Institute for Transport Studies

OPTION VALUES, BUSINESS AND POPULATION IMPACTS IN TRANSPORT ASSESSMENT

SCOPING STUDY

Final Report

A Report to Highlands and Islands Enterprise

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EXECUTIVE SUMMARY

1. While the appraisal framework for transport initiatives set out in the Scottish Transport Appraisal Guidance is generally relevant to the appraisal of projects in the Highlands and Islands, there are some elements of particular significance which warrant further attention.

2. In the context of sparse networks of limited capacity and frequency, the value for travellers of an assured facility (option value), reduced schedule delay and improved reliability are of greater significance relative to the standard elements of time and costs.

3. In the context of rather fragile economies dependent on a few enterprises the relationship between transport quality and costs and the transport-using sectors (final product, labour) becomes more important. This is especially the case if there is a social objective of protecting isolated communities and their economies.

4. We have reviewed over twenty documents from the HIE library and other published reports. There are studies of various transport initiatives. Many of these make reference to the insurance value of transport links, access to employment, medical care and schools, in short the minimum infrastructure required to sustain and attract people to live and work. A number of ex-post studies (Scalpay, Berneray, Sound of Harris, Vatarsay, Skye) provide evidence that transport investment can help support these communities. In some cases the absolute numbers and changes in numbers are extremely small. The evidence suggests that population migration within the region is dominated by access to employment, though the relationship between migration, quality of life and employment opportunities is complex. It is clear that transport quality can affect residential location within a particular locality, though its ability to support long term population stability may be a second order effect associated with improved employment opportunities.

5. Transport improvements are likely to have quite complex consequences on businesses and the economy in general. Transport quality improvements are expected to improve business competitiveness through reductions in input costs, productivity and efficiency savings, increased market size, improved access to the labour market and a positive contribution to image and business confidence. The reports reviewed suggest some significant local impacts particularly in situations where a step change in transport generalised costs can be achieved – such as Scalpay and Berneray where a ferry service was replaced with an untolled fixed link. The impacts are more muted where generalised cost changes are smaller, such as the Skye Bridge. The issue that is less clear cut and for which little local evidence exists is whether the improved business performance noted for some businesses displaces existing economic activity or is additional to it. In general transport improvements will tend to have a centralising tendency except where the resources (tourist sites, quarries, fish stocks) are fixed in location. In the context of the Highlands, where the proportion of self-employed and small micro-businesses is high it could be the case that more businesses than would initially be expected are fixed in location. This is because for such

businesses the costs of living and working costs are often shared. Another complex area is tourism, improving the infrastructure is likely to strengthen the Highlands' market position vis a vis competing destinations (e.g. Ireland). Yet, building a bridge to an island may actually reduce tourist spend on the island. One must also expect some facilities (schools, hospitals) to migrate in response to transport improvements.

6. Significant emphasis is placed on transport cost reductions as a means of improving business performance within the Highlands and Islands. This is at odds with some of the evidence regarding business costs within the region and is also at odds with other parts of the UK where the emphasis is on the labour market and 'unlocking' land for development. Prices of goods and services do however appear high in peripheral areas suggesting that maybe the Highlands and Islands is a special case, but this requires further research.

7. Businesses of different types appear to require different types of transport infrastructure, indicating that transport can affect some business location decisions. However, this appears only to be the case within a locality. In terms of business re-location (from one region to another) or inward investment, transport is a necessary but not sufficient condition in the choice of location. It is therefore unlikely that improvements in the transport system will affect business locational or investment decisions, unless transport forms one element of an economic development package or is the only element missing from the region's 'assets'. Similarly a direct link between transport investment and the number of business start ups appears tenuous.

8. To make the case for investment in rural infrastructure more robust it is clear that STAG should be used in its full flexibility with the contribution of transport projects to regional policy goals being appraised. It is therefore recommended that an audit regarding how STAG has been used in recent appraisals is undertaken. We have also identified the following as areas worthy of further research to enhance the robustness of economic appraisals of rural infrastructure:

   - Business, resident and tourist values of schedule delay and assurance or option values of fixed links and guaranteed services;
   - Establishing and maintaining a database of travel pattern and cost data;
   - Factors that will influence the analysis of and improve the robustness of economic activity and location impact indicators:
   - The role of transport costs as a constraint on businesses within the region, and the types of transport initiatives that can significantly affect these costs;
   - More ex-post studies focusing particularly on impacts of freight rates and final prices to consumers. The removal of tolls on the Skye Bridge may be the next opportunity for such a study;
   - Local data on price elasticities of demand and regional multipliers.

- Relationships between transport quality and the labour market in the Highlands and Islands.
- Long term research regarding the influence of transport quality on tourism.

9. A number of these research areas are particular to the Highlands and Islands, however, others such as the establishment of a transport data database and research into transport and tourism will have a number of interested partners thereby allowing the development of a collaborative research proposal. Even for research that is unique to the Highlands and Islands it may also be possible to promote a project through the Scottish Executive's research programme.

1. INTRODUCTION

1.1. Study objectives

The focus of this study is on certain linkages between the transport network, the local/regional economy and society which are not fully represented in a conventional transport cost benefit analysis (CBA) based on user benefits. Potentially these linkages may also not be represented in the analysis of wider economic activity and location impacts (EALIs). It is a scoping study that sets the agenda for the development of a future research programme by Highlands and Islands Enterprise.

The three objectives of the study are to:

- To review existing research in the Highlands and Islands and elsewhere in order to assess the likely scale of these impacts in different situations. This is covered in Chapter 2 of this report;
- To form a conceptual basis for their rigorous and consistent evaluation through the assessment of option values or other appropriate measures (Chapter 3); and
- To set out clearly the research which needs to be undertaken in Phase 2 to fill knowledge gaps and develop STAG methodologies (Chapters 4 and 5).

1.2. Transport assessment practice

Scottish Transport Appraisal Guidance (STAG)

The publication of the Scottish Transport Appraisal Guidance (STAG) (SEDD, 2003) was part of a shift to a more objective orientated approach to appraisal. STAG is organised around five principal national policy objectives: environment, safety, economy, accessibility and integration. With the introduction of STAG and its predecessor New Appraisal Methodology (NAM) (SEDD, 1999) the focus of appraisal moved away from the traditional economic efficiency measures, such as Net Present Value, to incorporate measures associated with each of the five principal objectives. The traditional measures of economic efficiency form only one part of the economy objective. Measures of impacts on employment and population were also introduced into the appraisal not only through the use of EALIs – also within the economy objective - but through measures associated with the accessibility and integration objectives.

The objectives approach within STAG is flexible. Apart from the five national policy objectives, local planning objectives and external objectives are also used in the appraisal. Within the STAG framework it is therefore possible to set objectives pertinent to employment generation and population stability and assess the performance of alternative transport projects against these objectives.

> *Where the objectives of a proposal are solely or substantially concerned with economic development or regeneration, the reasons for preferring a transport proposal rather than other economic development measures need to be clearly articulated.....*
>
> *Where there is a development or regeneration agenda for a particular area, it is likely that in most instances the transport investment will be only one component of a strategy; here, alternative transport inputs should be tested against total (economic development/regeneration) outcomes.*
>
> *In all cases, but especially where EALIs are central to the case for the proposal, it is necessary to be able to demonstrate how the economic development or regeneration outcomes can be attributed to the transport proposal....*

STAG (page 8-14) (SEDD, 2003)

As part of the appraisal, the impacts of the proposed transport project are set out against each of the local objectives and national objectives. The resulting table is known as an Assessment Summary Table (AST). Some impacts are quantified in monetary terms such as economic efficiency and GDP, whilst others are only quantified in absolute terms (e.g. change in volume of CO_2 emitted, number of jobs created or lost). Other impacts are described purely in qualitative terms. The impacts contained within the AST cannot therefore be summed. The main criticism that can be levelled at this method of summarising the impacts is that for a decision to be made regarding whether a project will progress or not implies the trading off of impacts against each other by the decision maker. However, at no stage are the weights ever made explicit. This introduces issues of consistency in decision-making, especially where the decisions are decentralised to regions or other agents.

Recent trends in UK and European transport assessment practice

Within the UK and Europe there has been an increasing trend to more formalised transport appraisal procedures. European Commission projects such as EUNET[1] and HEATCO[2] (ongoing) are focused on the development of unified or harmonised approaches to appraisal. Within this increasing trend towards more formal transport appraisal procedures there has also been a trend towards the monetisation of more impacts. The Department for Transport (DfT) is for example intending to introduce monetised values for noise in the coming year. Research into the value of journey time variability (a close proxy for reliability) was also recently published by the DfT (Ove Arup *et al*, 2003).

[1] Socio-Economic and Spatial Impacts of Transport (EUNET)
[2] Developing Harmonised European Approaches for Transport Costing and Project Assessment (HEATCO)

2. EVIDENCE FROM THE HIGHLANDS AND ISLANDS

2.1. Population impacts and migration

The population of the Highlands and Islands Enterprise (HIE) area has risen slightly between the 1991 and 2001 censuses (HIE, 2003), however, this is not a uniform increase across the region. Population growth has occurred in some locations (e.g. the Inverness and Nairn area and the Skye and Lochalsh area), whilst population loss has occurred in the remoter, peripheral areas. Total population of inhabited islands in Scotland fell by 3% between 1991 and 2001 (GROS, 2003), with the Western Isles exhibiting the most dramatic decrease at over 10%. In the year prior to the 2001 census 4,846 people left their addresses on a Scottish island for another UK address. Of these 62% moved to the Scottish mainland and 23% to somewhere else in the UK. Only 15% moved to another island. The local authorities that proved most attractive to these out-migrants were the City of Glasgow, Highland (mainland) and Aberdeen City. Of in-migrants to the islands we find that the largest proportion of people are moving from the Scottish mainland (46%), but that the proportion of people moving from other parts of the UK to an island is significantly larger than its opposite flow (31%).

Positive population impacts leading to population stability are cited in many of the studies reviewed as a desired outcome of a proposed transport improvement or as a rationale for the continued support of an existing service. Such studies are identified below:

EX-ANTE STUDIES

- *Yell to Unst fixed link*: Generally seen by the population surveyed as reducing remoteness from Lerwick and services located there. It would also remove a perceived potential future threat that the ferry service maybe reduced at some point in the future or made more expensive (EKOS, 2001).
- *Eriskay causeway*: the main reason for people leaving the island is lack of employment opportunities. The causeway will offer opportunities to work elsewhere in the Uists, and an increase in employment on the island is also expected (EKOS, 1999)
- *Air services to Coll, Tiree and Colonsay*: access to services including medical care and schools are fundamental to an island's infrastructure. The air service improvements would amongst other things permit children to return home from school at weekends. An air service provides the convenience and security needed to attract young people to live on the islands (SQW, 2003).
- *A830 Mallaig Road*: the road restricts the areas economic potential lowering business and community confidence, creating uncertainty about when/if improvements will be made. Its upgrading is one of the main means of ensuring the future economic and social viability of the area (EKOS, 1997).

EXISTING INFRASTRUCTURE

- *Corran ferry*: the existing ferry is important in sustaining an economically active population on the Ardnamurchan peninsula. The labour force on Strontian is important for Fort William and the jobs in Fort William are important for Strontian residents. The high school (essential for the future of the community) depends on teachers commuting from Fort William for its viability. Access by emergency services is important, as is access by tourists (McQuaid *et al*, 2003).
- *Case for Rail:* 20% of rail passengers surveyed would either move to a larger town or city or leave the region all together if the rail network did not exist (Steer Davies Gleave, 2003a).

Studies, such as those detailed above, are important sources of information regarding the link between transport infrastructure/services and population. However, they are always open to the criticism of strategic bias – that is respondents will answer the questions in a way that will produce the solution they desire. We now therefore turn to a number of ex-post studies to allow us to consider further whether there is any evidence regarding a link between positive population impacts leading to population stability and transport infrastructure.

