5)	-0.322	(-0.6)	-0.299	(-0.6)
RP_fearheH	-0.768	(-2.6)	-0.751	(-2.5)	-0.799	(-2.7)	-0.805	(-2.6)
B_Landend	0	(*)	0	(*)	0	(*)	0	(*)
B_Newquay	-0.411	(-3.1)	-0.583	(-2.8)	-0.382	(-3.1)	-0.548	(-3.0)
B_Exeter	2.29	(3.3)	5.41	(4.6)	2.08	(3.5)	4.58	(4.6)
B_Bristol	2.47	(3.3)	4.50	(4.0)	2.14	(3.4)	3.91	(4.0)
B_Southam	3.36	(3.8)	6.87	(5.0)	3.23	(4.0)	6.17	(5.2)
B_seasickF	-0.0119	(-0.1)	-0.140	(-0.4)	-0.0185	(-0.1)	-0.125	(-0.4)
B_fearhelH	-0.136	(-1.0)	-0.340	(-1.2)	-0.0850	(-0.7)	-0.224	(-0.9)
B_fearplaP	-0.191	(-1.4)	-0.436	(-1.7)	-0.152	(-1.3)	-0.347	(-1.6)
B_seasicNT	0	(*)	0	(*)	0	(*)	0	(*)
B_fearheNT	0	(*)	0	(*)	0	(*)	0	(*)
B_fearplNT	2.17	(1.1)	3.04	(1.3)	3.06	(1.0)	3.86	(1.3)
B_HeliC	-6.27	(-1.2)	-8.58	(-1.4)	-8.48	(-1.1)	-10.3	(-1.4)
B_PlaneC	-6.11	(-1.1)	-8.39	(-1.4)	-8.31	(-1.0)	-10.1	(-1.4)
B_Inert_F	-5.02	(-1.0)	-6.06	(-1.0)	-7.21	(-0.9)	-7.96	(-1.1)
B_Inert_H	0.613	(3.4)	1.26	(4.2)	0.605	(3.7)	1.14	(4.4)
B_Inert_P	0.220	(1.4)	0.576	(1.9)	0.168	(1.2)	0.442	(1.7)
B_Inert_Fl	7.42	(1.4)	10.9	(1.8)	9.46	(1.2)	12.2	(1.7)
B_NoTripC	-19.7	(-1.4)	-28.7	(-1.8)	-25.5	(-1.2)	-32.8	(-1.7)
B_NoTripNF	7.98	(1.2)	11.0	(1.5)	10.8	(1.0)	13.1	(1.4)
W_Neith	-4.44	(-3.7)	-9.20	(-4.9)	-4.41	(-4.0)	-8.39	(-5.2)
W_seasickN	0.416	(2.2)	0.814	(2.2)	0.382	(2.1)	0.703	(2.0)
W_fearhelN	0.546	(1.8)	1.16	(1.8)	0.455	(1.5)	0.870	(1.5)
W_fearplaN	-0.237	(-0.9)	-0.630	(-1.1)	-0.0352	(-0.1)	-0.222	(-0.4)
W_TrescoN	0.758	(2.8)	1.53	(3.0)	0.817	(3.0)	1.49	(3.2)
ScaleWithn	1.07	(3.7)	0.485	(4.9)	1.04	(4.1)	0.523	(5.3)
ScaleBetw	2.13	(3.8)	1.08	(5.0)	2.34	(4.0)	1.26	(5.1)
thetaAirB	0.599	(8.5)	0.579	(8.5)	0.579	(8.5)	0.566	(8.5)
theta	0.140	(1.4)	0.197	(1.8)	0.101	(1.2)	0.150	(1.7)
thetaAirRP	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
thetaFer	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)

