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Road user charging in rural areas: Upper Derwent valley, UK

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Road user charging in urban areas and highways has been studied and implemented in several places worldwide. However, limited attention has been given so far to the impacts of a local road user charging scheme for rural or other protected areas, particularly in the UK. The focus of this paper is the road user charging scheme, which has been proposed for implementation in the Upper Derwent valley of the Peak District national park. By applying both quantitative and qualitative methods it is shown that such schemes share considerable differences compared to other urban or highway schemes, such as diverse objectives, trip purposes, visitors' value of time and dispersion of traffic in neighbouring areas. Nonetheless, management of a rural scheme, the evaluation method used, as well as equity issues appear to be equally significant as in other urban or highway schemes. The conclusion is that a road user charging scheme in the Upper Derwent valley could bring positive impacts by reducing high car usage at peak periods and creating additional revenue to serve essential improvements in the area, but is sensitive to the income and age of the visitors.

1. INTRODUCTION

Numerous cities worldwide have already implemented some form of road user charging schemes due to the surge in urban traffic. Currently there is a variety of such schemes, in London, Stockholm, Rome and the Norwegian cities in Europe, and Singapore, Hong Kong, Seoul, Melbourne, Toronto, New York and San Diego overseas (Kim and Hwang, 2005). Further similar schemes are being considered in various cities worldwide, as for example, Dublin (Rogers and Eagney, 2008), Copenhagen (Laursen and Nielsen, 2008) and Tokyo (Kato *et al.*, 2008; Sato and Hino, 2005). In Manchester citizens rejected plans for a road user charging scheme in a referendum (Owen, 2008). These schemes vary not only in their implementation (e.g. cordon or route-based schemes, technology used) but also in their respective aims. Often, the scheme objectives vary, from congestion relief (Ison, 2005a) to revenue generation (Langmyhr, 1997) and environmental concerns (Namdeo and Mitchell, 2008). Nonetheless, it is generally a combination of multiple objectives that leads to the introduction of a road user charging scheme.

It is apparent that urban areas have drawn most of the attention among researchers and practitioners when referring to road user charging schemes, despite the fact that the situation is comparable and the issues analogous when addressing transport management issues outside of urban areas. Rural areas and non-urban tourist destinations are the focus of this paper. National parks, which are mostly located in rural areas attracting large numbers of tourists, are considered as a homogeneous unit to research the implications of implementing road user charging in a non-urban area.

A wide range of policies, such as restrictive policies and economic dis/incentives, have been implemented globally in rural areas and national parks to deal with those concerns linked to increased congestion, environmental considerations or funding. However, there is an obvious gap in the transport and tourism literature regarding the role, analysis and conceptualisation of tourism transport or in a broader context the significance of transport management in rural areas (Hall, 1999).

In the UK, research and implementation concerning road user charging has been evolving at the same pace as abroad, focusing mostly on urban road user charging schemes. The interesting point in the UK context, however, is that until recently there has been an ongoing public debate, supported by the government, about the introduction of a nationwide road user charging scheme.

It is a decade now since the Department of the Environment, Transport and the Regions published the first report explicitly stating its intention to allow local authorities to charge road users (DETR, 1998). The Transport Act actually granting the aforementioned authority was passed at the end of 2000 (Transport Act 2000, 2000). Only pilot studies and relevant academic research had been conducted before 2000, despite road user charging having been under review in the 1990s. The only occasion when a trial had been conducted was in Cambridge between 1990 and 1993 (Ison, 1996). The setting changed significantly in the UK due to the initiative of London authorities to introduce a congestion charging scheme in 2003. Those facts prove the increased interest in implementing local road user charging schemes and the determination of the UK government to push towards a national road user charging scheme (Ladyman, 2007, 2008). Recently however, the Department for Transport (DfT) altered its view on a national road pricing scheme (Kelly, 2008), also due to high opposition by the public, expressed through an online petition in February

2007 which has been signed by 1·8 million people (Roberts, 2008). Following the rejection of the Manchester and Edinburgh schemes, there are currently no plans for a national scheme, although there is still increased interest about other local schemes.

However, one aspect of this interesting topic which has received very limited attention so far in the UK is the challenges and effects of such schemes for rural or other sensitive non-urban areas. In order to add to our understanding of the effects of these schemes for rural and sensitive non-urban areas this paper analyses the implications of the proposal to implement a road user charging scheme in an area of the Peak District national park.

2. LITERATURE REVIEW AND CASE STUDY

This section reviews the principles and the underlying issues of road user charging schemes, referring to why such schemes are used, how they can be implemented and why they are conceived as useful policy measures. Subsequently, background information about national parks in the UK is provided, along with a description of the site selected for the case study.

2.1. What is a road user charging scheme?

Road user charging may act as a corrective policy measure (Rouwendal and Verhoef, 2006). It is a measure used to allocate scarce road network capacity more efficiently. It manages to restrain traffic by charging users of a road network. The term 'road user charging' is used here as an encompassing term referring also to congestion pricing or other kinds of road pricing schemes.

The argument of Pigou (1920), which still stands nowadays, was that by implementing road user charging, road demand and congestion would decrease, whereas network speed and net benefits by travelling would increase (Santos and Rojey, 2004). Therefore, it is mostly implemented in congested routes or networks, but also as a revenue-raising measure in other cases (e.g. Norway). Congested routes are usually found in and around urban areas and so such schemes have so far focused mostly on these areas. However, it is obvious that congested routes or local networks may also be found in rural areas, which attract a large number of visitors, particularly for recreation.

There are various forms of road user charging, such as: road tolls, which may be used on motorways, tunnels or bridges either to fund specific transport projects or to provide general funding; congestion pricing, which is mostly used in urban areas to reduce congestion and provide funding for public transport; in/direct taxes, which may refer to vehicle licences or fuel tax. The collection of the road user charging fee may also be conducted by a range of means: toll booth, licensing, electronic toll collection or automatic number plate recognition. Experience has shown that each method has advantages and disadvantages and may be affected by local characteristics. In London for example, payment is convenient, but confirmation of fee payment is labour intensive and so the system operating costs are relatively high (Palma *et al.*, 2006). The electronic road pricing system which has been in place in Singapore since 1998 has proved to be successful in reducing congestion (Menon, 2000). The latter has replaced a previous paper-based area licensing scheme that had been operating since 1975.

Despite the variety of the incentives to introduce a road user charging scheme, the ambiguity regarding positive and negative effects, as well as the local specificities of each scheme, there have been numerous studies that demonstrate the potential benefits of such a scheme (Eliasson, 2007; Evans and Oswald, 1999; FHWA, 2008; Jones and Hervik, 1992; May, 1992; Niskanen and Nash, 2008; Santos and Fraser, 2006). One has to take into account the following issues however, before introducing a road user charging scheme.

2.2. Issues to consider

After the introduction of the first two road user charging schemes in the UK – in Durham (2001) and London (2003) – it has been argued that the question should no longer be whether to introduce more such schemes, but rather when to introduce them (Hensher and Puckett, 2005). Nevertheless, there are various issues to consider before or after the introduction of a road user charging scheme. Table 1 summarises the issues considered vital regarding the success or failure of any road user charging scheme, including schemes in rural areas.