Hope *et al* (2004) in a study of in-migration to 'remote' parts of the Highlands and Islands found that only 19% of the in-migrants had moved from other parts of the region to the area being studied. They identified that the most common reason cited for the move was the physical environment, including personal safety. Moving for work or business was also important, as was moving to be close to family. However access to good transport did not appear significant. Of course this could be due to self-selectivity, in that in-migrants that desired good transport links would not have moved to the remote areas studied. These main motivations for migration are part of a broader picture that involves combinations of: links to an area (e.g. family) and a major life event (e.g. retirement). In fact 24% of in-migrants surveyed were returning to the area they were brought up in or had lived in before, whilst 29% were retiring. "For many retirement offered the opportunity to return 'home', as the ending of work ends the requirement to stay away [to access work] for many people" (Hope *et al*, 2004).

In a smaller study on the growth of Inverness it was found that 55% of in-migrants came from elsewhere in the Highlands and Islands. Immediately it is apparent that in-migration patterns for Inverness differ from the remote parts of the region studied by Hope *et al*. Employment dominated the reasons for a household to move to Inverness (58%) and family reasons came second at 27%. The key criteria associated with choice of location were health provision, crime rates, employment prospects and cost of living/houses. A small number of respondents also indicated that they moved to Inverness as it is a hub for road, rail and air transport. In-migrants are typically either in their early twenties or their thirties (with children), whilst out-migrants were typically young people under the age of 20, whom it is supposed are leaving to pursue higher education and perhaps career opportunities. (Cogentsi, 2004).

If one focuses on migration of existing residents of the Highlands and Islands it is apparent from the Hope *et al* and Cogentsi studies that access to employment is a key factor. This is also borne out from research undertaken on the reasons for residents of Eriskay to leave it (EKOS, 1999). It should of course be noted that it is not just lack of access to any job that is the driver for out-migration, but the lack of access to 'appropriate' employment. EKOS (2001) for example, argue that the lack of quality jobs to be created by the Yell/Unst fixed link would do nothing in the long run to halt population decline.

In terms of ex-post data regarding the population impacts of specific projects:

- Vatarsay causeway (opened in 1991): increased Vatarsay residents' participation in the Greater Barra labour market. Construction of the project also coincided with an increase in population from 65 people in 1988 to 83 people in 1993 (EKOS, 1999). By the time of the 2001 census 92 people were resident on Vatarsay (GROS, 2003).
- Skye Bridge (opened in 1996): although the bridge had led to increased traffic growth the social and economic impacts were limited. Notwithstanding that 6% of Skye residents indicated that they had moved to Skye from elsewhere because of the bridge (DTZ Pieda, 1999)[3].
- Sound of Harris ferry (opened 1996): has created better access to training and education events, which can now be held in South Harris so as to permit day return access from all over the Western Isles as well as better access to health services particularly for residents of the southern isles. From a social perspective it has created more social interaction between neighbouring parts of the Western Isles, through participation in sporting events and visiting friends and family, thereby reducing the extent of isolation felt by residents (Grangeston Economics, 2003).
- Scalpay bridge (opened in 1997): between 1991 and 2001 there was a slow down in rate of population decline. Since 2001 there has been a net in-migration of 4 people against a background of out-migration on other islands. Male employment levels rising from 67% to 77% and from 48% to 56% for women. Significant improvement to quality of life with much better access to friends, family, services and shopping. 28 people indicated that they or a member of their household would have left without the link (SQW, 2004).
- Berneray causeway (opened in 1999): population fell between 1991 and 2001 censuses, but the rate of decline was lower than elsewhere. As with Scalpay, since 2001 there has been a very small net in-migration against a background of out-migration on other islands. There has been a dramatic increase in rates of employment among women from 50% to 76%. Additional to that almost a quarter of all residents are off the island in the daytime – suggesting that the sharp increase in employment levels is due to increased employment opportunities off the island. The new link has led to an improved

[3] cited in McQuaid and Greig (2002)

quality of life for 90% of residents with access to shopping, services, culture and leisure as major benefits. (SQW, 2004).

Investment in transport infrastructure can also increase community confidence and optimism, of which evidence was found in the ex-post studies of the Berneray causeway and the Scalpay bridge (SQW, 2004). Such confidence can stem from financial security, better access to emergency services as well as better employment, education and social opportunities. Such opportunities need not be taken advantage of immediately or ever, but are often viewed as a backup - an insurance policy – or as something that improves choice. EKOS (2001) considered that residents on Unst looked favourably upon a fixed link to Yell, not because it would immediately allow them to switch jobs to one on Yell or on the Shetland Mainland, but because it would act as an insurance policy if they lost their job. Such an argument applies in lots of places and is not just unique to the Highlands and Islands, but is particularly likely to be a feature of ‘lifeline’ facilities/services.

Remote communities typically have low crime rates and strong social networks, developed around the need for mutual co-operation. This is particularly evident in crofting communities and is sometimes referred to as social capital (see for example Árnason *et al*, 2004). Research undertaken in the Highlands and Islands indicates that residents of such communities, whilst acknowledging the benefits of improved transport links, also perceive such improvements a threat to their social networks and low crime rates (SQW, 2004; McQuaid *et al*, 2003).

The local evidence suggests that out-migrants from remote parts of the Highlands and Islands either leave the region completely or move to regional centres such as Inverness. In-migration to remote areas of the region is dominated by people from the rest of Scotland or England, Wales and Northern Ireland. Within the context of such out-migration the evidence suggests that for **existing residents of the region** choice of location is strongly influenced by access to employment. People leave locations where employment opportunities are limited and move to places where opportunities are perceived to be better. Upon retirement people are released from such constraints and may return ‘home’. Transport infrastructure can influence choice of residential location within a particular locality. For example the population growth within Inverness and its surroundings has been along a north-south axis parallel to the upgraded A9. There has been little development to the west (Beauly) or to the east (Nairn) - areas which have seen little change in accessibility over the last two decades, particularly when compared with the A9 corridor (TRL, 1994) [4]. This local evidence is consistent with general evidence on population migration. SACTRA (1999) considered that transport costs were not one of the primary reasons that individuals choose to move location or employment. However, once the decision to move has been made, transport and accessibility of the place of residence, can become important.

[4] The role of transport links as a contributor to the growth of Inverness and the Inner Moray Firth area is discussed later in this report (see Section §2.2). Here we are focusing on the manner that accessibility within a locality can influence choice of residential location, once the choice to move to Inverness has already been made (e.g. for reasons of employment).

The evidence also suggests that access to services, including health, education and shopping facilities, is an important criteria for residential location as is access to friends and family. In situations where access to services and friends and family are difficult transport improvements can have positive population impacts improving the quality of life for residents. There is also evidence that residents place a value upon being 'connected' to a range of opportunities, which may not be immediately consumed or used, but maybe best thought of as increasing the choice set or acting as an insurance policy.

New transport infrastructure and services can, through improvements to quality of life, affect migration and potentially help stabilise declining populations - or at least reduce the rate of decline. However, as employment opportunities are often cited as the motive for migration, population stability is also linked to the success of local businesses – an issue to which we now turn.

2.2. Business impacts and choice of location

Business impacts

Changes in transport infrastructure can have many positive impacts on business performance, examples of which can all be found within the Highlands and Islands:

Transport costs of business inputs and exporting of goods: form an important element of the total cost of production of a good. Ex-post studies of the Vatarsay causeway (EKOS, 1999), Berneray causeway and Scalpay Bridge (SQW, 2004a), Sound of Harris ferry (Grangeston Economics, 2003), Corran Ferry (McQuaid *et al*, 2003) all indicate significant freight cost savings can be made by businesses. Transport cost increases associated with the reduction of the freight subsidy to the Orkney and Shetland Islands also resulted in businesses experiencing increases in price of inputs and having to increase the price of their products (INC, 1996). The importance of transport costs in transport economic appraisals has long been recognised and the inclusion of vehicle operating costs and out of pocket costs (e.g. ferry fares, air fares, bus fares, and train fares) is standard.

Increased business productivity and efficiency: at a basic level transport infrastructure or services that provide travel time savings may reduce the amount of time that employees spend travelling, thereby increasing the amount of time that they can contribute to the production process of the business. Additionally, the distances involved in travelling in the Highlands and Islands can often involve overnight stays. Travel time savings may also permit new methods of business organisation, giving rise to efficiency savings. For example, there is some evidence that the fixed links to Berneray and Scalpay have meant that companies will now deliver goods (inputs) to businesses on these islands (SQW, 2004). Apart from time and cost savings to business travellers the Sound of Harris ferry appears to have led to some re-organisation of at least the road haulage sector, as there has been significant growth in commercial vehicle traffic and direct evidence of a rationalisation in the vehicle fleet of one of the surveyed companies. Additionally, there has also been some re-organisation of corporate training with central locations in South Harris now being used – accessible from almost all parts of the Western Isles as part of a day return trip (Grangeston Economics, 2003). The road improvements in the Inverness area and the A9 upgrades are, in part, responsible for the re-organisation of the fish sector with landing of fish in ports close to the fisheries (Ullapool, Lochinver, Kinlochbervie and Scrabster) and onward transport by road, rather than landing the catch further south (TRL, 1994). Air services not only provide time savings over other forms of travel, but can also bring knowledge and expertise to an area. Routes, like the Inverness-Manchester route, are important for UK wide companies to efficiently manage facilities or branches in the region, and for companies based in the region to buy in advice and expertise (i.e. consultancy services) to improve their business performance (SQW, 2004b). SQW, however, found it difficult to put a monetary value on such efficiency savings in their ex-post work on the Inverness to Manchester route.

Increased size of market for goods and services: all consumption and production within an economy has a spatial context. Reductions in transport costs and improvements to accessibility can lead to an increase in the size of the space (market) that a business can reach for a set cost. Such an increase in market size can increase the number of contact opportunities that a business may have for 'making a sale'. There is evidence that the fixed links to Berneray and Scalpay have increased the market size for businesses resident on those islands as they have been able to export services to neighbouring islands, thereby increasing turnover (SQW, 2004a). There is also evidence that the Inverness-Manchester link has assisted new business to be obtained by firms resident to the Highlands and Islands (SQW, 2004b). However, improvements in transport accessibility not only open up the 'national economy' to businesses in the remote region, but also work in the opposite direction. There is evidence of this competing effect in the ex-post studies reviewed: a local grocery shop on Berneray losing business to supermarkets (SQW, 2004a), local shops losing trade when bypassed by the A9 (HIDB, 1979), retail trade in Dingwall suffering as a consequence of the transport improvements in the Inverness area (TRL, 1994), and businesses in north-west England exporting services to the Highlands and Islands – though it should be noted that not all of the exported services in this example are competing services, some services are specialised and not available locally (SQW, 2004b). Ultimately, falling transport costs are likely to have centralising tendencies that can lead to regional specialisations.

Access to labour market and changes in real wages: in the same way that transport accessibility improvements can increase the size of the market for goods it can also increase the supply of labour. Conceptually increases in accessibility can lead to reductions in job search time and the ability for businesses to take advantage of economies of scale (if the labour market supply is a constraint on business expansion). A reduction in travel costs to and from work would also, if wages are fully flexible in the long term, result in a reduction in the minimum wage that an employee would require to accept a job. From the perspective of the firm this is a productivity gain. Alternatively, if wages are sticky the transport cost reduction associated with the travel to work is not passed on to the firm by the employee. In this situation the travel to work cost reduction represents a gain in real income to the employee. In the ex-post studies reviewed there is evidence that some transport improvements have increased the size of the labour market. The Vatarsay causeway has allowed residents of Vatarsay to participate in the Barra labour market (EKOS, 1999), the new Stolt fish processing plant on Scalpay employs people who live on Harris and in Stornoway (SQW, 2004a), an increased percentage of people spend their daytime hours off the islands of Berneray and Scalpay suggesting increased participation in the North Uist and Harris labour markets (SQW, 2004a) and commuting distances in the Inverness area have increased over time reflecting the increased geographic size of the labour market (TRL, 1994; Cogentsi, 2004). The Skye Bridge, however, appears to have had only a limited effect on travel to work patterns (TRL, 1996)[5]. The impact on user costs of the Skye Bridge, compared to the other fixed links mentioned, is limited by the tolls. This provides a useful contrast to the other ex-post fixed link studies as it appears to suggest that a significant step change in user costs may be required to have a significant labour market impact.

None of the reports reviewed looked at the impact on real wages of the transport improvements, however, there is evidence that disposable incomes of residents have increased, particularly in situations where an untolled fixed link has replaced a ferry.