Table 30:   **Staying Visitors Model Results**

File	joint034onecost.F12		joint034b_nb.F12		joint035inc.F12		joint035inc_bus.F12	
Observations	5654		5654		5654		5654	
Final log (L)	−6164.2		−6162.8		−6114.5		−6115.4	
D.O.F.	45		46		49		50	
CostPP	−0.0843	(−8.0)	0	(*)	0	(*)	0	(*)
CostPP12					−0.0760	(−7.4)	−0.0764	(−7.4)
CostPP3					−0.0549	(−5.8)	−0.0569	(−6.0)
CostPP4					−0.0741	(−7.5)	−0.0748	(−7.6)
CostPPBus	0	(*)	−0.0930	(−7.4)			−0.0836	(−7.0)
CostPPN−B	0	(*)	−0.0814	(−7.7)				
FTime	−0.884	(−4.4)	−0.862	(−4.4)	0	(*)	0	(*)
FTime12	0	(*)	0	(*)	−0.381	(−2.3)	−0.407	(−2.4)
FTime3	0	(*)	0	(*)	−1.22	(−5.4)	−1.21	(−5.2)
FTime4	0	(*)	0	(*)	−0.986	(−4.6)	−1.03	(−4.7)
AccTime	−0.293	(−7.2)	−0.285	(−7.0)	−0.273	(−6.7)	−0.273	(−6.7)
Boat	1.12	(5.8)	1.09	(5.8)	0.956	(5.7)	0.984	(5.7)
StMary	0	(*)	0	(*)	0	(*)	0	(*)
Penzance	0.435	(3.3)	0.423	(3.3)	0.363	(3.3)	0.373	(3.3)
RP_PlaneC	1.76	(8.5)	1.72	(8.3)	1.59	(8.0)	1.60	(8.0)
RP_HeliC	2.00	(7.6)	1.95	(7.4)	1.75	(7.0)	1.78	(7.1)
RP_Landend	0	(*)	0	(*)	0	(*)	0	(*)
RP_Newquay	−0.440	(−2.1)	−0.442	(−2.2)	−0.496	(−2.5)	−0.483	(−2.4)
RP_Exeter	2.95	(6.0)	2.84	(5.9)	2.46	(5.4)	2.50	(5.5)
RP_Bristol	3.97	(5.6)	3.81	(5.4)	3.18	(4.9)	3.26	(5.0)
RP_Southam	2.88	(2.8)	2.69	(2.6)	1.70	(1.7)	1.79	(1.8)
RP_TrescoH	2.29	(8.9)	2.29	(8.9)	2.28	(8.9)	2.28	(8.9)
RP_seasicF	−0.519	(−3.5)	−0.518	(−3.5)	−0.513	(−3.4)	−0.511	(−3.4)
RP_fearplP	−0.402	(−1.7)	−0.398	(−1.7)	−0.400	(−1.7)	−0.403	(−1.7)
RP_fearheH	−0.406	(−1.9)	−0.406	(−1.9)	−0.398	(−1.9)	−0.401	(−1.9)
B_Southam	5.05	(6.7)	4.85	(6.5)	4.29	(6.3)	4.32	(6.3)
B_Bristol	3.07	(5.9)	2.97	(5.8)	2.59	(5.6)	2.63	(5.7)
B_Exeter	1.26	(3.4)	1.23	(3.4)	1.00	(3.1)	1.04	(3.2)
B_Newquay	0.0553	(0.2)	0.0557	(0.2)	0.0524	(0.2)	0.0482	(0.2)
B_Landend	0	(*)	0	(*)	0	(*)	0	(*)