All the issues mentioned in Table 1 have been identified as crucial in the implementation of a road user charging scheme in urban areas either in literature or by past practice (Kim and Hwang, 2005; Nash *et al.*, 2004; Palma *et al.*, 2006). However, it is noteworthy that the majority of existing evidence refers to urban or highways schemes (see http://www.cfit.gov.uk/map/index.htm for a summary of road user charging schemes worldwide). Hence, it is evident that a gap exists regarding the impacts of either a local road user charging scheme within rural or other sensitive areas such as national parks. This is quite striking if one considers the fact that it has been more than three decades since the first successful urban road user charging scheme worldwide was implemented in Singapore (Menon, 2000; Santos *et al.*, 2004) and more than 5 years since the Durham scheme was introduced in the UK (Durham County Council, 2002, 2003; Ieromonachou *et al.*, 2004). Therefore, this case study will provide useful contrasts between rural and urban road user charging schemes, considering the issues included in Table 1.

2.3. Transport and recreation

After the emergence of recreation as an organised activity of the public in the latter part of the twentieth century, transport has constituted an intrinsic element of it in both urban and rural areas. Previous studies have acknowledged this fact by

Geography of the area
Financial issues
Road user charge fee level
Equity concerns
Privacy issues
Capacity and commitment of managing authority (including toll collection) (Kim and Hwang, 2005)
Evaluation issues (NERA *et al.*, 2006)

Table 1. Main issues to consider when designing a local road user charging scheme

using variable values of time for different transport user groups (Mackie *et al.*, 2001). The focus in this paper is transport to national parks in particular, which are considered recreational areas, although the situation in the UK is slightly different in comparison with other European countries or the United States of America.

A wide range of transport management schemes have been employed worldwide to manage travelling to and from recreational sites. Transport demand in such sites may be categorised in the following way based on Hall (1999).

(*a*) Demand by the host community: residents, often not involved in the local recreational activities.
(*b*) Demand by employees of the recreational activities: those employees may be either local residents or incomers from other regions, who need to access the recreational site outside visitor hours.
(*c*) Demand by visitors: tourists, whose principal reason for visiting is for recreational purposes.

This categorisation also fits the profile of transport demand for national parks in the UK and elsewhere. However, it is the third group – that is, visitors – who are mostly responsible for acute traffic congestion at 'honey pots' in either urban or rural areas.

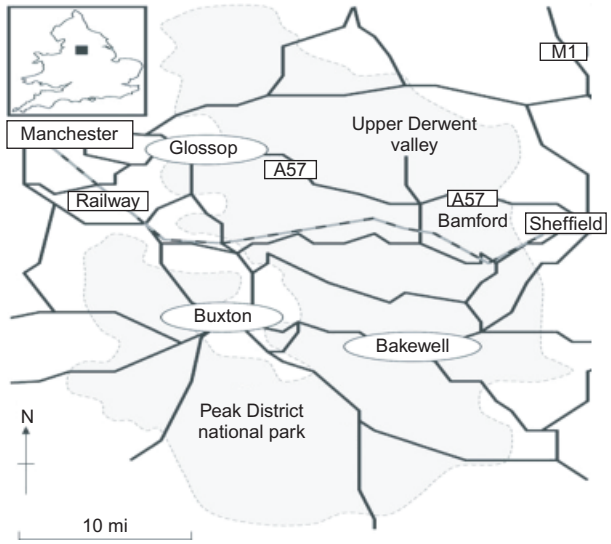
Large visitor numbers and restricted access have been the main reasons for the introduction of the Durham road user charging scheme by local authorities in 2002. The situation has improved after the implementation of this scheme (Durham County Council, 2003). This has motivated various national park authorities to consider the implementation of road user charging schemes at certain 'honey pot' rural areas (Eckton, 2003; Maclellan, 2007; Steiner and Bristow, 2000) and the Upper Derwent valley in the Peak District National Park has been selected as the only non-urban area to pilot such a scheme in the UK.

2.4. Site

The Peak District National Park, located in the centre of England (Figure 1), is the second most visited national park worldwide, after Mount Fuji in Japan (Derbyshire County Council, 2004). According to Nicholson (2007), 32% of the population of England could reach the Peak District national park within one hour's drive (Nicholson, 2007). The Peak District National Park Authority's data reveal that 15·7 million people live within 60 miles of the park's boundaries. This results in 75% of staying visitors to be from home or neighbouring counties, whereas 22% are from other counties within the UK and 3% are from overseas (PDNPA, 2003).

National parks in the UK are mostly rural areas of natural beauty, which are designated by the Environment Act (Environment Act, 1995) to conserve and enhance the natural beauty, wildlife and cultural heritage of the national parks, and also to promote opportunities for the public understanding and enjoyment of the special qualities of the parks. A major differentiation of UK national parks that is worth mentioning is that access is free. In contrast, many other countries apply an entrance fee to national parks, either as an operational-administrative fee or as part of a broader transport management scheme.

Within the Peak District National Park there is a wide variety of landscapes which allow for a range of activities to be carried out. Nevertheless, there are certain spots which are considered as 'honey pots' due to their attractiveness and the facilities offered. The Upper Derwent valley is one of those 'honey pot' areas, attracting about 2 million out of the over 25 million annual Peak District visitors (PDNPA, 2008). It is located in the north part of the park, off the A57, which links Sheffield to Manchester (Figure 2). Its proximity to those two conurbations is one additional reason for its high visitor rates, but there are also other towns in the surrounding area, such as Huddersfield, Chesterfield and Derby. Surveys have shown that the majority



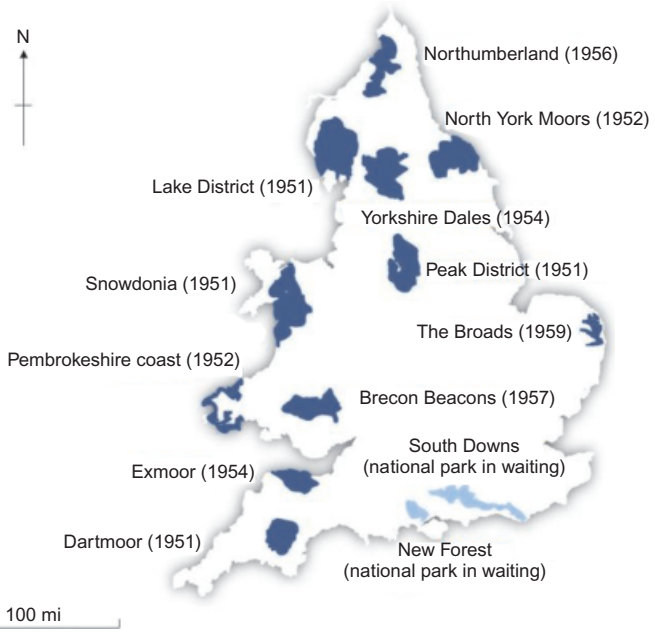


Figure 1. National parks in England and Wales

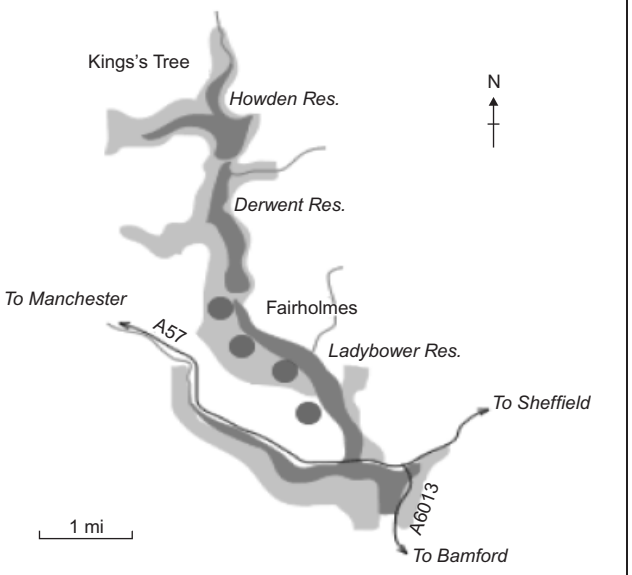


Figure 2. Upper Derwent valley car parks. ● stand for local car parks

Figure 3. Cars parked illegally on the verges and clearway between Hagg Side and Derwent Overlook – Sunday 29/10/2006 (Nicholson, 2007)

(almost 90%) of the trips to the Peak District National Park are made by car, whereas less than 10% are made by public transport. The situation in the Upper Derwent valley is similar (Derbyshire County Council, 2004), with the vast majority of visitors arriving by car.