Changes in output and employment: direct transport cost savings and business efficiency improvements arising out of a transport project should allow a business to lower the price of its products or services. Conceptually such a lowering of price should expand sales and could lead to a business expansion including an increase in the size of the work force. On Berneray and Scalpay there is evidence that turnover has increased for most businesses. Employment increases have also occurred but these are associated with new business start-ups rather than endogenous growth of existing businesses. The Skye Bridge appears to have had only limited impacts on tourism and business on Skye (McQuaid and Greig, 2002).

The ex-post studies reviewed have a tight geographic focus and do not provide information on the wider geographic impacts of the projects. Thus there is no information, for example, on whether the use of supermarkets in North Uist by Berneray residents has increased turnover of these businesses or increased the workforce. Similarly, has the increased participation in the Harris and North Uist labour markets by the Berneray and Scalpay residents displaced residents of those islands from employment or has it allowed businesses in these locations to take on more employees and expand output - previously constrained by lack of labour? Has the increased business by the joiner on Scalpay displaced work from joiners located on Lewis and Harris, or was there a previously unmet demand for joiner services? Whilst the Skye Bridge appears to have had limited impact on Skye residents and businesses, possibly the increased traffic volumes on the bridge are indicative of increased economic growth in other parts of the region or country. These questions are important as they help us to understand

[5] Cited in McQuaid and Greig, (2002). This study was also undertaken prior to the introduction of discounted multi-journey books of tickets.

whether the undoubted improvements in economic performance of local businesses are additional or displaced. This is a topic to which we return below.

Perceptions, image and business confidence: consultations with businesses can often raise issues regarding perceived accessibility, image and confidence in relation to transport infrastructure and services. McQuaid *et al* (2004) suggests that perceived accessibility may be as important for businesses as actual accessibility. McQuaid *et al* also emphasise the importance of reliability with regard to perceptions. EKOS (2001) identified that actual costs incurred due to reliability problems with the Yell/Unst ferry were small compared to business turnover and that ferry fares were not a barrier to movement. However, the ferry service was perceived as constraint by business and it was also perceived as a barrier for involvement in the Yell labour market by Unst residents.

Connectivity to transport networks that have an associated quality (such as the air network, the motorway network, the rail network or the road network) can reinforce an image that a business wishes to cultivate. This is particularly true if a business exports products or services to other regions or countries, or to a business whose clients are unfamiliar with the locality or region in which it is based. . ERM Economics (1999) identify that loss of image to Inverness businesses was an important perceived cost of the withdrawal of the Inverness to Heathrow air service and its replacement with a Gatwick service. McQuaid *et al* (2004) consider that air transport is important to the perceived quality of a location, particularly when a business is unfamiliar with the area. “Motorway links” were also identified as being of prime importance for UK businesses investing in the UK. The lack of a dual carriageway from Inverness to the Central Belt in Scotland is now perceived as a constraint on business (Cogentsi, 2004).

Advocates of transport investment often argue that investment in transport infrastructure, can instil confidence in an area. Similarly lack of investment, or uncertainty regarding the likelihood or form of the investment, can create the opposite effect - a lack of business confidence. Local evidence suggests that lack of certainty over future transport links has for example led to (or coincided with) postponement of business investment decisions in Eriskay (EKOS, 1999) and the postponement of inward investment on Unst (EKOS, 2001). Lack of investment in the A830 Mallaig road also delayed (or coincided with a delay in) investment in visitor facilities (EKOS, 1997). On the other hand investment in transport infrastructure within the Inverness area coincided with significant private sector business investments and significant economic growth (Cogentsi, 2004). Business confidence is not solely dependent upon transport infrastructure investment, and consequently transport investment may not always lead to improvements in confidence and business investment. For example, Lawless and Gore (1999)[6] found that the Sheffield Supertram had a minimal effect on business confidence and regeneration.

[6] Cited in McQuaid *et al* (2004)

Tourism and Business Visitors

Tourists and visitors on business are important to many businesses in the Highlands and Islands because of the money they spend on services (accommodation and subsistence) and for the goods that they may also purchase. The relationship between transport infrastructure and visitor expenditure is, however, complex and is not fully understood (McQuaid *et al*, 2004). It is also case specific.

Tourists require quick access to and from destinations (OECD, 2002). Research has shown that airports and air services are therefore important in attracting tourists to a region (McQuaid *et al*, 2004). This is also borne out by local data as air links between Inverness and London are significant contributors to inbound tourism within the region (SQW, 2002; ERM, 1999). Using the same argument a good quality strategic transport network will also be important for tourists to access a region. However, impacts on local businesses reliant on the tourist and business visitor trade are case specific and may also appear counter-intuitive:

- Transport improvements, whilst potentially increasing the number of visitors to an area may reduce the need for visitors to spend a night there. For example the Skye Bridge, despite encouraging a substantial increase in tourist bus and coach travel to Skye, has had a neutral impact on bed occupancy rates and number of overnight stays (DTZ Pieda, 1999; TRL, 1996)[6]. Similarly an enhancement to the internal air network in the Highlands and Islands is expected to reduce overnight stays associated with business travellers (Steer Davies Gleave, 2004a).
- On the other hand improvements to the internal transport network in the Western Isles are attributed with making the island group a more attractive tourist destination. An improved internal transport network means that it is possible to access more sites from a single place, giving tourists more things to do and places to see[7]. As a consequence tourist expenditure has increased and the associated expansion of output and employment has been an important business impact identified in each of the ex-ante and ex-post studies of transport projects in the Western Isles (SQW, 2004; Grangeston Economics, 2003; EKOS, 1999).
- Conversely good accessibility within a locality may not be something that tourists necessarily desire, as in some cases slow transport links (e.g. single track roads and ferries) may be part of the tourist experience (SACTRA, 1999). Remoteness is also something that tourists can desire. Such tourists may in fact only comprise a small percentage of overall tourists, but the fact that such a group exists demonstrates the potential for counter-intuitive effects when transport accessibility is improved.

[7] Conceptually this is similar to the market expansion impact, that transport improvements can have for businesses.

Choice of Business Location

McQuaid *et al* (2004) undertook a significant review of the role that transport plays in business location. Whilst there are some areas where its role is still uncertain one of the key messages is that transport is a necessary, but not a sufficient condition for business investment in an area. In addition to transport: labour supply; market demand; institutional networks; a culture of 'civicness' and entrepreneurship; agglomeration economies; technological development; as well as more social factors such as climate, lifestyle and image are cited as important factors influencing business location and investment. Consequently, economic growth maybe stimulated by transport infrastructure if the 'other pieces of the jigsaw' are already in place, but transport investment in isolation is unlikely to be effective in stimulating new growth. For example:

> *Large-scale investments in transport infrastructure, e.g. Sicily and Mezzogiorno in Italy have failed to stimulate economic growth in the long run and have resulted in underutilisation of resources. However, when infrastructure is used to support existing growth it can be an effective catalyst for development, e.g. airports in Crete to support the growing tourist industry, inter-regional motorways in Abruzzo (Italy) to improve market access to local industry.*

McQuaid *et al* (2004) (p100)

UK examples of Merseyside, Tyneside and Kent are also cited by Barrett (1999) as situations where transport infrastructure has failed to stimulate economic development. In places where transport infrastructure has stimulated development, it is the only missing feature of a strong economy (e.g. Cambridge, South Hampshire and Warwickshire).

It is also clear that different types of transport infrastructure appeal to different types of businesses (all other requirements for investment being satisfied). Air services have a strong influence on foreign investors and firms that have highly mobile staff, provide external expertise and require face to face meetings. The 'Business services' sector is a classic example of such businesses, but firms involved in computing, software, R&D, biotechnology and some food manufacturing are also likely to be attracted to locations with good air links. Agglomeration economies appear important in the manufacturing sector, with firms preferring to locate near to other firms of the same industrial type. This is true for both the traditional heavy manufacturing sector and the new high technology companies. The new high technology companies also appear to locate in areas which have good road and possibly air access. Retail business location is strongly influenced by customer accessibility. There has therefore been a trend for retail business to move to locations which have good accessibility by car, though specialist retailers have maintained city centre locations. As noted above tourism that takes advantage of natural resources, whilst location dependent, is influenced by external accessibility. Tourist related businesses would therefore be expected to locate in strategically accessible areas with unique natural resources.

Labour supply is often considered the single most important factor in business location. As discussed earlier, transport investment has an obvious role to play in reducing the travel time and increasing the labour pool.

McQuaid *et al* also emphasise that perceived accessibility maybe as important as actual accessibility when considering inward investment. This is, however, an area that they consider requires further research. As discussed above, and elaborated in the following chapter we consider that perceived accessibility has a close relationship to the concept of option values.

Local evidence from the Highlands and Islands is entirely consistent with the views expressed by McQuaid *et al*:

Transport as part of a package:

- Cogentsi (2004) attributed the strong economic growth of the Inverness area to a combination of factors of which transport links were only one. Others are significant capital investment; diversification after economic shocks (e.g. contraction of the oil industry); the role of influential individuals in business, government and the public sector; as well as 'flexible social networks' that allow people to connect more easily than in 'establishments' elsewhere and lastly but not least the local environment. Improvements to the transport network: bridges across the Moray, Cromarty and Dornoch Firths, the upgrading of the A9 to the Central Belt and air links have all been vital to the success of Inverness, but form only one component of the package that has given Inverness and its hinterland its growth.
- Investment in the Stolt fish processing plant on Scalpay, that provides 70 FTE jobs, occurred with grant support from Highlands and Islands Enterprise as well as the investment in the new bridge.

Industrial structure and business location:

- The primary sector (agriculture, fish, forestry, quarrying and oil) play an important role within the local economy, and as such a lot of business locations are heavily influenced by the places in which these natural resources are found. For example, 70% of businesses located on single track roads reported a low probability of being able to relocate (Halcrow Group, 2004).
- The manufacturing base within the region is smaller than within the Scottish economy with firms tending to specialise in processing products from the primary sector (e.g. fish processing, food and drink and textiles) (HIE, 2003). In terms of location, such firms tend to be influenced by accessibility to suppliers (farmers, fishermen, etc.), rather than proximity to high quality air, road and rail links. Thus the Scalpay bridge improved Scalpay's proximity to the suppliers of fish, thereby making Scalpay a more attractive location for Stolt to develop a fish processing plant.
- An analysis of the distribution of employment in sectors traditionally associated with the tourism (wholesale, hotels and restaurants) suggests that the tourist industry within the Highlands and Islands is

strongest in areas served by good quality long distance road, rail and air links. Thus employment in the wholesale, hotels and restaurants sectors is close to or above 25% (of total employment) in Inverness, Lochaber, Skye and Argyll. Whilst employment in this sector is below 20% (the Scottish average) for the peripheral parts of the region – Caithness and Sutherland (19.5%), the Orkney Islands (19.3%), the Shetland Islands (18.1%) and the Western Isles (17.5%) (GROS 2001 Census)[8].

- *Labour market:* Jewellery companies requiring a unique set of labour skills have formed a cluster (an agglomeration) on mainland Orkney. Inverness Medical chose to locate in Inverness (in 1995), where a healthcare cluster already existed (Cogentsi, 2004). It's successful and rapid expansion to a company employing in excess of 1,000 people probably could not have occurred without Inverness having a large labour market pool (the largest in the region).
- *Perceived accessibility:* EKOS (2001) considered that a fixed link between Yell and Unst would not significantly alter actual accessibility, but may alter the perception that it is difficult and expensive to travel between mainland Shetland and Unst. Such a reduction in perception may assist in attracting inward investment.