B_seasickF	−0.274	(−0.8)	−0.259	(−0.8)	−0.257	(−0.9)	−0.254	(−0.8)
B_fearhelH	−1.43	(−3.5)	−1.39	(−3.5)	−1.23	(−3.5)	−1.25	(−3.5)
B_fearplaP	−1.97	(−4.5)	−1.90	(−4.5)	−1.67	(−4.4)	−1.69	(−4.4)
B_seasicNT	0	(*)	0	(*)	0	(*)	0	(*)
B_fearheNT	0.422	(0.8)	0.314	(0.6)	0.336	(0.7)	0.270	(0.6)
B_fearplNT	0	(*)	0	(*)	0	(*)	0	(*)
B_HeliC	1.06	(1.3)	1.08	(1.4)	2.79	(3.8)	2.88	(3.9)
B_PlaneC	0.912	(1.1)	0.915	(1.2)	2.67	(3.6)	2.75	(3.8)
B_Inert_F	3.45	(4.2)	3.41	(4.3)	2.83	(3.9)	2.93	(4.1)
B_Inert_H	3.02	(6.8)	2.91	(6.7)	2.60	(6.5)	2.61	(6.5)
B_Inert_P	2.34	(5.8)	2.28	(5.7)	1.98	(5.5)	2.01	(5.6)
B_Inert_Fl	2.31	(3.8)	2.19	(3.9)	1.98	(3.6)	1.96	(3.7)
B_NoTripC	−7.58	(−5.1)	−6.97	(−5.0)	−5.14	(−4.3)	−4.85	(−4.2)
B_NoTripNF	1.28	(1.7)	1.04	(1.5)	1.34	(2.0)	1.18	(1.8)
Sail_1	0	(*)	0	(*)	0	(*)	0	(*)
Sail_2	−0.334	(−1.9)	−0.323	(−1.9)	−0.274	(−1.9)	−0.281	(−1.9)
Sail_34_EE	−2.89	(−6.5)	−2.83	(−6.4)	−2.34	(−6.1)	−2.42	(−6.2)
Sail_34_EL	−1.30	(−5.4)	−1.27	(−5.3)	−1.04	(−5.1)	−1.08	(−5.2)
Sail_34_LE	−1.59	(−5.7)	−1.56	(−5.7)	−1.27	(−5.4)	−1.32	(−5.5)
Sail_34_LL	−3.31	(−6.6)	−3.25	(−6.5)	−2.68	(−6.2)	−2.78	(−6.3)
W_Neith	−6.22	(−6.9)	−6.05	(−6.8)	−5.42	(−6.5)	−5.55	(−6.6)
W_seasickN	0.807	(3.5)	0.805	(3.6)	0.642	(3.4)	0.681	(3.5)
W_fearhelN	0.303	(0.8)	0.279	(0.7)	0.180	(0.6)	0.181	(0.6)
W_fearplaN	−0.822	(−2.1)	−0.801	(−2.1)	−0.678	(−2.1)	−0.702	(−2.1)
W_TrescoN	0.0077	(0.0)	0.0205	(0.1)	−0.157	(−0.7)	−0.133	(−0.4)
ScaleWithn	0.569	(7.2)	0.580	(7.1)	0.703	(6.7)	0.678	(6.8)
ScaleBetw	0.603	(7.4)	0.624	(7.2)	0.719	(6.9)	0.712	(6.9)
thetaAirB	0.814	(9.6)	0.811	(9.6)	0.801	(9.7)	0.796	(9.7)
theta	0.730	(6.5)	0.776	(6.6)	0.677	(6.5)	0.717	(6.5)
thetaAirRP	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
thetaFer	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)