The natural beauty of the valley is partly owed to the three large water dams built during the first half of the twentieth century: Howden (1912), Derwent (1916) and Ladybower (1945). It is the interaction of water and the surrounding landscape, in conjunction with the available recreational activities, which makes this area one of the most visited areas within the Peak District National Park (Nickolds, 2004).

2.5. Scheme

So, why is there a need to affect the tranquillity of such a location in a national park and consider the introduction of a road user charging scheme? The answer is given by the local authority: 'On August bank holiday 2001, 3044 vehicles travelled along Upper Derwent valley – almost three times more than a normal summer day'. An incidence of high visitor numbers and augmented traffic for that time has been reported as early as 1978 (Nicholson, 2007). This means that congestion existed also at that time. Increasing car use and increasing congestion on busy days has led the authorities to the conclusion that some form of action needs to be taken. The fact that Derwent Lane is a cul-de-sac, parking spaces in the surrounding area are limited (not exceeding 500 places in Derwent Lane in total), and that the public transport service was inadequate for those busy days, contribute to converting the problem into an acute one, as shown in Figure 3.

Thus, although there are other congested rural areas in England, due to the unique geography of the place as well as the political will to implement a pilot scheme in a rural area, the Upper Derwent valley appeared to be an interesting case to study the potential effects of a road user charging scheme outside an urban area. Funds were secured to financially support this pilot scheme through local transport plan 1 (Worth and Thomson, 1999), a partnership was formed between the local authority and also the Highways Agency, the water company which manages the reservoirs, the Peak District National Park Authority, the district councils, the Forestry Commission and the National Trust.

The initial objective was to reduce congestion levels on busy summer weekends and bank holidays and improve recreational opportunities. Furthermore, the scheme would aim to improve car parking and public transport provision. However, some additional more general objectives have been added to this pilot scheme since its inception.

(*a*) Maintain and improve the quality of the environment in the area.
(*b*) Improve the facilities available to visitors of the area.
(*c*) Support the sustainable development of the area.

Quite a few key aspects of the scheme had never been finalised, but there have been some guidelines about the main scheme aspects: those who would prefer to drive in Derwent Lane would have to pay a fee and a park-and-ride service would be offered for those who would prefer not to drive in Derwent Lane. Currently there exist four free car parks along Derwent Lane (Table 2) and one pay-and-display car park at the information centre (Figure 4), managed by the water company that manages the reservoirs in the area. Among the issues which needed to be further looked at were the use of any

Parking sites	Parking places
Information centre – Fairholmes	200
Derwent overlook	100
Hikeside	20
Bridgeend	50
Hirschcliffe	30
Heatherdene	50
Total	450

Table 2. Estimation of car park places in Upper Derewent valley

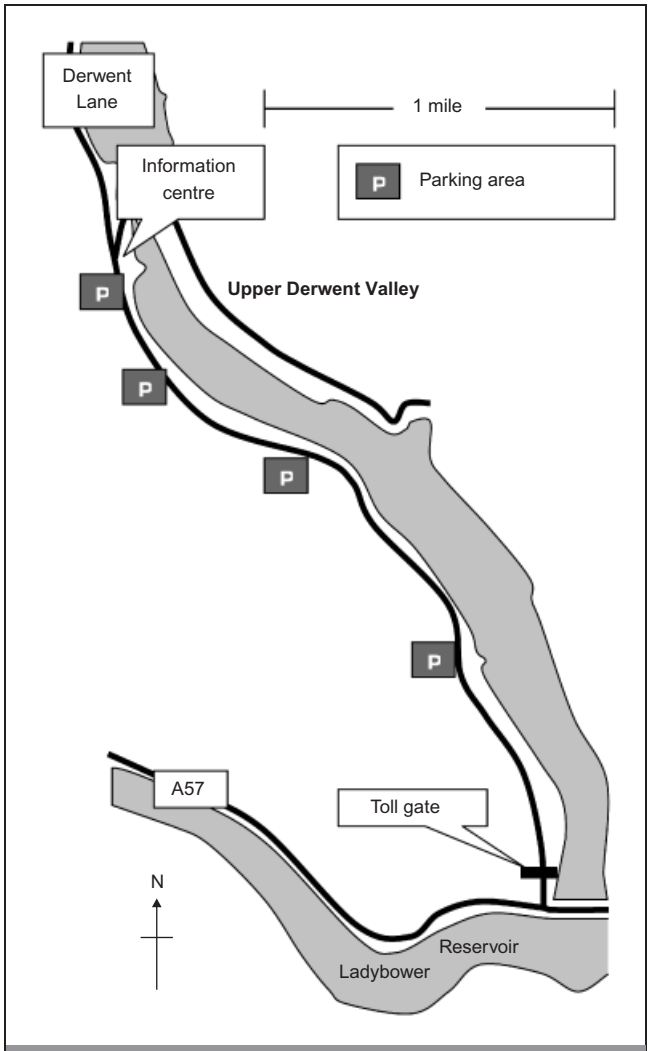


Figure 4. Car parks and Information Centre location in Derwent Lane, off the A57

revenues of the road user charging scheme (earmarking), the fee and bus fare level, the technology to be used, the managing authority of the scheme, any discounts for scheme users and the deriving equity implications, as well as the overall appraisal framework of such a scheme.

For a variety of reasons the Upper Derwent valley road user charging scheme has not yet managed to become the first such scheme outside an urban area in the country, although it has been included in local transport plan 2, which is put forward by the same partnership. Thus, it has not been shortlisted in the successful transport innovation fund (TIF) schemes proposed in 2005 and 2006 (DfT, 2007). Nonetheless, it stands as a valuable example in the debate of whether and how to implement local road user charging schemes.

3. METHODOLOGY AND FINDINGS

The methodology applied in this case study was a combination of quantitative and qualitative methods, as the aim was twofold: to assess the situation at Upper Derwent valley and to assess any potential impacts of the implementation of a road user charging scheme in the area. Thus, qualitative analysis complements the quantitative findings.