Business start-ups

McQuaid *et al* considered that the locations of business start ups or births are influenced by the same factors as that associated with the location of inward investment. Transport improvements can improve the attraction of an area for business start ups by increasing the competitiveness of the area (lowering transport costs), by increasing labour market accessibility and by increasing access to markets and suppliers. However, other factors will also be important including the availability of grants, suitable business premises, appropriately skilled workforce and importantly the confidence and entrepreneurship implicit within the community. Barrett (1999) in his report to SACTRA considered that transport improvements did not have any significant effects on business start ups:

> *So far as we are aware there is little evidence that transport investment has any significant impacts on rates of new firm formation. Whitelegg (1994) notes that none of the studies for seven countries which he reviews identifies road infrastructure as important to this issue and we have never seen a scheme appraisal which has given it any weight. A UK study (Keeble and Walker, 1994) identifies that "local population growth and capital availability", the presence of people with professional and managerial skills, "firm structures and geographically concentrated labour demand" as the key factors. Of course, to the extent that transport investment influences patterns of housing development it may have 'second order' indirect effects, but we exclude these from consideration.*

[8] Table KS11a Industry of Employment: http://www.scrol.gov.uk/scrol

McQuaid *et al* and Barrett considered the role of business start ups within the context of a UK wide review. If the Highlands and Islands are a special case their findings may not necessarily be applicable to the region. We now therefore consider the local evidence. The fixed links to Berneray and Scalpay have been associated with the start up of a small number of bed and breakfast businesses (associated with the increased tourist traffic) and the Stolt fish processing plant – though this also required financial support from local government agencies. On the other hand McQuaid and Greig (2002) considered that the impact of removing the Skye bridge tolls on the number of business start-ups would be limited. In consultation with the Skye and Lochalsh LEC they considered that the effectiveness of business start up programmes, availability of industrial space and generally high travel costs outweigh much of the deterrent effect of the tolls. EKOS (2001) considered that the competitiveness of business start-ups on Unst who were directly providing services to Shetland based customers would be enhanced, though made no predictions regarding changes in the number of business start ups.

Whilst obviously many factors influence the number of business start-ups and the success of those ventures, the literature and local evidence would suggest that transport has a minor role to play, except in situations where inbound tourism can be significantly affected by a transport project.

2.3. User costs and non-use values

A transport project that connects a location or region to a ‘network’ can bring about a significant step change in user costs. Large step changes in user costs would be expected to generate significant amounts of traffic. Table 1 looks at ex-post studies of transport infrastructure or services that have provided a step change in the level of user costs imposed on travellers. As can be seen from this table significant amounts of traffic have been generated with year on year growth rates of between 3% (Skye Bridge) and an exceptional 34% (Scalpay Bridge). These year on year growth rates in travel demand give rise to a percentage change in traffic volumes of between 26% and in excess of 600%. Such changes have to be set against comparable growth rates of 3% in Scotland (between 1995 and 2001) and a *fall* of 9% in the Highland area (McQuaid et al, 2002).

Table 1: Traffic Growth on new infrastructure/services that provide a step change in user costs

Service/ Infrastructure	Summary of improvement	Units	Demand Before	Year	Demand After	Year	Percentage growth	Year on Year growth	Source
Scalpay Bridge	Ferry to fixed link no toll.	Passengers	25,400	1996	200,000	2003/4	687%	34.3%	SQW (2004)
Berneray Causeway	Ferry to fixed link no toll.	Passengers[1]	28,000	1997	124,000	2003/4	343%	28.1%	SQW (2004)
Skye Bridge	Ferrry to fixed link with toll set equal to ferry fares	Vehicles[2]	520,260	1995	653,637	2001	25.6%	3.3%	Scottish Executive (1999) McQuaid et al (2002)
Sound of Harris ferry	Increased frequency and reduced journey times (compared to Lochmaddy Tarbet route)	Passengers[3]	30,582	1997	44,653	2002	46.0%	7.9%	Grangeston (2003)

Note 1: Includes traffic using Sound of Harris ferry

2: Excludes motorcycles

3: Report does not detail loadings before opening of route. Loadings reported are therefore those in the first full year of operation. These aggregate numbers also disguise some significant variations by vehicle type as commercial vehicles' use of the ferry has increased by 90% since the year of opening.

For economic appraisal purposes it is important that changes in all user costs are included within the transport cost benefit analysis. However, with two exceptions, the ex-ante studies reviewed only include user costs associated with travel time, vehicle operating costs and out of pocket costs (including the cost of overnight stays in accommodation). The two exceptions are:

- HITRANS air service proposals (Steer Davies Gleave, 2004a): included (i) the willingness to pay to be able to make day return trips, and (ii) the willingness to pay for increased frequency of service. The unit values for this were surveyed as part of the study. User benefits associated with these attributes of the service comprised 42% of total user benefits.
- HITRANS investment in lifeline rural roads (Halcrow Group, 2004): included a component of user benefit associated with reliability and quality. However, the unit valuations for improvements to reliability and quality were not surveyed or modelled directly.

It is our view that all significant components of user benefit should be included in an economic appraisal. This is because it is only by doing so that the positive population and business impacts identified earlier in this chapter can be included in the measure of economic efficiency. We would consider that the key aspects of user benefit, in addition to travel time, vehicle operating costs and out of pocket costs, relevant within the Highlands and Islands are **schedule delay** and **journey time variability**. Schedule delay is the inconvenience users experience with low frequency services and inconvenient timetabling. For example, current timetabling arrangements for the Sound of Harris ferry and the Yell/Unst ferry are perceived as constraints on users of the service (Grangeston Economics, 2003; EKOS, 2001). Any economic appraisal of improvements to these services should therefore include schedule delay user benefits. Journey time variability may also prove an important component of user benefit when options are considered for the upgrading of single track roads to double track or single carriageway roads to dual carriageway. The Department of Transport are currently developing methods for assessing journey time variability (DfT, 2003; Ove Arup *et al*, 2003).

The evidence reviewed also points to the fact that residents and businesses place a value on being securely connected to a network which has a perceived quality. Such a network may for example be perceived as offering a better and more reliable quality of service than other types of transport infrastructure. For example, double track roads may be perceived as offering a very different level of service compared to single track roads; motorway standard roads perceived as offering improvements in service compared to fast single carriageway roads and fixed links offering a perceived level of service greater than a frequent, low cost ferry. The value placed on such connectivity is a form of non-use or option value, which forms the subject matter for the next chapter.

3. OPTION VALUES: A REVIEW OF METHODOLOGY AND APPRAISAL PRACTICE

3.1. Background

Option values have their origins in the field of environmental economics (see Weisbrod, 1964), where they have since been measured for forests, wildlife, fish stocks and oil reserves. From the start, however, the theory has been applied to a wider range of public and private assets. **Option values are the value which people and businesses place on the assurance that a particular asset will continue to exist in the future.**

It is worth recalling that prior to 1999, option values were alien to transport appraisal, with only a few, experimental exceptions. Since 1999 there has hardly been an explosion of activity, rather a gradual increase in interest in this aspect of appraisal, including the key work by Humphreys (2004) which we will discuss below, which included primary research in Scotland.

In this scoping study, we are concerned with the value which people and businesses in the Highland and Islands of Scotland place on the continued existence of the transport infrastructure and services which make up the Highlands and Islands transport network – including both internal and external connections. There is circumstantial evidence from research reviewed in Chapter 2 that such option values exist and that in some circumstances there is reason to believe they may be significant compared to the use value of transport services ordinarily measured in the TEE analysis within STAG. It is important to recognise, however, that the study of option values in Scotland (and in fact elsewhere in Europe) has been limited and therefore that both the theoretical framework and empirical techniques are not widely known. It is the purpose of this paper, therefore, to set out the approach in a concise fashion, so that readers can judge for themselves the merits and demerits of option value research, and consider whether it is appropriate, and if so how, to spend further resources developing this approach in the Highlands and Islands.

3.2. Option Values in transport appraisal

Following the election of the new government at Westminster in 1997 and following the establishment of devolved government in Scotland, appraisal methods in Scotland and elsewhere in the UK shifted to an objectives-led approach, organised around the five principal policy objectives of: environment, safety, economy, accessibility and integration.

Initially, option values were not included, either in the New Appraisal Methodology (NAM) in Scotland (SEDD,1999) or in the New Approach to Appraisal (NATA) in England (DETR, 1998). Their introduction into transport appraisal in the UK came instead with the rail industry's adoption of NATA (OPRAF, 1999; SRA, 2003) and the 'multi-modal' version of NATA (DETR, 2000): both of these methods incorporated Option Values as part of the assessment of Accessibility criterion.

Most recently, STAG mentions option values, again in the context of Accessibility. The guidance reads:

> *"Accessibility is such a broad concept that its application within appraisal can at first appear complex. It is therefore important to start by clarifying the main dimensions of accessibility:*
>
> - Expressed accessibility or revealed accessibility *i.e. travel demand. This is covered under the economy criterion since a monetary value can relatively easily be given to observed and forecast travel demand (see Chapter 8).*
>
> - Community accessibility or potential accessibility *allows standards of accessibility to be defined in absolute terms based on an assessment of basic needs. Different communities have different needs, and the term "option value" is sometimes used to describe the value a community places on accessibility even though it does not express this through use [our emphasis].*
>
> - Comparative accessibility *looks at the fairness of the distribution of access opportunities. The impacts on different groups in society can be compared by gender, geographical location, income, mobility characteristics etc"*
>
> (SEDD, 2003, Section 10.1).

STAG continues to define and present measures of Accessibility. There is no specific advice on the calculation of option values, however, and they do not feature in the Appraisal Summary Table which synthesises and presents the appraisal results for decision makers to examine. In the former respect, STAG is consistent with the current rail industry appraisal guidelines, which have the following advice:

> *Non rail users might be prepared to pay to retain the option of using public transport, particularly if its withdrawal is irreversible. This might be the case, for example, if infrastructure was demolished. SRA is required to make changes to present service patterns in a gradual way. This requirement imputes a value to transitional costs of change so sudden changes in accessibility are unlikely.*
>
> *However, it would be useful to have additional information on the benefits people derive from the existence of the rail service, over and above values of use. Attitudinal surveys may be helpful. It is probably most relevant to use a method by which values are obtained directly from respondents. Survey work in this area is rare at present.*
>
> (SRA, 2003).

The Department for Transport's guidance on Option Values gives further details (see Annex I of this report), including the types of projects for which option values may be important, an explanation of the concept of option value, and references to sources of suitable methodology, but again not actually any detailed advice on the calculation of option values.

Against this background of 'interest' but relatively little concrete action in the appraisal manuals, it is necessary to turn to the specific literature on option values in transport in order to firm up on the concept and set out some specific methodology which could be used to measure the option values for transport infrastructure and services in the Highlands and Islands.

3.3. The concept of Option Value in transport

The basic concept of option value, in any situation, is as follows. There exists a total amount of money which an individual person or business is willing to pay, to use *and to maintain the option to use*, a particular asset over a period of time. In this context, we may be talking about any Highlands and Island transport service or a particular piece of infrastructure – whether it be a bridge or an air service or a ferry service. This total willingness-to-pay (WTP) for the asset is known as the 'Total Economic Value' (TEV) of the asset, for obvious reasons.

Within that Total Economic Value, in principle we can separate out three components. The first is the expected expenditure on the use of the asset. So for a ferry service, this is the amount the person (or business) expects to spend on ferry fares over the period. We will label this E(X).

The second component is the expected consumer surplus. This is the excess of the *maximum amount* the person (or business) would have been willing to pay to use the asset, over the amount they expect to pay E(X). We label this amount E(CS) – the expected consumer surplus.

Finally, there is an amount which the person or business would be willing to pay, *not* for their expected use of the asset, but to retain the *option* of using the asset. This is their *option value*, which reflects the fact that the future supply of the service or infrastructure in question is not absolutely certain. If the individual or business is risk averse in relation to their transport costs (as most individuals and businesses are), then we can expect them to be willing to pay more[9] to ensure that the service or infrastructure *will* in fact be available in the future. In other words, the option value is like an insurance premium or a waiver fee in return for the assurance that the particular asset will continue to be available.

[9] that is, more than the expected consumer surplus

So, the total economic value of a facility or service can be thought of in three components, two of which are related to an ordinary transport appraisal – the expected expenditure on use of the asset, E(X), and the expected sum of consumer surplus[10], designated E(CS). The other component is new the *option value*[11].

Total economic value = E(X) + E(CS) + Option Value (1)

The expected future expenditure on transport services (E(X)) and the expected future sum of consumer surpluses E(CS) will be usually estimated by the *transport economic efficiency* (TEE) analysis within STAG.

In transport, we might expect positive option values to manifest themselves where, for example:

- the individual or business perceives that the substitutes are poor so that the consequences of removing the transport service or infrastructure would be serious;
- the individual or business perceives that the risk of the service or infrastructure stopping being available is real, and the perceived level of risk is larger;
- the individual or business perceives that their own circumstances are vulnerable to change and they may find themselves becoming more dependent on the service or infrastructure in question than they are now; or
- the individual is concerned with *others* in the community, and those *others* have fewer alternatives available, or are more vulnerable to adverse changes in their own circumstances.