Table 31:   Residents Model Results

	Single cost		bus+non-bus		income		bus+ inc.	
File	joint075.F12		joint076.F12		joint079.F12		joint078.F12	
Observations	1402		1402		1402		1402	
Final log (L)	−1330.9		−1330.3		−1326.8		−1329.6	
D.O.F.	27		28		29		30	
trescoH	0.497	(1.5)	0.506	(1.5)	0.540	(1.6)	0.499	(1.5)
fearheH	−0.396	(−1.8)	−0.407	(−1.9)	−0.347	(−1.6)	−0.395	(−1.8)
fearplP	−0.480	(−1.9)	−0.483	(−1.9)	−0.417	(−1.6)	−0.473	(−1.8)
RP_seasicF	−0.434	(−1.2)	−0.433	(−1.2)	−0.435	(−1.2)	−0.443	(−1.2)
B_seasicF	0	(*)	0	(*)	0	(*)	0	(*)
EgrTime	0	(*)	0	(*)	0	(*)	0	(*)
Boat	0.453	(2.2)	0.450	(2.1)	0.446	(2.1)	0.445	(2.1)
Penzan	0.162	(0.8)	0.166	(0.8)	0.166	(0.8)	0.170	(0.8)
StMary	0.467	(1.4)	0.480	(1.4)	0.474	(1.4)	0.469	(1.4)
Sail1	0	(*)	0	(*)	0	(*)	0	(*)
Sail234_LE	−0.379	(−1.5)	−0.387	(−1.5)	−0.385	(−1.5)	−0.382	(−1.5)
Sail34_EE	−2.87	(−4.9)	−2.92	(−4.9)	−2.88	(−4.9)	−2.87	(−4.9)
Sail34_EL	−3.28	(−5.3)	−3.32	(−5.3)	−3.29	(−5.3)	−3.28	(−5.3)
Sail34_LL	−8.99	(−3.4)	−9.23	(−3.4)	−9.05	(−3.4)	−8.97	(−3.4)
RP_HeliC	2.40	(11.4)	2.43	(11.5)	2.40	(11.4)	2.39	(11.2)
RP_PlaneC	1.34	(6.3)	1.36	(6.4)	1.34	(6.3)	1.34	(6.2)
B_HeliC	−0.679	(−0.9)	−0.712	(−0.9)	−0.714	(−0.9)	−0.714	(−0.9)
B_PlaneC	−0.819	(−1.1)	−0.845	(−1.1)	−0.831	(−1.1)	−0.838	(−1.1)
B_NoTripC	−5.21	(−6.4)	−5.28	(−6.4)	−5.30	(−6.5)	−5.25	(−6.4)
B_NoTripNF	0.249	(0.7)	0.275	(0.8)	0.169	(0.5)	0.252	(0.7)
B_Inert_F	0.574	(1.8)	0.548	(1.7)	0.539	(1.7)	0.554	(1.8)
B_Inert_H	1.08	(4.5)	1.11	(4.6)	1.11	(4.6)	1.12	(4.6)
B_Inert_P	1.82	(5.5)	1.78	(5.4)	1.70	(5.1)	1.79	(5.4)
B_Landend	0	(*)	0	(*)	0	(*)	0	(*)
B_Newquay	0	(*)	0	(*)	0	(*)	0	(*)
B_Exeter	0	(*)	0	(*)	0	(*)	0	(*)
B_Bristol	0.610	(0.8)	0.638	(0.8)	0.735	(0.9)	0.644	(0.8)
B_Southam	2.56	(4.4)	2.64	(4.5)	2.66	(4.4)	2.66	(4.5)
W_Neith	−5.40	(−5.1)	−5.51	(−5.1)	−5.36	(−5.0)	−5.42	(−5.1)
WN_tresco	1.29	(1.7)	1.37	(1.8)	1.19	(1.6)	1.30	(1.7)
ScaleWithn	0.437	(6.6)	0.426	(6.5)	0.435	(6.7)	0.439	(6.5)
ScaleBetw	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
thetaAirB	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
theta	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
thetaAirRP	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
thetaFer	1.00	(*)	1.00	(*)	1.00	(*)	1.00	(*)
FTime	−0.661	(−2.4)	−0.670	(−2.4)	−0.663	(−2.4)	−0.667	(−2.4)
CostPP	−0.0608	(−11.7)	0	(*)	0	(*)	0	(*)
CostPP_NB			−0.0630	(−11.2)	0	(*)	0	(*)
CostPP_B			−0.0584	(−10.3)	0	(*)	−0.0582	(−10.3)
CostPP_12					−0.0673	(−11.6)		
CostPP_3					−0.0526	(−7.8)		
CostPP_4					−0.0581	(−9.8)		
CostPPNB12							−0.0636	(−10.5)
CostPP_NB3							−0.0534	(−5.4)
CostPP_NB4							−0.0634	(−9.9)

Appendix B: Sunday Sailings

As part of the SP survey, respondents were asked about their preferences for Sunday sailings. Their responses are summarised in this memo.

Non-Residents

Non-residents were first asked to confirm the day of the week on which they made their journey to the Isles.

Day of Week of Outbound Trip

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monday	57	14.2	14.2	14.2
	Tuesday	61	15.2	15.2	29.4
	Wednesday	92	22.9	22.9	52.4
	Thursday	74	18.5	18.5	70.8
	Friday	65	16.2	16.2	87.0
	Saturday	33	8.2	8.2	95.3
	Sunday	3	.7	.7	96.0
	cannot remember	16	4.0	4.0	100.0
	Total	401	100.0	100.0	

170 of the 398 respondents (42.7%) who did not make their outbound trip on a Sunday indicated that they would have made their outbound journey on a Sunday, if a Sunday ferry service was available.