3.1. Quantitative analysis

3.1.1. Demographic and stated preference survey. A range of quantitative methods were considered for this case study. Using travel elasticities to assess travel demand (Olszewski and Xie, 2005) was not possible, as sufficient data were not available. Additionally, there is the open question of which travel time to use for such an analysis: the whole trip travel time or solely the travel time within the Upper Derwent valley? The answer to this question has a large impact on the analysis outcome. As there is no road user charging scheme yet implemented in another rural area or national park in the UK, it was impossible to conduct a revealed preference survey either (Eckton, 2003; Steiner and Bristow, 2000). Therefore, a stated preference (SP) survey has been conducted via a questionnaire to capture any potential alterations in visitors' travel behaviour. The innovation of the stated preference survey lay in the fact that the survey was not only conducted at the destination point (i.e. at Upper Derwent valley) but also at certain points of origin (i.e. the two main cities nearby). This is particularly important when assessing recreational activities, in contrast with the assessment of business activities within most urban road user charging schemes. The questionnaire also included questions about visitors' characteristics to understand the demographic and socio-economic issues of the scheme. The surveys were conducted during weekends and the bank holiday of summer 2003 and 2004. This period has been selected as the proposed scheme was supposed to be implemented only during bank holidays and summer weekends. Over 1200 questionnaires were handed out both at points of origin (i.e. Manchester and Sheffield) and the point of destination (i.e. Upper Derwent valley). At the points of origin, questionnaires were distributed at various locations, as the aim was to have a diverse sample. The two largest shopping centres in Sheffield and Manchester were identified as popular weekend recreational sites. In order to target car users, questionnaires were distributed at car parks. Furthermore, questionnaires were distributed at Sheffield bus interchange and the bus route linking to the A57 from Manchester. In addition, a few questionnaires were distributed in three neighbourhoods near the A57 south-east of Manchester.

The questionnaires were distributed by hand and the responses were received by post. Respondents at points of origin were filtered while handing out the questionnaires, depending on whether they have visited the Upper Derwent valley in the past. Moreover, a filter question existed at the beginning of the questionnaire asking respondents whether they have visited the Upper Derwent valley and how long ago this was. Their trip frequency to the Upper Derwent valley was included in the questionnaire.

The return rate was 46·1% at the point of destination, whereas it was only 10·65% at the points of origin. This difference in the response rate may be attributed to a variety of reasons, including the obvious interest and motivation of the visitors already in the Upper Derwent valley. However, it is acknowledged that in this case study it is mostly due to sample bias and interest in the respective survey and the proposed road user charging scheme.

Responses from the stated preference questionnaire were

analysed by the multinomial mixed logit model with the normal distribution. Respondents of the stated preference questions had to choose one of the three options offered (Table 3).

(*a*) 'Auto' option: pay a toll fee for road use and drive into Derwent lane to get to the information centre.
(*b*) 'Bus' option: arrival near the valley by any mode and then use complementary park-and-ride service to get to the information centre in Upper Derwent valley.
(*c*) 'Cancel' option: cancel the trip to Upper Derwent valley and go elsewhere instead (or stay at home).

Five attributes with four levels each were selected and equally distributed in the 16 fractional factorial experiments to form a lattice square in a design with 16 questions (Lindner and Rodger, 1997). The following attributes were selected.

(*a*) Road user charging fee (£): a toll fee payable to enter Derwent Lane from A57.
(*b*) Park-and-ride fare (£): a fare for bus service, which links local parking areas, Bamford train station and the Upper Derwent information centre.
(*c*) Frequency of bus service (min): time intervals between departure times of the shuttle bus.
(*d*) Search and walking time (min): the sum of time needed to find a car parking place and to walk to the information centre.
(*e*) Parking fee difference (£): the difference between the 'auto' and 'bus' options paid by visitors: toll fee and parking fee for the 'auto' option, bus fare for 'bus' option.

The four levels for each attribute were determined by using the boundary value evaluation technique (Fowkes, 2000). Those levels have also been confirmed as rational by the stakeholders who participated in the case study. Data about vehicle numbers in the area have not been officially reported; however, vehicle numbers during a summer holiday period were counted during the SP survey and the local authority has been counting vehicle numbers at the entrance of Upper Derwent valley. These traffic data were considered while conducting the quantitative analysis.

3.1.2. Quantitative findings. Table 4 shows the results of the stated preference survey at the points of origin and destination. The willingness to pay the road user charge at each point is compared below.

The average willingness to pay the road user charge was found to be £2·37 at the point of destination and £1·55 at the points of origin. As was expected, willingness to pay the road user charge is higher at the point of destination as respondents who have recently visited the site have a higher utility and value the valley more. Those two values are also subject to the sample limitations and common stated preference bias (Lu *et al.*, 2008). Both values are near the £2–3 margin that was found to be the most probable and preferable fee by the stakeholders interviewed for this case study. However, the median of £2 seems to be a better representation of the central value as shown in Figure 5, where there is around 30% probability density towards a £2 fee, the highest among responses. Previous research (Steiner and Bristow, 2000) has produced similar results, offering a median value of £2·80 and again a high probability density at £2.

Conditions to visit the Information Centre		
Park-and-ride service	Toll and drive	Under these circumstances I would
Fare 20p per person	Toll £2·00 per car	[✓] Park and ride
A bus every 15 min	Searching for a parking space and walking to the centre takes 30 min	[ ] Pay toll and drive
Parking fee 50p per car	Parking fee £2·50 per car	[ ] None of them (don't visit the valley)

Table 3. Example question of the stated preference survey

Coefficients	Parameter	Estimate	Std error	*t*-value
Points of origin				
β_1^t	Toll – bus fare	−0·415	0·0492	−8·43
β_2^t	Search and walk time	−0·022	0·0044	−4·83
β_3^t	Park fee difference	−0·520	0·1011	−5·14
α^t	Toll and drive	1·554	0·1689	9·20
α^n	None – don't visit the valley	−0·344	0·0759	−4·54
Point of destination				
β^t_1	Toll – bus fare	−0·628	0·029	−21·34
β^t_2	Search and walk time	−0·033	0·002	−14·66
β^t_3	Park fee difference	−0·567	0·059	−9·67
α^t	Alternative specific constant (toll and drive)	2·374	0·103	23·10
α^n	Alternative specific constant (not go)	−0·921	0·045	−20·37

Table 4. Stated preference survey results

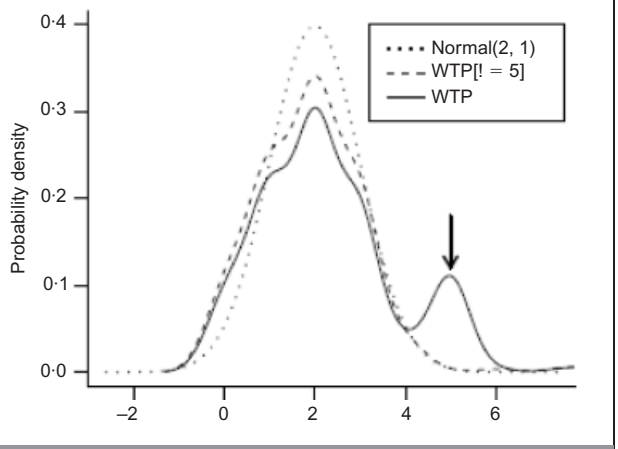


Figure 5. Density of willingness to pay (WTP)

An additional interesting finding about the road charging fee level was a small peak of responses at the value of £5. There is no clear reason to explain this apart from questionnaire bias (Lu *et al.*, 2008) and a potential response influence by the London congestion charge (£5) which was introduced a few months earlier and was widely covered by media at a national level. Respondents were possibly influenced by the maximum toll value used in the SP survey (£5), which was asked before this willingness to pay (WTP) question.

The survey at the point of destination showed that only 16% of the respondents came from the same local county council as that to which the Upper Derwent valley belongs. The majority of visitors (60%) came from local towns and surrounding cities including Sheffield and Manchester. This is possibly attributed to the proximity of this area of the Peak District national park to those large conurbations via the A57 (Sheffield is only a 20 min drive away from the Upper Derwent valley). Socio-economic characteristics of the on-site survey respondents are shown in Figure 6.