Putting flesh on these bones, the first situation above would be likely apply for example in a remote rural area where networks tend not to be duplicated. Thus, for example, the occasional severing of the road to a coastal community during the winter months is a serious issue if there is not another practicable form access to the main business centres.

If an individual or business is located in a place that is connected to the rest of the network by one ‘lifeline’ service, for example a ferry service or an air route, then their judgements about whether to stay located there – and others’ judgements about whether to move there – will be influenced by the perceived risk associated with the future of the ‘lifeline’ service, its quality if not its actual existence. Thus option values are likely to be substantial when the connection to a location is a ‘lifeline service’ with which the individual or business thinks there is a considerable risk.

[10] or producer surplus in the case of a business, or the sum of both in the case of a social appraisal considering both private individuals and businesses.
[11] We are using ‘option value’ as a generic term to describe all courses of non-use value. The literature breaks this down further - see for example Humphreys (2004) who attempts to estimate the different components (vicarious indirect use value, functional indirect use value, option value and existence value).

At an individual level, we can expect people to report greater option values when their own circumstances are more vulnerable – for example as people progress into older age and face a greater risk of losing their licence to drive.

Finally, any business has to consider the travel needs of its customers, not only itself. And many individuals are concerned not only with their own travel needs but those of their dependents and relatives. That makes option value dependent on the perceived risks to others on whom one's own livelihood or business depends.

Since 1991, a number of authors have developed these basic ideas and gone on to estimate option values in real transport situations. In the next section we assess these contributions, in the light of the Highlands and Islands case.

3.4. Experience with estimating Option Values in transport

When doing economic appraisal of projects or strategies, we are interested in the change between one policy scenario and another, or between a policy scenario and a do-nothing scenario. Therefore in practice we are interested in the change in consumer surplus, the change in expenditure and the change in option value.

The challenge is to elicit a person's (or a business') willingness to pay using one of an array of techniques, each of which has particular strengths and all of which are vulnerable to some weaknesses unless great care is taken. These are:

1. Contingent valuation – involves conducting an experiment where the person is asked what they would be willing to pay to secure the *change* under investigation. Can be done using *open-ended questioning*, or the *bidding game* approach. Or *payment card* or *dichotomous choice (take-it-or-leave-it).* Dichotomous choice is the least biasing, hence most reliable, but yields least data per question (yes/no).

2. SP techniques also conduct an experiment, this time based around a hypothetical choice that the respondent is asked to make. The conditions under which the choice would be made are repeatedly changed by the questioner, to find out how the subject responds to changes in different variables. From this can be inferred the individual's WTP.

3. Travel cost method….infer WTP for use of a resource from people's willingness to travel to get there… simply convert to generalised cost.

4. Hedonic pricing…infer WTP from a related market. A good transport example is housing market used to evaluate WTP to avoid traffic noise, by comparing properties in different locations.

From our review, there have only been three UK studies that have measured option values in transport.

- Bristow *et al*, (1991) measured the option value of retaining local bus services in the evenings and at weekends to be £57 per year among non-users and £22 amongst users (1991 prices), averaged over

Hawksworth estate in Leeds and Rainow, Macclesfield. Non-use values formed a lower proportion of total economic value in Rainow than in Hawksworth.

- Crockett, (1992): measured the option value of the Settle-Carlisle railway to be £43 per year among users and £24 among non users for residents of Settle.
- Humphreys (2004): measured the option value of the North Berwick to Edinburgh rail service to be £240 per year for users (net of fares) and £219 for non-users.

Each of the three studies used the contingent valuation methodology, though Humphreys supplemented contingent valuation with some stated preference questions. There are, however, slight differences in the manner that the methodologies were applied with Bristow *et al* and Crockett using iterative bidding questionnaires and Humphreys using a payment ladder.

As could be expected from such developmental work each of these studies raised a number of issues that need to be borne in mind for future research:

- Respondents may have difficulty understanding the concept of non-use values (option values) with corresponding implications for survey design.
- Cognitive burden and package effect: both can lead to individuals responding to surveys with higher willingness-to-pay values than they attach in reality. Future research should therefore include fixed boundary values in stated preference design, as well as validating stated preference values using contingent valuation data from a package[12].
- Respondents' biases. Contingent valuation techniques require that respondents indicate a willingness-to-pay an increased charge, and this charge has to be collected by some mechanism. With respect to non-use values such as option values the obvious mechanism is some form of local taxation. For example, Bristow *et al* posed their survey in the context of increases in the poll tax, whilst Humphreys posed it in the context of increases in council tax. Respondents' views and opinions regarding local taxation issues may therefore bias their response to the contingent valuation questions.
- Enumerator experience: Humphreys found that the inexperience of the sub-contracted market research company with this form of data collection undermined the quality of the data, and therefore the scope of the analysis that was permitted.
- Type of interview technique: face to face questionnaires are necessary, because of the complexity of the tasks respondents have to cope with. Such a survey approach is expensive compared to self-completion

[12] Phrasing of questions that encourage respondents to be aware of household budgetary constraints in their response to a contingent valuation question is complex. This is underlined by the fact that Humphreys found that the framing of his second contingent valuation undermined the usefulness of the data for examining the package effect issue.

questionnaires and for budgetary reasons sample sizes may have to be reduced.

- Small sample sizes can preclude investigation into the influence of other variables.

It is therefore clear that the field of measuring transport option values is far from developed. It is a conceptually complex area, question phraseology is critical, as is the inclusion of internal consistency checks. As with all complex surveys pilot surveys are also vital, along with the use of experienced survey enumerators. It is, however, worth noting that there has been a great deal more experience in estimating option values in environmental resource economics than in transport. That means that whilst there is a limited pool of knowledge within the transport sector there exists a far more extensive pool of experience from which appropriate methods for use in the Highlands and Islands can be drawn from.

It is interesting to note that each of the studies focussed on the absolute option value placed on a particular piece of transport infrastructure and/or service by residents. None of the studies has considered either the option value that a business will place on transport infrastructure or services – something for which local circumstantial evidence presented in Chapter 2 suggests may exist – nor have any of the studies considered the change in option value associated with an improvement to services or infrastructure, such as the upgrading of a ferry route to a fixed link. This could be a research challenge since it may be more difficult to elicit values of upgrades than values of losses of facilities.

Measured option values can be included in an appraisal as part of the transport economic efficiency calculation. If the option value is to be added to user benefits it is important that the surveyed value does not include any double counting of user benefits (e.g. schedule delay). Any survey associated with measuring option values must therefore clearly separate out significant elements of user benefit. We would expect option values to be significant elements of total economic value for the following types of projects in the Highlands and Islands:

- Provision of a lifeline service where no service currently exists;
- Replacing a ferry link with a fixed link, particularly to/from a small island community with limited services;
- Increasing frequency of a very low frequency public transport service (ferry or air); and possibly
- Connection to a double track road network for communities previously connected to a single track network and connection to the national dual carriageway network for the regional centres of Inverness, Elgin and Fort William.

In addition one may expect option values associated with air and rail networks, however, within Scotland such values would not be unique to the Highlands and Islands.

4. CAPTURING THE IMPACTS OF TRANSPORT IMPROVEMENTS ON BUSINESS AND POPULATION

4.1. Accessibility and generalised cost

A change in accessibility is the primary impact of a transport improvement. It is the engine that leads to the ultimate population and business impacts. Within an economic framework generalised cost is used as a measure of accessibility. Components of generalised cost used in all appraisals are:

- Travel time;
- Vehicle operating costs; and
- Out of pocket costs (e.g. fares, tolls, parking charges, cost of an overnight stay, etc.).

Whilst components of generalised cost and accessibility that are used occasionally or rarely include:

- Quality (comfort, overcrowding, etc.);
- Journey time variability;
- Schedule delay; and
- Option value (including the value of a guaranteed/reliable connection to a network).

The importance of the latter components will vary by transport infrastructure type, by location and by user. Comfort and overcrowding may be issues for urban environments and not an issue for rural environments. Residents may be more inconvenienced by schedule delay - through an enforced overnight stay - than a business that transports non-perishable products once a week. Businesses specialising in business services or that form part of a larger UK wide company will place a different option value on an air network than a primary sector business would (e.g. a farmer). Conversely, a farmer may value a good quality ferry service for transportation of livestock and other heavy freight more highly than the business services firm. Whilst some work has been undertaken on the measurement and valuation of these components of generalised cost, the work is far from complete. The state of the art is represented by:

Quality:	Passenger Demand Forecasting Handbook (PDFH) (ATOC, 2002)
Journey time variability:	Bates *et al* (2001); Ove Arup *et al* (2003); DfT (2003)
Schedule delay:	PDFH (ATOC, 2002) up to headways of two to three hours. Our literature review has not identified any sources for headways greater than this threshold except the work on air services by Steer Davies Gleave (2004a).
Option values:	Humphreys (2004)

The areas in which the literature is sparsest is that of schedule delay (of very low frequency services) and option values. Yet these attributes would seem to be particularly relevant in the context of transport services in the Highlands and Islands, especially to and between islands. There is therefore scope for further research in these areas.

4.2. Appraisal

Business and population impacts and double counting

Transport projects can undoubtedly have significant local business and population impacts - we term these final impacts. This is particularly true when the objectives of the project are economic development and regeneration, as evidenced from the studies reviewed in Chapter 2. Final business and population impacts, however, are not included within the Cost Benefit Analysis (CBA) measure of economic efficiency used in the STAG appraisal. For politicians and laymen, focused on the economic and regenerative effects of transport projects, this can seem perplexing.

The rationale for the exclusion of ‘final’ business and population impacts (e.g. change in wages, output, etc.) from the CBA is that these impacts arise as a direct consequence of the primary impacts of a transport project – savings in transport costs, travel time, etc. The same primary impact can lead to changes in many final impacts, including land use patterns. It is clear that summing the primary impacts of a transport project (travel time savings, etc.) with the final impacts (changes in prices, outputs, etc.) would lead to substantial double counting of the same benefit at two different stages in the economic process. Furthermore, if prices are elastic in any of the final markets it can be shown that summing final impacts across all final markets (products, labour, land, etc.) will not give the correct measure of total economic impact (see for example Mackie *et al*, 1990). A full measure of the total economic impact of a transport project can only be made through either:

(a) Summing all impacts in the **transport market** only – i.e. travel times, out of pocket costs and all other components of generalised cost.[13]; or

(b) Assessing the change in economic welfare at household level within a **wider economic modelling** framework (Bröcker *et al*, 2004).

Until recently the latter option was computationally too difficult, and in fact there have still only been a limited number of applications - none of which, to the best of our knowledge, have occurred in the UK. Up to now the most robust measure of total economic impact, including that on business and population, has therefore been transport efficiency – and it is for that reason that it is the measure of economic performance used in STAG.

[13] This does, however, require an assumption of partial equilibrium. That is all markets, other than the transport market, are operating in perfect competition and at constant returns to scale (Dodgson, 1973; Jara-Diaz, 1986).

Of course in practice there are three categories of reason why the "true" net social benefits of a project might differ from the measured transport efficiency benefits:

First, the actual measured benefits in the transport market will be incomplete. Schedule delay and option values may for example form significant components of benefit for certain projects within the Highlands and Islands, and with the exception of the recent air services project (Steer Davies Gleave, 2004a) these are not usually included in the CBA.

Second, where prices do not equal marginal social cost in transport using sectors of the wider economy, there will be unaccounted for benefits/costs in those sectors (SACTRA, 1999). There is however no consensus on the significance of these unaccounted benefits. Venables and Gasiorek (1999) found that in the UK situation if a transport project were able to reduce the cost mark-up on goods from 20% to 10% then the additional benefits compared to a transport CBA could be in the region of 30%. Newbery's review of their findings, however, indicates that the additional benefits need to be scaled down by a factor of 10 (Newbery, 1999; SACTRA, 1999). The SACTRA committee's final comments indicate that they found additional benefits in the region of 6 to 12% plausible. More recent research in the Netherlands, that included labour market interactions in addition to mark ups on goods, suggests that additionality may range from -15% to +85% (Oosterhaven and Elhorst, 2003). Oosterhaven and Elhorst found that projects that link the periphery to the core gave rise to positive additionality, but projects that focus on the core led to 'negative additionality'. With respect to the trans-European transport network (TEN-T), research associated with the IASON project has indicated that the TEN-T priority projects may generate between 20% and 30% more economic benefit than would be measured in a normal transport CBA (Bröcker, 2004). Within the UK, there is no evidence regarding the scale of any potential additionality associated with the wider economy beyond the theoretical work of Venables and Gasiorek and Newbery. The significance of this argument depends crucially on the divergence of wages and prices from competitive levels and an elasticity of demand for goods and labour in the regional economy.