95 of the 252 respondents (37.7%) who were not making a day trip and who hadn't made their return journey on a Sunday indicated that they would have made their return journey on a Sunday, if a Sunday ferry service was available.

Respondents who indicated that they would have used a Sunday service, for either their outbound or return trip were then asked whether this would have influenced the number of nights that they spent on the Isles of Scilly. Just over 60% indicated that a Sunday ferry service would *not* have influenced the number of nights that they spent on the Isles. 33%

indicated that they would spend one more night on the Isles of Scilly, if there was a Sunday service.

If there were a Sunday ferry service would this have influenced the number of nights that you spent on the Isles of Scilly?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	117	29.2	61.9	61.9
	yes, one night more	63	15.7	33.3	95.2
	yes, one night less	2	.5	1.1	96.3
	other NOTEPAD	7	1.7	3.7	100.0
	Total	189	47.1	100.0	
Missing	-1.00	212	52.9		
Total		401	100.0		

Over 85% of non-residents indicated that a Sunday service would *not* have influenced the number of nights that they spent in Cornwall, with nearly equal numbers saying that they would spend one night more and one night less in Cornwall.

Would it have influenced the number of nights that you spent in Cornwall?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	163	40.6	86.2	86.2
	yes, one night more	14	3.5	7.4	93.7
	yes, one night less	11	2.7	5.8	99.5
	other NOTEPAD	1	.2	.5	100.0
	Total	189	47.1	100.0	
Missing	-1.00	212	52.9		
Total		401	100.0		

Respondents were then asked whether they would make more journeys per year to/from the Isles if there was a regular Sunday ferry service. 86% of respondents indicated that they would *not* make any more journeys. 13% indicated that they would make more leisure journeys. Only one respondent indicated that they would make more business journeys and two respondents indicated that they would make both more leisure and business journeys.

Would you make more journeys per year to/from the Isles if there was a regular Sunday ferry service?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	345	86.0	86.0	86.0
	yes leisure	53	13.2	13.2	99.3
	yes business	1	.2	.2	99.5
	yes leisure & business	2	.5	.5	100.0
	Total	401	100.0	100.0	

Respondents were then asked whether they would make more journeys per year to/from the Isles if services ran for all twelve months of the year. Just over 80% indicated that they would not make more journeys per year. Nearly 18% of respondents indicated that they would make more leisure trips.

If the ferry services ran for all twelve months of the year, would you make more journeys to/from the Isles of Scilly?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	326	81.3	81.3	81.3
	yes leisure	71	17.7	17.7	99.0
	yes leisure & business	4	1.0	1.0	100.0
	Total	401	100.0	100.0	

Lastly, respondents were asked whether they would make more journeys per year to the Isles if there were helicopter and airplane services on Sunday. 88 respondents indicated that they would make more journeys per year (21.9%) if there were Sunday helicopter and airplane services. This is an increase of 66% (53 to 88 respondents) compared to those who make additional leisure trips if Sunday ferry services only existed.

If there were Sunday services for helicopter and airplane services, would you make more journeys per year to/from the Isles of Scilly?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	311	77.6	77.6	77.6
	yes leisure	88	21.9	21.9	99.5
	yes business	1	.2	.2	99.8
	yes leisure & business	1	.2	.2	100.0
	Total	401	100.0	100.0	

Residents

Residents were also asked to confirm the day of the week on which they made their journey to the mainland. None of the respondents made their outward journey on a Sunday.

Day of Week of Outbound Trip

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monday	13	21.3	21.3	21.3
	Tuesday	7	11.5	11.5	32.8
	Wednesday	5	8.2	8.2	41.0
	Thursday	11	18.0	18.0	59.0
	Friday	7	11.5	11.5	70.5
	Saturday	9	14.8	14.8	85.2
	Cannot remember	9	14.8	14.8	100.0
	Total	61	100.0	100.0	

6 of the 61 respondents (10%) indicated that they would have made their outbound trip on a Sunday if a Sunday ferry service was available.