The survey at the car parks in Upper Derwent valley showed that visitors spend on average 4·1 h in the valley. The value of time of respondents at the point of destination was estimated based on the stated preference survey and was found to be 7·24p/min, which is close to the non-commuting values of time in the report of the Department for Transport (i.e. 7·55p/min). The value of time in this case is essentially the difference between bus and private car use within the valley area. In such, the time included in this value includes the searching time to find a car park, walking time from the car park to the Information Centre, as well as bus headway time. The travel time from home (i.e. trip starting point) to the entrance of the Upper Derwent valley is not included in the respondents' value of time estimation. Table 5 shows the proportion of visitors who chose to park at the pay-and-display car park at the Information Centre. Those results have been disaggregated by age and frequency of visits (Figures 7 and 8). This disaggregation was chosen to present the differences in behaviour depending on the age group. Only 50% of younger-aged visitors (24 or younger) were observed to park their vehicles at the Information Centre pay-and-display car park. On the other hand, 82% of those older than 65 years and more than 70% of those older than 25 years chose to park their vehicle at that car park. This difference among age categories may be partially attributed to income differences, apart from the obvious walking desirability variation. Income data were provided by the questionnaires, but no generalised conclusion can be drawn by the sample regarding visitors' income.

Another interesting result about visitors' behaviour is the relationship between their frequency of visit to the Upper

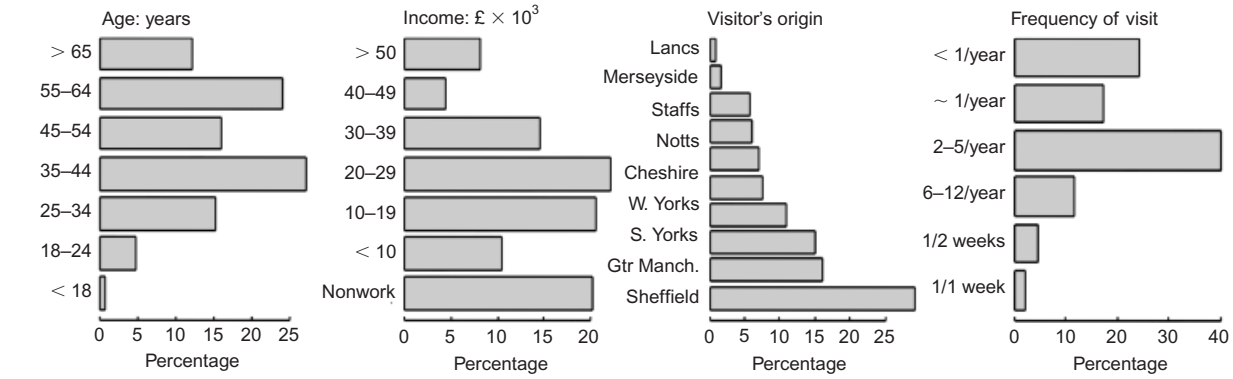


Figure 6. Socio-economic characteristics of visitors to Upper Derwent valley

Park fee (£)	0	0·5	1	1·5	2	2·5
Parking time up to	–	1 h	2 h	3 h	4 h	1 day
Parking at Information Centre?	No	Yes	Yes	Yes	Yes	Yes
Percentage of visitors	26·8	5·1	2·9	1·0	6·4	58·0

Table 5. Parking costs and proportion of visitors at the Information Centre

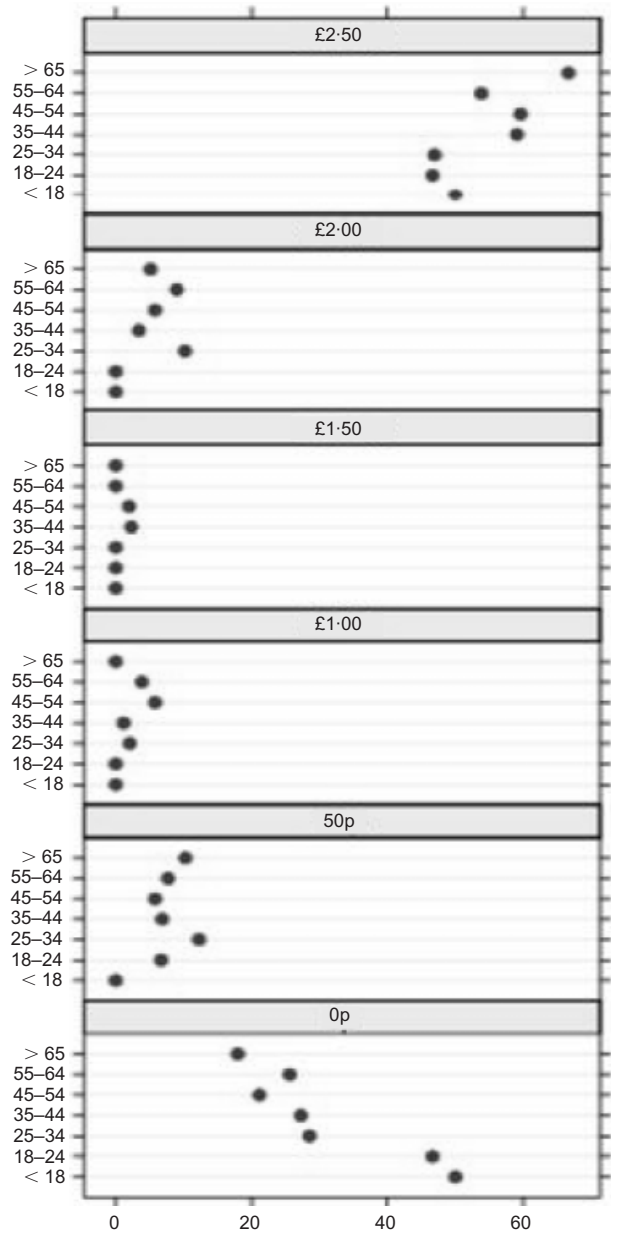


Figure 7. Percentage of visitors who would pay the parking fee, disaggregated by age

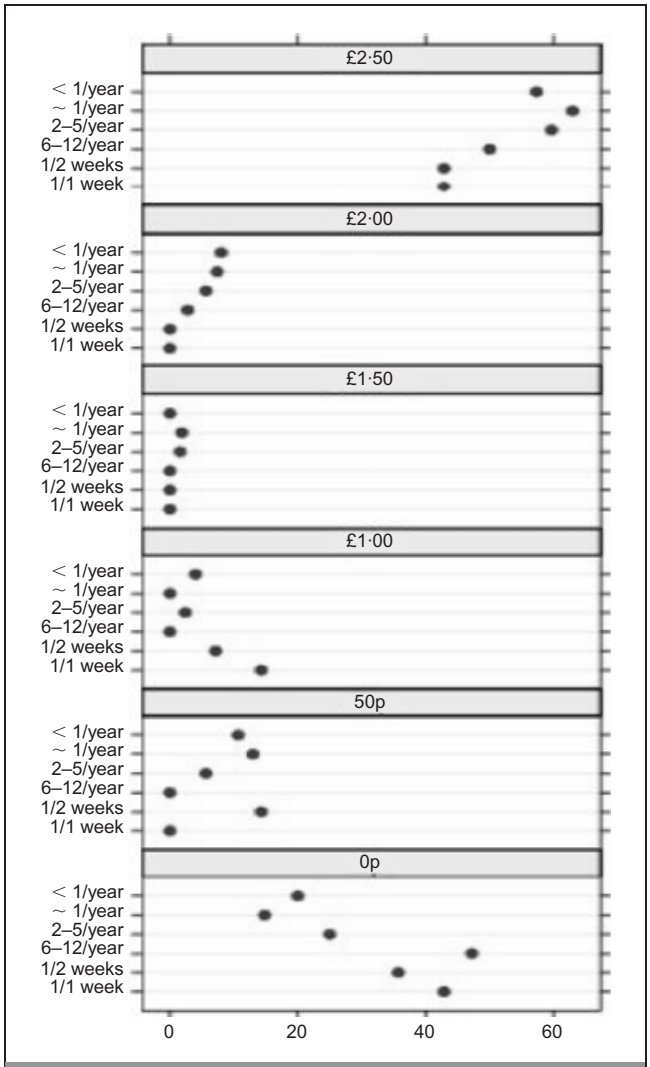


Figure 8. Percentage of visitors who would pay the parking fee, disaggregated by frequency of visits