Thirdly, the measured transport efficiency benefits do not take account of any relevant distributive considerations. If projects contribute to (or take away from) social objectives, then this introduces a further dimension to the analysis. Obviously, many projects within the Highlands and Islands could have positive distributional consequences, which will not be reflected in the transport efficiency measure. Negative distributional impacts associated with outside 'competitive' firms displacing businesses in the local economy (the two way road effect) are also not reflected within the transport efficiency measure.

It is because of the incompleteness of the transport efficiency measure that SACTRA recommended the use of EALI measures in transport appraisal. It will of course be apparent, from the above discussion, that elements of double counting between the different EALI measures (e.g. GDP and employment) and between the EALI measures and transport efficiency exist. This is recognised within STAG.

Business and employment impacts: additional or displaced?

Transport investment can contribute to net economic growth through increased economic efficiency; however, displacement of economic activity will also occur (SACTRA, 1999; McQuaid *et al*, 2004; OECD, 2002). Neither of these two points is disputed, however, what is often disputed is how much of 'new' economic activity is additional and how much has been displaced from another location.

Until recently, the official Treasury position was that regional policies had no net aggregate impact on the UK economy as a whole (HM Treasury, 1997). The publication of the new Green Book (HM Treasury, 2003) has, however, made this position less clear cut, as national efficiency gains have been acknowledged though whether regional policies can influence national efficiency is another matter. STAG is consistent with the Treasury position:

> *It is likely that net impacts at the Scotland level will occur in very few cases, mainly for large proposals. This is because it is rare for individual transport infrastructure or service changes to generate additional economic activity which does not represent displacement from another location, or locations, in Scotland.*

STAG (page 8-12) (SEDD, 2003)

It is a requirement of appraisal practice in Scotland to report both EALI gains at a local level and net gains at a Scotland level. From the perspective of the Scottish Executive it is the net gains at a Scotland level that are of most interest. Notwithstanding that the Scottish Executive does recognise that localised EALI impacts, with no net impact at a Scotland level, can have a positive impact if they "affect people/social groups who are the subject of other Scottish Executive (or UK Government) policies, such as those suffering from social exclusion and people in remote rural areas" (page 8-12 SEDD, 2003).

It is of course difficult to technically derive the proportion of economic activity generated compared to that which is displaced. Only a system wide transport and economic model can inform such an analysis, and such models are not suited for the analysis of small individual projects (e.g. upgrading 15 miles of single track road to double track). In the absence of such a model or comparable economic analysis it is our understanding that, the "default STAG appraisal" position is that a small transport project will only displace economic activity. For promoters of the small project, that may form part of a regional strategy this can sometimes be a difficult position to accept, but it also a difficult position to contest. This is because to contest the official stance may require expensive surveys and analytical work to identify potential negative effects on businesses located outside the locality of the scheme, which is not in keeping with the scale of the project.

Total economic impact

A full measure of the economic impact of a project requires that all significant user benefits and non-user benefits (i.e. actual and perceived accessibility) are included in the analysis. Further research is needed to understand under what circumstances perceived accessibility is a significant component of total economic impact for transport projects in general and in the Highlands and Islands, in particular.

If prices diverge from marginal social costs in transport using sectors of the wider economy, then transport user benefits and non-user benefits will form an incomplete picture of total economic impact. Such characteristics would be most likely to occur in a region with high transport costs, because high transport costs allow spatial monopolies to exist and can allow natural resources to go unexploited. It is unclear from the evidence that we have seen whether transport supply issues are distorting the wider economy of the Highlands and Islands. To understand this issue more clearly questions that need to be answered would include: do transport costs within the region prevent the development of businesses that would exploit the regions natural resources (e.g. fish farms, farming, quarrying, tourism)? Do transport costs prevent unemployed workers finding employment, or do they hinder businesses recruiting staff with the right skills? Do transport costs reduce external competition for goods thereby allowing local suppliers to act as monopolists and include high cost mark ups on goods?

If the answers to the above questions suggest that transport supply truly does distort the economy of the Highlands and Islands, research will then be needed to identify a transport project's level of economic impact additional to that measured by a transport cost benefit analysis. Related to this point is trying to get a grasp on exactly how much of the increased economic activity that occurs in response to a transport investment has been displaced from other regions and how much is new. Both questions will probably require the development of a transport-economy model. The nature of such models are that they are typically unsuited for the analysis of small projects, therefore such a model would be most appropriate for considering the answer to these questions within the context of network wide regional improvements (e.g. step change in provision of ferry services, step change in the quality of the internal road network, or a step in the provision of air services).

4.3. Modelling

SACTRA (1999) considered that different approaches utilised to calculate the economic impact of transport projects have "very little in common" (§9.69). In part this is due to the widely varying circumstances in which appraisals have to be undertaken and the variability of the data available, though in other regards this was due to a lack of commonality in the specification of the economic impact studies. In many regards this criticism is still true, however, inroads have been made in formalising economic impact reporting procedures. STAG provides clear guidance, including worksheets, on the reporting requirements associated with EALI indicators. The Department of Transport has also published "Guidance on preparing an Economic Impact Report" (Steer Davies Gleave, 2003b). Additionally, land use and transport interaction models (LUTI models), which contain formal methods linking transport accessibility to land use change and economic activity, are now much more common. In Scotland LUTI models have been developed for the Glasgow conurbation associated with the corridor studies, the Edinburgh conurbation associated with road user charging and for Inverness and the Inner Moray Firth area. A LUTI model with the same coverage as the Transport Model for Scotland is also being developed (Transport, Economic, Land Use Model of Scotland – TELMoS).

Small projects

Economic impact studies for small transportation projects are typically based on a 'bottom-up' analysis. Such an approach focuses on the actions of individual firms who are directly affected by the project. The DfT's guidance (Steer Davies Gleave, 2003b) sets out procedures associated with this method type, and includes worksheets, approaches for the calculation of labour market accessibility and sample business questionnaires. Despite formalisation the approach still requires a lot of subjective assessment including the important issues of:

- Will businesses use transport cost savings to increase profit margins, or will they pass on the savings to customers through lower prices, thereby expanding output and, potentially, employing more staff? and
- Will the improved transport links mean that businesses in the newly accessible locality will be displaced by more cost efficient firms located outside the area, and will newly created jobs by filled by people living outside the locality (the two way road effect)?

Additionally, this approach cannot practically address the issue as to whether or not increased economic activity in the vicinity of the transport scheme is additional or displaced. This is because it is not practical to identify and survey businesses that maybe adversely affected by the project but located in a different region.

Barrett (1999), in his report to SACTRA, considered that the primary mechanisms through which transport investments impact on the economy are business location decisions, particularly unlocking land for development, and through the labour market. Barrett downplayed the role that reductions in transport costs have on economic activity. Primarily, this is because that transport costs typically form only a small percentage of a business' total costs and that a large amount of transport costs are fixed – i.e. are terminal costs. "The argument is thus that the impact on the firm's total costs of any particular project is likely to amount to only a fraction of 1% of total costs and….the impact on sales and employment are not likely to be very great". McQuaid *et al* (2004) also expresses a similar position that variable transport costs affected by a transport infrastructure improvement form a percentage of overall transport costs which form only a small percentage of total business costs.

This position does, however, appear to conflict with the views of planners within the Highlands and Islands. For example, the Highlands and Islands regional transport strategy, developed through consultation, identifies that transport costs are *"the most pressing concern of communities and businesses within the region*" (HITRANS, 2004). Transport cost reductions, along with increased tourism impacts, also form the source of the majority of the economic impacts identified by the ex-post studies we have reviewed as part of this work. Possibly the views expressed by McQuaid *et al* and Barrett reflect the general situation in the UK, whereas the Highlands and Islands are a special case. We therefore felt it important to obtain a better understanding of the role that transport costs may constrain economic activity within the region. To this end we examined a number of studies, but find that there does not appear to be a consensus.

On one hand there is a body of evidence that suggests transport costs within the region are not significantly higher than those faced by businesses located in other parts of Scotland, as a proportion of total costs (Brian Burns Associates, 1996; Pieda, 1997; EKOS, 1997). In fact the first of these studies was undertaken for the HIE and focused on demonstrating this characteristic to potential inward investors. Whilst transport costs as a proportion of business costs vary by industry, they are generally of the order of 5 to 6%. Natural resource based firms (e.g. forestry) have higher transport cost proportions and manufacturing firms (particularly with high value products) have lower cost proportions. Some businesses may also utilise national services (e.g. the Royal Mail) where there is a tariff involving elements of cross subsidy.

Conversely there are a number of studies that suggest that transport costs form an important element of total cost:

- Halcrow Group (2004) in a survey of businesses located on single track roads identified that for 22% of firms surveyed transport costs exceeded 20% of total business costs.
- General high travel costs are a deterrent for new business starts in Skye (McQuaid and Greig, 2002)
- The movement of people and goods within and from the Highlands and Islands appears to require more effort than in other regions. For example within the Highlands and Islands more people are employed in the transport and communications sector (16.0%) than the Scottish average (14.2%). Within the island local authority areas which have internal air and ferry networks these sectors correspondingly employ an even greater proportion of people (up to 19.2%) (GROS, 2001 Census).
- The Rural Expenditure Survey (Sneddon Economics and Market Research, 2001) identified that the greatest disparity in household expenditure between rural Scotland and Scotland as a whole lay in motoring expenditure. In terms of transport expenditure as a whole[14] households in the HIE area spend 24% more than households in Scotland and 8% more than households in the UK. This has to be set

[14] Motoring expenditure plus other transport costs

against the fact that average household incomes in the HIE area are significantly lower than Scotland and UK averages (HIE, 2003).

- The Rural Scotland Price Survey in 2001 indicated that overall prices in the HIE area were higher than in urban areas. The biggest differences occur in the price of fuel (+10.6%) and the price of food and catering (+10.4%). An average basket of good and services were most expensive in the island locations of Shetland (9.1% higher), Western Isles (7.6% higher) and Orkney (7.3% higher than urban areas). Food prices were particularly expensive in Orkney, Shetland and the Western Isles (on average over 20% higher than urban locations), and road fuel was 14% higher, on average, in these island locations (HIE, 2001). To a certain extent this will be due to higher average unit costs due to small firm size and turnover in comparison to shops in urban locations. However, the evidence that prices increase with the more peripheral island locations suggest that transport costs must also be an influencing factor.
- The Office of Fair Trading report on petrol prices attributed the differentiation in petrol pump prices between remote areas in the Highlands and Islands and urban areas to three contributory factors: additional transport costs, smaller turnover and less competition (due to the absence of supermarket retailers of petrol and diesel). Evidence from retailers suggested that in 1999 it cost 2p per litre more to transport petrol to North West Scotland than elsewhere – the price differential between North West Scotland and urban areas was 8p per litre at the time (Scottish Parliament Information Centre, 1999). This demonstrates firstly that transport costs in the region are higher than elsewhere and secondly that the price differential between goods for sale in remote areas compared to urban areas is strongly influenced by turnover and competition (for petrol additional transport costs only comprise 25% of the price differential).

It appears difficult to rationalise the fact that the proportion of transport costs as a function of sale price is relatively similar across Scotland with the fact that the prices of some goods can cost up to 20% more on the islands. We therefore believe that some attempt should be made to rationalise these two separate facts. Issues that may be of relevance would include the market area served by firms located in the Highlands and Islands compared to similar firms located in areas with more accessibility (e.g. in the Central Belt); potentially higher unit costs for businesses in the Highlands and Islands due to lack of opportunities to exploit economies of scale; the potential that for firms serving a market where the price is given (e.g. aggregates, fish)[15] the market may only allow transport costs to lie below a threshold value; the hidden costs of poor accessibility such as increased levels of stock; transport costs on inputs to the production process; as well as the efficiency costs associated with lost time spent travelling in the course of work. It is clear that prices vary substantially across the region, with the islands having the highest prices, thus any research should stratified by geographic area.