23 of the 54 respondents (42.6%) who were not making a day trip and who hadn't made their return journey on a Sunday indicated that they would have made their return journey on a Sunday, if a Sunday ferry service was available.

Respondents who indicated that they would have used a Sunday service, for either their outbound or return trip were then asked whether this would have influenced the number of nights that they spent on the Isles of Scilly. 36% indicated that a Sunday ferry service would not have influenced the number of nights that they spent on the mainland, 20% indicated that they would spend one more night on the mainland and 44% indicated that they would spend one less night on the mainland.

If there were a Sunday ferry service would this have influenced the number of nights that you spent on the mainland?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	9	14.8	36.0	36.0
	yes, one night more	5	8.2	20.0	56.0
	yes, one night less	11	18.0	44.0	100.0
	Total	25	41.0	100.0	
Missing	-1.00	36	59.0		
Total		61	100.0		

Respondents were then asked whether they would make more journeys per year to/from the mainland if there was a regular Sunday ferry service. 75% of respondents indicated that they would *not* make any more journeys, 18% indicated that they would make more leisure journeys and nearly 7% indicated that they would make both more leisure and business journeys.

Would you make more journeys per year to/from the mainland if there was a regular Sunday ferry service?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	46	75.4	75.4	75.4
	yes leisure	11	18.0	18.0	93.4
	yes leisure & business	4	6.6	6.6	100.0
	Total	61	100.0	100.0	

Respondents were then asked whether they would make more journeys per year to/from the mainland if services ran for all twelve months of the year. Just over 50% indicated that they would not make more journeys per year. Over 30% indicated that they would make more leisure trips and 16% indicated that they would make more leisure and business trips.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	32	52.5	52.5	52.5
	yes leisure	19	31.1	31.1	83.6
	yes leisure & business	10	16.4	16.4	100.0
	Total	61	100.0	100.0	

Lastly, respondents were asked whether they would make more journeys per year to the mainland if there were helicopter and airplane services on Sunday. 85% of respondents indicated that they would not make more journeys per year if there were Sunday helicopter and airplane services. Just over 6% indicated that they would make more leisure trips and 8% indicated that they would make both more leisure and business trips.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	52	85.2	85.2	85.2
	yes leisure	4	6.6	6.6	91.8
	yes leisure & business	5	8.2	8.2	100.0
	Total	61	100.0	100.0	

Conclusions

A substantial proportion of both visitors and residents (about 40% in each case) indicated that they would have made at least one of their journey legs on a Sunday, if a Sunday service was available. The impact on the number of journeys made, however, was much

smaller with 14% of visitors and 25% of residents indicating that they would make extra journeys with a Sunday service.

A Sunday service would also influence the number of nights that visitors stay on the Islands, with 33% of the visitors who said that they would use the Sunday service indicating that they would spend an extra night on the Island. Of these, about 7% said that they would also spend one more night on Cornwall: 6% said they would spend one less night in Cornwall. 20% of the residents who indicated that they would use a Sunday service reported that they would spend one more night and 44% reported that they would spend one less night on the mainland with a Sunday service.

Appendix C: Accent Fieldwork report

Memo

To: Isles of Scilly travel study team

From: Rachel Risely

Date: 30.01.06

Subject: Recruitment and RP fieldwork debrief note

This memo sets out a summary of the fieldwork conducted for the main phase of the Isles of Scilly travel survey.

Non-Resident Interviews – Revealed Preference

A total of 87 shifts were completed in order to conduct the non-resident RP interviews. All interviews were conducted face to face and were administered by Accent field interviewers. Depending on the mode, interviews were conducted either at the point of departure (in the case of the fixed wing and helicopter shifts) or in transit (in the case of the ferry shifts). The 87 shifts covered 710 interviewer hours and were split across the following modes:

- Lands End Airport: 25 shifts
- Ferry: 35 shifts
- Penzance Heliport: 27 shifts

In addition, interviewers conducted interviews at St Mary's Heli/Airport in between ferry sailings in order to avoid any down time during the shift.