Derwent valley (Figure 9) and car park selection, which may contrast with findings based on age distribution. It was found that frequent visitors predominantly come from neighbouring areas, whereas occasional ones came from more distant areas.

Frequent visitors are less likely to park their car at the Information Centre and thus avoid the parking fee. In contrast, the occasional visitors seem more inclined to paying the £2·50 pay-and-display fee. This behaviour corresponds with the general view that infrequent visitors do not mind so much paying a parking fee to enjoy a day in the countryside. This is particularly relevant to this case study, as the proposed road user charging scheme would only be implemented on bank holidays and busy summer weekends.

The analysis below is based on the multinomial logit model

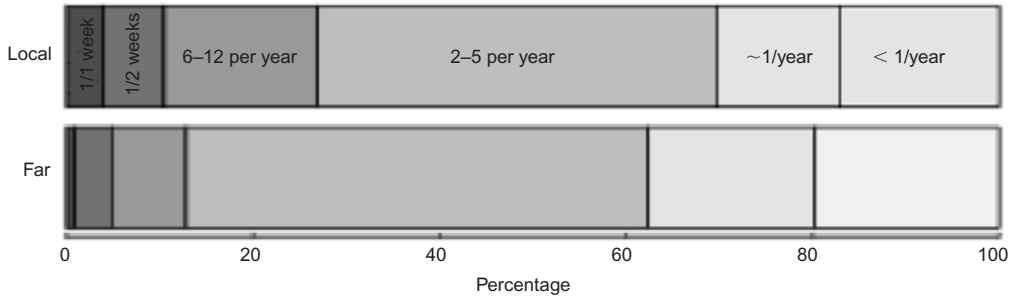


Figure 9. Visiting frequencies to Upper Derwent valley from local/far areas

between three modes. Parking fee for 'bus' option is 50p, 'bus' fare is also 50p and bus headway is 30 min, based on the interview with the stakeholders. It is apparent in Figure 10 that the 'Auto' option has a negative trend, decreasing as the toll fee increases, whereas the 'bus' and 'cancel' options have a positive trend against the toll fee. Although there is a trend showing that people would not visit Upper Derwent valley, this is not very significant and definitely not as strong as the mode shift from 'auto' to 'bus'. The trend of not visiting the valley because of the implementation of a road user charging scheme was found to be more intense at the survey conducted at the points of origin, which should receive further attention. Figure 10(a) shows travel behaviour avoiding any parking fee, whereas Figure 10(d) shows travel behaviour at the Information Centre. Nevertheless, it should be stated that any conclusions drawn out of this model are not indisputable, as no park-and-ride option currently exists in conjunction with a road user charging scheme either in Upper Derwent valley or other UK national park. The expected probabilities of travel mode choice after the implementation of a £3 road user charging fee are included in Table 6.

To summarise the results of the quantitative analysis, the introduction of a road user charging fee of £3 would alter the travel behaviour of visitors depending on where they would park their vehicle. There is a modal change (42%) towards bus for those (currently) parking at the Information Centre, while this change would be smaller (27%) for those using other car parks (Table 6). Of course travel behaviour will also depend on visitors' age and income as has been shown in the socio-economic analysis. Moreover, it appears that the majority of visitors travelling by bus still start their bus journey to Upper Derwent valley from Sheffield and Manchester (Table 7).

3.2. Qualitative analysis

3.2.1. Stakeholders interviews. Interviews with stakeholders in the area were conducted in summer 2004 using a semi-structured questionnaire including 30 questions. The stakeholders were from local authorities, local businesses and other organisations, researchers, as well as environmental and recreational organisations active in the area. The questionnaire was divided in three thematic parts.