[15] Such firms may only be able to sell their product if transport costs lie below a certain threshold of total costs.

Barrett (1999) did make two exceptions to his view regarding the limited role that transport costs have and this was in relation to the tourism and retail sectors. The tourism sector was also identified by SACTRA (1999) and McQuaid *et al* (2004) as a sector in which transport costs could form a significant element of total costs because natural assets are fixed in location and tourists have to travel to these locations. The tourism sector is of particular importance to the Highlands and Islands, but the relationship between transport quality and tourism is not well understood, and is worthy of further research. Improved strategic access (e.g. air services) can make a region more attractive as a tourist destination, as can a transport network that allows an ‘appropriate’ number of visitor sites to be accessible; however, improved accessibility may also allow visitors to pass through an area without spending a night there. Thus improving accessibility may just displace tourists from one location to another.

Even if transport costs form a small percentage of total costs they can be quite strongly perceived both by individuals and businesses. This is because they are a very visible cost. They are also a cost that can be influenced by government. For businesses that are fixed in location for example, mining, quarrying, forestry and some forms of tourism transport costs can achieve a particularly importance, principally because they are a cost faced by the business (or the customer in the context of tourism) that can be influenced to increase profitability. In addition to these types of businesses, which are the mainstay of the rural Highland and Island economy, there are also a lot of ‘micro’ businesses and self-employed workers within the Highlands and Islands. Such businesses and people may also be fixed in location as they may for example work from home – where living and working costs are shared. For such businesses and people the classic economic paradigms of business may not apply and once again transport costs may achieve a more significant emphasis than in comparable businesses in the same sector but located in an urban environment.

A clear understanding of the significance of transport costs within the Highlands and Islands is fundamental to a transport strategy that has, as one of its primary objectives, a reduction in such costs. Transport projects that reduce costs will need to be appraised. A good database of cost information by industrial sector and geographic area would be of assistance in this. This would allow proposed transport cost reductions to be contextualised against overall transport costs and business costs. Of course it is important to gain an understanding as to how transport cost reductions will feed through to the final economy. It is perfectly plausible that cost savings will just increase the profitability of freight and logistic operators rather than leading to a reduction in freight rates that would benefit local businesses. A study into the removal of freight subsidies to Orkney and Shetland found that not all the freight price increases were passed on by the operator to final consumers (in terms of prices in shops) (INC, 1996). Therefore in reverse it may be the case that only a proportion of a decrease in transport costs will feed into freight rates, of which only a proportion will find their way into a reduction in prices faced by consumers (including the prices of inputs, such as animal feed, required by businesses). It is also possible in the context of national freight and logistic companies that small changes in a region’s transport network may not significantly affect freight costs. For example, McQuaid *et al* (2004) emphasise the role of the structure of the freight industry as determining transport costs to business and Mackie and Tweddle (1993) found that only large changes in network quality are likely to affect optimal supermarket distribution (which in Scotland is currently centred on the Central Belt). A better understanding of how changes in transport costs feed through into the economy of the Highlands and Islands would therefore assist future economic impact studies. To this end, we can see a continuation of the policy of undertaking ex-post studies as being beneficial, though more attention than is currently made should be given to changes in freight rates and final prices of goods as a consequence of the transport improvements.

Economic impact studies are reliant on the use of price elasticities of demand and multipliers to translate increases in expenditure and reductions in prices/costs into increased economic activity and increased employment. In the absence of such data only the subjective responses of businesses interviewed can be used to indicate whether cost reductions will translate into increased economic output and employment impacts. In some instances the reliability of such responses is questionable (e.g. Halcrow Group, 2004; Steer Davies Gleave, 2004a). Local multipliers can be derived from input-output (I-O) models of the economy. However, with the exception of the Western Isles – for which an updated model I-O model is currently being developed – no up to date I-O models of the regional economy exist. We believe that HIE are doing some work on the development of regional multipliers, and would encourage this. The robustness of any projections of increased economic output and employment will be reliant on the validity of key data such as price elasticities of demand and regional multipliers.

An important impact of transport projects is on the labour market (SACTRA, 1999; McQuaid *et al*, 2004; Steer Davies Gleave, 2003b). Within the Highlands and Islands parts of the labour market are tight (e.g. mainland Orkney, Inverness and Lochaber), whilst other parts are slack (e.g. Western Isles and Caithness and Sutherland). The role that transport issues plays within the region in the creation of these tight and slack labour markets is not however clear. We understand that HIE and Future Skills Scotland are currently undertaking research into the causes of tight labour markets within the region and that a research study into the costs of the journey to work/education has just been completed (Steer Davies Gleave, 2004b). The latter study demonstrates that high transport costs can affect the decision regarding whether or not to apply for a job. We would consider that the issues related to transport and the labour market should be drawn out from these studies and supplemented with further research on the role that transport plays in local economies with slack labour markets. This would provide further information, important for the assessment of transport schemes, as to whether transport accessibility is a serious constraint preventing the smooth operation of the labour market.

Large scale projects and network wide improvements

Formal models can be used to assess the economic impacts of larger scale projects or network wide improvements. However, there is no standard method or model that is applied – in fact SACTRA identified six different approaches.

The first thing to note regarding formal methods and models is that the literature is much stronger in concepts regarding the linkages between transport and the wider economy than models are in formalising the relationships. Partly this is due to a lack of data and partly this is due to the limitations of current techniques (e.g. model convergence, computing power, etc.). Many of the transport-economic linkages discussed in this paper, and in the literature in general, are not well represented in some or all of the model types. An example of a weakness would include location choice as a consequence of perceived accessibility (McQuaid *et al*, 2004). Obviously each model type has its own set of strengths and weaknesses, no model type is as yet all encompassing.

It is not the purpose of this study to review different model types as this has been done elsewhere, though admittedly there is not a single review (see for example DSC/MEP, 1999; SACTRA, 1999; Oosterhaven and Knaap, 2003; Schade *et al*, 2004). Instead we will briefly consider the practical benefits associated with such formal methods and in doing so will focus on LUTI models and Spatial Computable General Equilibrium (SCGE) models. We choose LUTI models because they are already a practical modelling tool with several commercial software packages being available – a good review of LUTI models is the Scottish Executive study into a LUTI model for Scotland (WSP, 2003)[16]. SCGE models on the other hand are, in our view, promising tools of the future. This is because they have solid microeconomic foundations thereby allowing the inclusion of many of the economic behavioural characteristics of businesses and individuals. Additionally, SCGE models are fully consistent with cost benefit analysis techniques. SCGE models, however, are in the infancy of their development and the number of transport investment projects that have been analysed within an SCGE framework is very limited.

LUTI models consist of linked transportation models and 'land-use' or better location models. They mostly employ a system dynamics type of modelling and are primarily developed to predict future growth and to analyse policy scenarios for large urban conglomerations. LUTI models are typically very disaggregated with numerous spatial zones, sectors, household types, transport motives, modes of transportation, etc. The strength of most LUTI models lies in their segmentation and detail, the benefit of which is the homogeneity of behaviour and the assumed stability of relations at that level of detail. LUTI models are very capable of acting as devices for:

- Estimating the costs and benefits of transport projects on the transport network; and
- Displaying the spatial impacts of policies/projects

LUTI models usually contain some form of economic input-output model. It is from such an I-O model that they are able to encapsulate changes in output and employment within their modelling framework. From the economic perspective their principal weakness is theoretical simplicity: perfect competition, fixed ratios, linear relations and the absence of scale economies. What this means in practical terms is that such models, whilst being able to give predictions regarding the spatial locations of future economic activities, cannot take into

[16] http://www.scotland.gov.uk/library5/transport/ssid-00.asp

account supply side constraints on economic activity; such as imperfectly operating labour markets, imperfectly operating product markets (e.g. spatial monopolies created by high transport costs) and the potential for firms to exploit internal and external economies or diseconomies of scale (Oosterhaven and Knaap, 2003). It is precisely these supply side impacts that give rise to the economic benefits that are additional to those that are measured by a transport cost benefit analysis.

Providing the study area is large enough these models can also give an indication regarding the number of jobs displaced and the number of jobs that are additional. These models can also reflect the two way road effect. However, LUTI models cannot model greenfield developments such as when a transport investment ‘unlocks’ the development potential for a site (e.g. the Stolt fish processing plant on Scalpay). This is because future predictions of economic activity within a location are, within a LUTI model, determined by existing activities. Whilst the output from LUTI models can be used as EALI indicators within STAG it is not possible to use their output within the economic efficiency calculation due to problems of double counting.

SCGE models are system models of the economy, and would typically operate at a zonal scale greater than that of a LUTI model. As economic system models, they include representations of government, businesses and households. They have strong microeconomic foundations and can represent the supply side characteristics of an economy. These include economies of scale in production, spatial monopoly power, imperfect labour markets and the clustering of industries (Schade *et al*, 2004). SCGE models can also reflect labour and business re-location, including to greenfield sites. As discussed in this report, it is the interaction between transport and these characteristics of an economy that are of interest to local planners and economists. SCGE models also allow the calculation of a single measure of economic welfare that can reflect impacts in the wider economy (such as reductions in employment, increase in real wages, reductions in monopoly power and prices, etc.). This is because SCGE models have a household sector in which consumers are represented with a utility function. This therefore allows welfare gains to be measured at the level of the household.

These models are still in the infancy of development. The complex non-linear nature of the models can make it difficult to converge to an equilibrium solution if many behavioural characteristics are included within the model. But if a full representation of the transport-economic situation is needed for strategic policy, then this approach seems to us to the most promising.

Data

Any modelling system first of all requires data, and secondly requires good data. The model is only as good as the data that underlies it. Data requirements for a regional transport model, such as one that would be needed as part of a LUTI model or a transport-SCGE model, are large, and as far as we are aware with the exception of data associated with the Inverness LUTI model there is no up to date origin destination data within the Highlands and Islands for any of the modes of travel. The exclusion of the Highlands and Islands from the Transport Model for Scotland (TMfS) is part of the reason for this.

Such an absence of data will probably preclude the development of any regional transport-economic model in the immediate future. We would therefore recommend that HIE and HITRANS encourage local authorities to collect travel pattern (origin-destination) data as part of their ongoing projects (e.g. investment in lifeline rural roads, air services and any ferry service project).

5. RESEARCH RECOMMENDATIONS

Transport appraisal guidance in Scotland is governed by STAG, which was only published in its final form in September 2003. Given its recent publication it is unlikely that alternative approaches to the STAG framework - multiple criteria analysis or cost effectiveness - will be considered by the Executive in the short term. The following recommendations are therefore set within the context of an overall STAG framework that will remain relatively unchanged in the near future. The STAG approach is not, in our view, restrictive or problematic for making the case for transport projects in the Highlands and Islands. This is because the STAG framework allows transport projects to be appraised against regional issues such as population retention and economic growth.

In many respects transport projects within the Highlands and Islands will be similar in nature to those elsewhere in Scotland – for example small road engineering projects. However, there are also instances, particularly in remote mainland and island communities, where their nature will be very different. We would consider that any research commissioned by HIE should focus on these areas.

We believe that these recommendations fit well within the overall STAG framework and would assist the development of that framework for application to projects of interest to the Highlands and Islands'.

R1

A number of STAG appraisals have been undertaken recently. These include Inverie pier, Harris spinal route, Sumburgh airport and Highlands and Islands Air Services. We recommend that HIE undertake an audit of these appraisals and any others that may exist against the arguments in this paper, particularly regarding:

- Whether the transport projects have been adequately appraised against regional policy objectives of population stability and economic development;
- Best practice in the treatment of option values (see Department for Transport advice in Annex I of this paper); schedule delay (see ATOC, 2002) and journey time variability (see WebTAG unit 3.5.7[17]).
- Best practice in the treatment of economic activity and location impacts (EALI) as embodied within the DfT's Guidance on Preparing an Economic Impact Report[18]. One would expect that the linkages between transport cost reductions and improvements in accessibility (travel time, option values, schedule delay and reliability) be referred to within the derivation of the EALIs in a manner as for example detailed in the DfT's guidance.