Interviews achieved against quotas for each mode and trip length are shown in the following table:

Mode & trip duration	Quota	Achieved
Fixed Wing	300	392
Helicopter - day	300	283
Helicopter - long	300	538
Ferry - day	300	337
Ferry - long	300	341
Total	**1,500**	**1,891**

The average interview length was 15 minutes against the budgeted 5 minutes. However, response rates and productivity were we in excess of those anticipated.

At the completion of each face to face interview respondents were asked if they would be prepared to participate in a follow-up stated preference interview. Of the 1,891 RP respondents, 1,512 agreed to participate in the stated preference interview.

Non-Resident Interviews – Stated Preference

Stated preference show material was generated for and mailed to each of the 1,512 RP respondents who opted into the SP interview.

Respondents were telephoned from Accent's telephone unit in Bristol and appointments were scheduled to complete the SP interview once the show material had been received.

The fieldwork for the non-resident SP interviews was completed between 3rd September 2005 and 21st October 2005. A total of 401 interviews were completed from the 1,512 opt-ins. This represents a conversion rate of 1/1.77 against the anticipated conversion rate of 1/1.50.

The journey modes and trip lengths for each of the 401 completed stated preference interviews are shown against quota below:

Mode & trip duration	Quota	Achieved
Fixed Wing	75	79
Helicopter - day	75	76
Helicopter - long	75	93
Ferry - day	75	76
Ferry - long	75	77
Total	**375**	**401**

Resident Interviews – Revealed Preference

It was the intention that residents were not interviewed during the main phase of the study but that all the revealed preference data was collected via self-completion questionnaires. Following on from the pilot it was recommended that the resident RP questionnaire be split into three sections:

- Section 1 (S1) – to be completed by all. Covered general demographic information, questions relating to sea sickness fear of flying and the number and type of trips made in the past 12 months

- Section 2 (S2) – to be completed by those who had completed 1 or more business trips to the mainland in the past 12 months
- Section 3 (S3) – to be completed by those who had completed 1 or more non-business trips to the mainland in the past 12months.

In total the questionnaires covered 19 pages. If a respondent had completed both business and non-business trips over the previous 12 months they were be required to complete all 19 pages. There was concern that the length of the questionnaire would deter many potential respondents from participating. Therefore, it was agreed that only half of the database of households on the Isles would be mailed during the first mailing to test response rates.

The response rates from the first mailing proved to be in line with expectations. Therefore, the remainder of the household database was mailed with all three questionnaires. The final number of residents RP interviews mailed and returned is shown below:

Total households mailed: 965
Responses: 280
In-scope for RP inclusion: 251 (ie: 29 did not return section 1 of the questionnaire or did not complete the fields required for the model – ie: number of trips, cost information etc)
Returned S1 & S2:   16
Returned S1 & S3:   160
Returned S1, S2 & S3:   75

Including all responses this represents a response rate of 29%. Excluding the 29 returns that were deemed to be out of scope, the response rate falls to 26%. However, this is still above the anticipated response rate of 15%.

Of the 251 who responded to the mailing and were in scope, 84 also opted-in to the stated preference research. These were:

Business trips only: 11
Non-business trips only: 11
Both business & non-business trips: 62

The first mailing was dispatched on 7th October 2005 and the second on 21st October 2005.

Resident Interviews – Stated Preference

Stated preference show material was generated for and mailed to each of the 84 RP respondents who opted into the SP interview. Show material was generated

to reflect the journey purpose. Where respondents had completed both business and non-business journeys they were sent two sets of showcards, one for business and the other for non-business.

Respondents were telephoned from Accent's telephone unit in Bristol and appointments were scheduled to complete the SP interview once the show material had been received.

The fieldwork for the resident SP interviews was completed between 21st November 2005 and 28th November 2005. A total of 61 interviews were completed from the 84 opt-ins. This represents a conversion rate of 1/1.38 against the anticipated conversion rate of 1/1.50.

The journey types for each of the 61 completed stated preference interviews are shown below:

Business trips only: 9
Non-business trips only: 42
Both business & non-business trips: 10

Questionnaires and Show Material

Changes were made to the RP and SP questionnaires following the pilot interviews. These changes proved successful in the main phase and both questionnaires and all show material worked well.