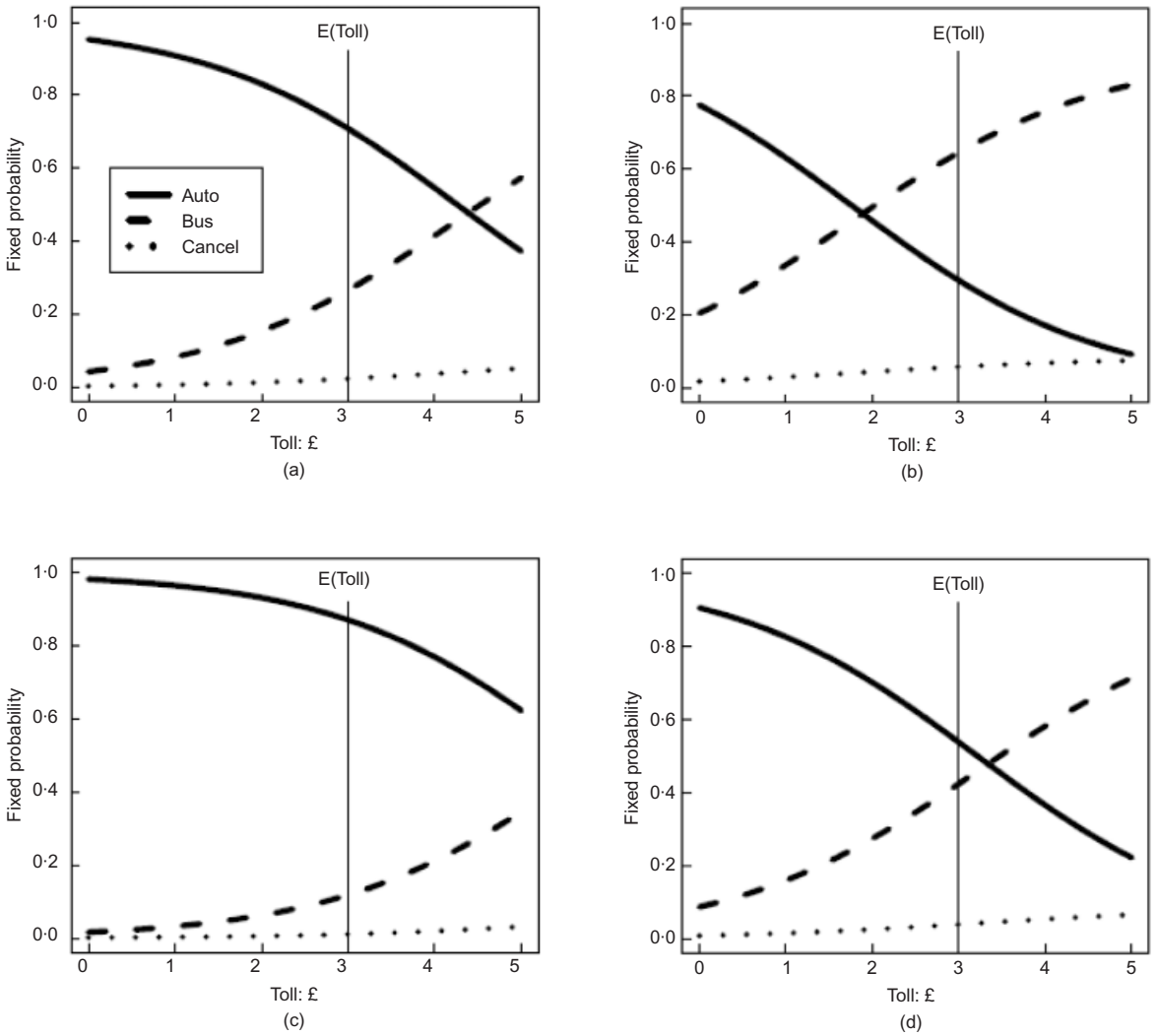


Figure 10. Results of the multinomial mixed logit model showing travel behaviour alterations: (a) no park fee for auto, search and walk: 20 min; (b) park fee £2·50 for auto, search and walk: 20 min; (c) no park fee for auto, search and walk: 0 min; and (d) park fee £2·50 for auto, search and walk: 0 min

Park at	Toll: £	S+W: min	Parking: £	Probability		
				Auto	Bus	Cancel
Centre	3	0	2·5	0·54	0·42	0·04
Other	3	20	0·0	0·71	0·27	0·02

S+W stands for search and walking minutes; Parking, parking fee for the Auto option.

Table 6. Expected probabilities of each mode choice between parking locations

Station	Journeys: %
Manchester	25·2
Sheffield	38·9
Other destinations/origins via Sheffield	11·5
Other destinations/origins via Manchester	9·7
Other destinations which could be via either Sheffield or Manchester	4·9
Other Peak District destinations en route	4·0
Other non-Peak District destinations en route	5·8

Table 7. Origins and destinations of journeys to Hope Valley line stations (amended from Nicholson, 2007)

(*a*) A stakeholder's group interaction with Upper Derwent valley and awareness of the area.
(*b*) Current situation in Upper Derwent valley and road user charging scheme awareness.
(*c*) Discussion about stakeholder's attitude towards the proposed scheme and its effects on the surrounding environment.

Twelve stakeholders were selected to participate (Krippendorff, 2004). The group of stakeholders was divided into two subgroups in an attempt to represent both insiders and outsiders of the design process. The initial attempt was to include all stakeholders who had previously participated in consultations about the proposed road user charging scheme organised by the Peak District National Park Authority. Even though the final sample may not have been fully representative (Thomopoulos, 2004), the findings have certainly been illustrative and informative about the situation in Upper Derwent valley. Secondary sources such as the minutes of local authority meetings and local newspapers have also been used to complement the analysis.

3.2.2 Qualitative findings. As already stated, the group of stakeholders was divided into outsiders and insiders of the design process, partially reflecting attitudes for and against the proposed road user charging scheme. Content analysis provided the qualitative findings, which have been categorised in key issues for all stakeholders. The respective role and impact of each stakeholder in the decision-making process of the proposed scheme has been evaluated.

It was interesting to find that the awareness level about the proposed road user charging scheme was low. Only three stakeholders (25%) who were involved in the local partnership which manages Upper Derwent valley were informed about the scheme at an adequate level. An additional two stakeholders had been informed about the scheme through secondary sources, but were not aware of any details about it. Consequently, it is not surprising that the scheme objectives had not been clearly communicated to 'outsiders' either. Stakeholders mentioned environmental issues such as sustainability, noise levels, emissions and visual intrusion along with financial issues as the scheme objectives, apart from the obvious traffic management aim. It is notable though that the scheme should be seen as fair and reasonable, as stated by an 'insider', raising equity issues for visitors.

Another key issue identified was the location of the car park which will be linked with the park-and-ride provision of the proposed scheme. Due to the complexity of the issue and the actors involved, no firm decision had taken place about it. Land ownership and visual intrusion in the heart of the national park were insurmountable obstacles. Similar concerns are not common for urban schemes when considering park-and-ride schemes. Nonetheless, two 'outsiders' had pointed to the need for a park-and-ride scheme to Upper Derwent valley. Their suggestion was that it would operate at a nearby conurbation, instead of a location within the park.

The third important issue highlighted was the use of revenues raised by the proposed road user charging scheme. All but one stakeholder agreed that any revenues should be reinvested in the area; however, the priorities of the managing authorities and whether there would be a need for constant improvements in the area were not specified. Therefore, it was not possible to conduct any accurate estimation of the potential scheme revenues, as there are several key decisions to be taken, namely fee level, car park location, technology to be used.

Furthermore, the issue of accessibility to and from the site is

deemed crucial. It has been noted that Upper Derwent valley attracts visitors not only from the surrounding region but also from more remote regions. Therefore, public transport should be easy to use and should also provide access to specific groups of visitors such as the elderly, disabled or cyclists. Service frequency during peak periods was also important.

Finally, the issue of traffic dispersion has been emphasised, as this cannot be overlooked in a site within a national park. All stakeholders had a view on this, but it was mainly 'outsiders' who placed more weight on it. 'Insiders' expressed concerns, yet admitted that this issue cannot be addressed before the road user charging scheme is implemented, as it is extremely difficult to make accurate estimates. However, the majority of stakeholders anticipated that previous traffic to Upper Derwent valley will be dispersed to other sites within the Peak District National Park. This was partially confirmed by the quantitative analysis too, although relevant literature notes that a range of reasons influence visitors' decision to substitute a visit to Upper Derwent valley with a visit to another place within the Peak District National Park (Caulkins *et al.*, 1986).

4. DISCUSSION

The combination of quantitative and qualitative analysis in this case study assisted in capturing any underlying issues and provided an in-depth analysis and insight into the proposed road user charging scheme. The issues highlighted in Section 3.1 and the findings of Section 3.2 are discussed here and examined in conjunction with Table 1 to contrast the findings of the Upper Derwent valley case with findings of other (urban) road user charging schemes.

One of the main issues that is key to any successful and acceptable road user charging scheme, is having clearly predefined objectives. This has not been the case in Upper Derwent valley, as apart from reducing congestion, a variety of objectives feature in the aims of the scheme, namely sustainable development, facilities improvement and wider environmental improvements. This finding corresponds with the Peak District National Park Authority's report (Thompson, 2003) which states that any road user charging scheme within the Park should not only protect the environment but also meet other objectives, such as reduction of congestion at peak times, raising revenue for local improvements and at the same time be fair and reasonable. This has been the case for other similar schemes in the UK, proposed to be implemented in urban areas such as Edinburgh and Manchester. So, one may conclude that a wide range of diverse aims has been attributed to a local scheme, although no specific target has been yet identified for any of those diverse objectives. The latter point raises obvious issues in the scheme's appraisal – both ex-ante and ex-post – as stated also in Section 3.2.