We would consider that such research should be undertaken in the near future, with the aim of say completing the research within 6 to 12 months. The

[17] DfT (2003)
http://www.webtag.org.uk/webdocuments/3_Expert/5_Economy_Objective/3.5.7.htm

[18] Steer Davies Gleave (2003)
http://www.webtag.org.uk/webdocuments/3_Expert/5_Economy_Objective/3.5.8.htm#1

research would primarily consist of a desktop literature review supported by a number of interviews with local planners responsible for the STAG appraisals and with the Scottish Executive's STAG team.

R2

We have argued in Chapters 3 and 4 that option values and schedule delay are important components of total economic impact for 'lifeline' facilities or services. Journey time variability may also be important for certain infrastructure types. To ensure that the case for transport projects in remote and peripheral areas is strong we therefore recommend that research is commissioned into the values of:

- option values; and
- schedule delay.

Such research should focus on lifeline links and low frequency public transport services and the incremental change in values associated with improving the infrastructure or level of service.

For projects associated with upgrading single track roads the modelling of journey time variability may prove an important contributor to economic benefit.

We would consider that such research could be undertaken in the near future, in a relatively short time period, say 6 to 12 months. With respect to valuing option values and schedule consumer expressed preference surveys would be used (i.e. stated preference or contingent valuation surveys). Potential locations for study could include:

- Option and schedule delay values of the proposed fixed link crossing to Bressay;
- Option and schedule delay values of proposed fixed links and increased ferry services in Orkney (fixed link between Westray and Eday and increased ferry frequencies between mainland Orkney and Eday, Sanday and Stronsay);
- Schedule delay value of increases in ferry frequency at the Sound of Harris;
- Option value of upgrading single track roads to double track.

With respect to journey time variability we would consider any research should be focused on implementing existing Department for Transport guidance. For example existing journey time variation on single track roads could be measured, and a microsimulation model developed to predict future reductions in variability. Potential locations for research would include the A830 Mallaig road and the single track sections of road analysed by HITRANS (Halcrow Group, 2004).

We are only aware of one ongoing study in this area that associated with the doctoral research being undertaken by ourselves. Part of this research will consider values associated with schedule delay and connective reliability, which is closely related to that of option values. This aspect of his research has been part funded by the Scottish Executive and it is our intention to keep in close contact with HIE and other local government organisations during the research. As it stands the proposed surveys will be relatively small in size. There is therefore scope for some partnership between HIE, the University of Leeds and the Scottish Executive in expanding the research programme.

We are not aware of any research regarding the contribution of journey time variability to the user benefit of upgrading single track roads. It may be possible to develop a collaborative research project in conjunction with the Scottish Executive Transport Policy Research Group (TRPG) regarding the A830 Mallaig road.

R3

The linkages between transport improvements and their social and economic impacts are much stronger in concepts than in modelling techniques. At this point in time, however, we see little value for HIE to invest in research associated with enhancing modelling paradigms of location choice in say LUTI models to incorporate characteristics such as option values. This is because the absence of a transport demand and cost database within the region precludes the development of a regional transport-economy model in which such modelling paradigms would sit. Instead we recommend that the process of developing a transport database is commenced. Such a database could also hold the results of the research proposed to enhance the robustness of EALIs (see research recommendations 4 to 7).

We would consider that the scoping of the database and collaboration with partners should begin in the near future. The development and maintenance of the database is however an ongoing commitment. In the first instance the database would collect together into a single source existing data. This would include Scottish Executive and local authority traffic count information, CAA passenger surveys, and whatever ferry and rail data is available. On the back of existing projects origin-destination and journey purpose intercept surveys could be commissioned. It is recommended that in the first instance the database focuses on strategic flows.

In terms of existing data collation we are aware of studies regarding a transport provision baseline within the Highlands and Islands and journey to work costs. It is recommended that such a database is developed in collaboration with (and possibly part funding from) the Scottish Executive, with the ultimate aim of incorporating the Highlands and Islands into the Transport Model for Scotland (and its database) or the development of a regional transport model that would sit alongside the Transport Model for Scotland.

R4

In the absence of a regional transport-economy model, surveys of businesses and residents directly impacted upon by a project will continue to form the mainstay methodology underpinning economic impact reports and EALI indicators. The review has identified that four further areas research would be useful to enhance the collective robustness of such studies. These are set out in research recommendations 4 to 7.

Firstly, we recommend that the role of transport costs as a constraint on business activities and the manner that different transport initiatives (infrastructure improvements and price reductions) can affect these costs is investigated. This research would need to rationalise the fact that transport costs form a similar percentage of business costs for businesses in the Highlands and Islands as for businesses in other parts of Scotland with the fact that prices of goods can be up to 20% higher in the more peripheral parts of the region.

Such research would primarily rely on interviews with businesses. It should pay particular attention to market area served by firms, constraints imposed by 'national or world prices' for goods exported from the region and the potentially higher unit costs of businesses in the Highlands and Islands due to smaller turnovers.

R5

Secondly we consider that the relationship between transport and the labour market within the Highlands and Islands should be researched. Is transport a contributing factor to tight labour markets within the region and/or is it a contributing factor to slack labour markets?

Such research would again be based around background literature review and market research interviews with businesses and residents as well as job centre personnel. Analysis of existing national databases on the performance of regional labour markets would also form part of this research.

In terms of ongoing work in this area we are aware of an ongoing study for Future Skills Scotland into the underlying reasons associated with tight labour markets within the region. This study would form an important input into this research, and Future Skills Scotland may be a potential partner with whom collaboration on this project would be beneficial.

R6

We also recommend that HIE continue with their sponsorship of ex-post studies. Such studies are a very valuable source of data regarding the actual impacts of transport projects within a region, and can act as guide for the linkages between transport and the wider economy that are important in the Highlands and Islands. We would however recommend that wherever possible increased emphasis is placed on how transport improvements have led to changes in freight rates and final prices to consumers, as it is these cost issues that improved transport services aim to address. The removal of tolls on the Skye Bridge may be the next opportunity for such a study.

R7

It is recommended that a literature review of (i) the price elasticity of demand for goods and services that are economically important within the region; and (ii) regional multipliers for changes in output associated with such goods and services is undertaken. If insufficient data in this area exists it maybe necessary to undertake further research to develop such values, possibly through the construction of regional input-output tables.

Such data is necessary in conjunction with data regarding how transport initiatives affect transport costs (research recommendation 4) to translate transport efficiency improvements into changes in output and employment in a robust manner. In terms of ongoing research in this area we are aware of a study for Comhairle nan Eilean Siar to develop a social accounting matrix (and input-output table) for the Western Isles by the Arkleton centre at the University of Aberdeen, and we believe that HIE themselves are doing some work looking at regional multipliers.

Each of research recommendations 4 to 7 could be commenced immediately. Each study would constitute a small study in itself that should be quite easily completed within say a 12 month period. With the exception of Future Skills Scotland, on the labour market research, most of the research would probably be of interest only to HIE. Notwithstanding that it maybe possible to propose a research project to the Scottish Executive's Transport Policy Research Group for inclusion on the 2005 Scottish Executive research agenda. We believe that any such proposals would need to be made during the Autumn of 2004.

R8

Our final recommendation for research concerns the relationship between transport quality and tourism. This is a little researched area and yet tourism is of vital importance to the economy of the Highlands and Islands. The absence of a broad literature on the relationship between transport quality and tourism would suggest that a significant piece of research would need to be undertaken, which would probably require a significant amount of time to deliver any useful findings. The cheapest mechanism to develop the research may be to sponsor a PhD student at an institution which specialises in travel and/or tourism[19]. The disadvantage with such an approach is that the output from the research can be variable as it is often dependent on the quality of the student that can be recruited. An alternative and more expensive approach may be to specify, in a brief, a long term research project (e.g. lasting two years or more) in partnership with say Visit Scotland, the Scottish Executive and possibly some international partners in Scandinavia or the west coast of Ireland thereby being able draw on EU Northern Peripheral Funding.

[19] An example of such an institution would be the Christel DeHaan Tourism and Travel Research Institute at the University of Nottingham (http://www.nottingham.ac.uk/ttri/)

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ANNEX I: ADVICE ON OPTION VALUES WITHIN *TRANSPORT ANALYSIS GUIDANCE*

Source: Department for Transport, TAG Unit 3.6.1, June 2003
http://www.webtag.org.uk

1 The Option Values Sub-objective

The following is reproduced from the DfT

1.1 Introduction

1.1.1 Option values are recognised by the SRA in their Appraisal Criteria (SRA, 2003) but in principle are equally applicable to other public transport modes (bus, coach, LRT, underground, air), to car ownership, road infrastructure and to freight facilities. Within the Multi-Modal Studies, it will be particularly important to consider option values if the strategies or plans which are being appraised include measures which will substantially change the availability of transport services within the study area (e.g. the opening or closure of a rail service, or the introduction or withdrawal of weekend buses serving a particular rural area).

1.1.2 The idea underlying option values can be explained using the following example. Consider a strategy or plan which includes the re-opening of a closed railway line linking a series of rural towns and villages to a major town or city that already has a railway service. Even if a particular individual living in one of the villages along the route does not intend to use the rail service with any regularity, they may still value having the option to use the service if they choose. For example, a car-owner may value the ability to use the service when for whatever reason they cannot drive or their car is unavailable. A non-car-owning resident who generally does not travel beyond the village may value the knowledge that, should they need to reach the town or city, the facilities exist for them to do so, at reasonable cost and with a reasonable level of convenience. In addition, those who do intend to use the service on a regular basis may also have an option value, over and above the value of their intended use of the service, since they too may value the options offered for rail travel other those already taken account of in their individual plans and expectations.

1.1.3 From this example, it can be seen that:

- option values are associated with unexpected use of the transport facility which is not built into the forecasts produced by the modelling stage, and would otherwise not appear in the appraisal as a benefit;
- option values are related to the individual's attitude to uncertainty - in practice a range of option values is likely to be found within the population; and

- there is a real risk of double counting, particularly when trying to separate individuals' willingness to pay to have the option of using the service from their willingness to pay for their actual use of the service.

1.1.4 Evidence of option values for transport has been found in two studies in particular (which should also prove useful as references on methodology): one examining the removal of a suburban bus service (Bristow et al, 1991) and one examining values placed on the retention of the Settle-Carlisle rail service (Crockett, 1992). The latter found values of around 70 pence per week, although the sample included both users of the service and non-users, and the latter were found to have significantly lower option values than the average. In the Multi-Modal Studies, it will be important (if option values are being estimated) to include both users and non-users as separate groups within the survey work.

1.1.5 Methodologies for calculating option values and avoiding the double-counting problem noted above are discussed in an unpublished report to OPRAF entitled Planning Criteria Research Requirements (ITS, March 1999). For further details, contact SRA.

1.1.6 In presenting the findings, the Qualitative Impacts column should be used to identify which group of transport services within a particular strategy (or option) are the source of any additional (or reduced) option value, the nature of the change in service and the sign of the change (i.e. option value gained or lost). The Quantitative column should be used to indicate the size of the populations affected and the nature of the analysis used to generate any monetary measures of total value. The Assessment column should be used to report the total monetary benefits (or disbenefits) of the option or strategy being appraised. For consistency with other sub-objectives, this monetary total should be expressed as a present value, discounted over the whole appraisal period.

1.1.7 For the 'Option values' sub-objective, it is recognised that it will often not be feasible to carry out the analyses outlined above, especially in the early stages of developing an option or when appraising a strategy, rather than a plan. Therefore an alternative qualitative procedure should be adopted, outlined in Box 1 below.

Box 1
Qualitative procedure for assessing option values

Qualitative scores should relate to the size of the resident community given options to travel by the strategy, according to the following scale:

Community	Service Withdrawn	Service Added
>2000 people	Strong adverse	Strong beneficial
500-1999 people	Moderate adverse	Moderate beneficial
1-499 people	Slight adverse	Slight beneficial
0 people	Neutral	Neutral

Where more than one community is affected the total number of resident individuals should be added together (with a negative sign attached to communities losing their service).

'Ghost' services not providing reasonable opportunities for return travel on all days of the week should not be treated as services for these purposes. Withdrawal of rail services replaced by bus should be counted as a withdrawal of service, given the lower level of accessibility offered to significant groups of users.

1.2 Application of TAG to Highway Schemes

1.2.1 The Option Values sub-objective did not previously appear in DMRB. However, Highway Schemes should be assessed against this sub-objective