The use of scheme revenues highlighted another quite controversial issue. Although it was suggested that any revenue should be used in the area, the primary objectives to be funded by this revenue have not been made clear. The fact that there are a number of authorities involved in the design and management of this particular scheme does not make the situation less complicated. There has been some discussion about whether public transport should be the main benefactor of any scheme revenues (to set up a functioning park-and-ride scheme) or whether other facility improvements should be primarily funded by this revenue (e.g. path improvements, cycle lanes). Similar discussions were held in Edinburgh (Laird *et al.*, 2007) and Stockholm (Eliasson, 2007) regarding funds hypothecation, which have obviously affected each scheme's acceptability level. London stands as a successful example in the UK, as there is a sole authority which promoted and currently manages the congestion charging scheme. Notwithstanding, there are two further pertinent questions: (*a*) whether there is a constant need for facilities improvement in an area of natural beauty such as a national park and whether this follows the overall objectives of UK national parks (Environment Act, 1995); and (*b*) what is the expected revenue level, which will inevitably affect the ability for any improvements. The second question is crucial no matter which particular model is used to evaluate the scheme (Mackie, 2005; Prud'homme and Bocarejo, 2005).

The second point is clearly a financial issue as described in Table 1 and is also contrasted to the level of the road user charging fee, which would definitely influence travel behaviour as shown in Section 3. This issue may influence the viability of the proposed scheme, as trip purpose in the Upper Derwent valley is definitely different in comparison with similar schemes in urban areas. Moreover, visitors' value of time is lower for leisure purposes in rural areas than the value of time for commuting or business in urban areas (Wardman, 1998). This observation is intertwined with the option to visit other places within the national park which would merely transplant the peak period congestion to other places in the region. This effect has been observed elsewhere, particularly at cordon schemes which have lower elasticity (Olszewski and Xie, 2005). However, research in other rural areas shows that the ultimate effect of this might be a reduction in car miles travelled, as alternative destinations would usually be closer to the visitors' origin (Mendes, 2003; Steiner and Bristow, 2000). However, the degree of substitutability between recreational destinations varies and depends not only on distance and travel cost but also on site characteristics and visitors' preferences (Caulkins *et al.*, 1986; Morey, 1981).

Furthermore, the geography of the place was identified not only as a benefit but also as a potential disadvantage of the area by stakeholders. This issue is linked to the main difficulty of implementing this particular scheme, which is the lack of a suitable location for the park-and-ride car park (Nicholson, 2007). The fact that the Upper Derwent valley is part of a national park means that it has to abide by certain strict regulations, which usually does not constitute a major issue for urban schemes. Thus, apart from the inherent difficulty of designating a location with an appropriate size, this car park would not have to be intrusive.

Similar restrictions apply to the technology to be used in the implementation of the proposed road user charging scheme, which again is a considerable difference in comparison with urban schemes. Installing and monitoring the required technology is not supposed to obstruct the surrounding environment of the area. Therefore, no technologically advanced system may be employed as in successful urban schemes such as London and Singapore. Use of global

positioning systems (GPSs) would be an option, but this would only be considered if a national scheme were implemented in the UK. Otherwise, the authorities would promote either a pay-and-display system in all car parks or a flat toll payable at the entrance of Derwent Lane (Figure 4). The apparent benefit of this option though, as for most rural schemes, would be that there are no privacy issues to be addressed, which retains a lower level of complexity in managing the scheme. Privacy issues have been taken into account in urban schemes, such as London and Stockholm to name a few.

As already mentioned, this goes back to the issue of scheme management. It has been stated that the fact that the scheme will be managed by a partnership of organisations with diverse objectives and hierarchy may cause difficulties in decision making, but it has also been acknowledged that the local partnership is an established one and has worked well for a few decades already.

Equity issues are a further issue that is often raised with regard to urban road user charging schemes (Eliasson and Mattsson, 2006; Kim and Hwang, 2005). Various options have been considered in urban schemes addressing the needs of specific user groups. In rural areas though the situation is quite different as trip purpose and value of time are naturally different. Discounts for elderly visitors have been considered in this case study, to address vertical equity issues. This option was selected for analysis as the national park issues discounts for car parks within its boundaries based on age and residence. Findings show that such a discount would have positive effects. Alternative or additional equity analysis based on income or other factors was not possible due to unavailability of data.

There are more potential benefits of such a scheme for a rural area compared to an urban one, but it is very difficult to place monetary values and evaluate benefits such as visual intrusion, accident reduction, reduced severance. Any effects on reduced environmental pollution and noise level will have to be reviewed when relevant data are available.

5. LESSONS TO BE LEARNT FROM THIS CASE STUDY

A summary of the lessons highlighted by this case study follows, highlighting potentially useful points for other rural road user charging schemes.

(*a*) Upper Derwent valley may be a useful case study to assess road user charging implications in a rural area, mainly due to the geography and the natural beauty of the place. However, it should be stressed that it is a very unique case, so it is hard to draw any generalised conclusions as each case study has its own regional and other characteristics (Kim and Hwang, 2005).

(*b*) The fact that there is more than one authority involved in managing the scheme complicates decision making and objective setting.

(*c*) Any issues still unresolved, namely road user charging fee level, park-and-ride location, bus route, bus fare, scheme enforcement technology, use of revenues, should be addressed before the proposed scheme is implemented. An efficient park-and-ride scheme would be a positive aspect (Steiner and Bristow, 2000), so recent developments in the area and public transport improvements are beneficial. A phased implementation would be constructive in this case too, as this has been proved by the experiences of other schemes in urban areas (Olszewski and Xie, 2005).

(*d*) Equity (social and vertical equity in particular – see Litman (2007)) considerations play an important role not only in urban schemes (Evans and Oswald, 1999) but also in rural ones. Therefore, any discounts or other special arrangements should be included with caution to address those concerns without compromising the scheme's revenues and overall effectiveness.

(*e*) Acceptability is a priority issue for rural schemes too, although not as high as in urban areas (Ison, 2005b). This may be attributed to trip purpose diversity and visitors' value of time. Careful selection of timing and phased implementation of the road user charging scheme may result in higher acceptability and success rates (Palma *et al.*, 2006). Furthermore, participation in decision making regarding revenue allocation may increase acceptability, although this is deemed problematic to apply in practice (Kim and Hwang, 2005).

(*f*) As the proposed road user charging scheme may result in dispersion of traffic into other areas of the national park (Caulkins *et al.*, 1986; Mendes, 2003; Morey, 1981), which would be a transplantation of the initial problem, a 'package approach' (Marsden, 2007) for the whole of the national park might be a more effective approach.

(*g*) Modal shift from car to public transport may be achieved through road user charging, but it should be taken into account that rural schemes operate in a different context in comparison with urban ones. Income and age influence travel behaviour too, as modal shift is a longitudinal process affected by various factors.

(*h*) It is significant to conduct surveys regarding rural schemes both at the points of origin and destination, as the main trip purpose is recreation and there are extensive alternative options for visitors not only in terms of location but also in terms of activities. This is a major difference in comparison with urban schemes, especially with reference to commuting travel.

6. CONCLUSION

By using the case study of the Upper Derwent valley of the Peak District national park, it has been shown that a pilot road user charging scheme may be a useful exercise which would contribute to the debate about this controversial issue, both in the UK and elsewhere. However, one has to bear in mind the special features of this case study which may not be easy to generalise, and also the differences between urban and rural schemes. The application of both quantitative and qualitative analysis has provided valuable information about the potential outcomes of the proposed scheme and may constitute useful input for an integrated appraisal of such a scheme. However, the most interesting finding of this research has been that national parks and areas of natural beauty are still capable of attracting large numbers of visitors. This is a worthy incentive for the local authorities of the area to continue improvements in public transport provision, as a prerequisite to introducing a road user charging scheme in the area.

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